

# **FORT SAM HOUSTON DINING FACILITIES**

**San Antonio, Texas**

## **Energy Engineering Analysis Program (EEAP)**

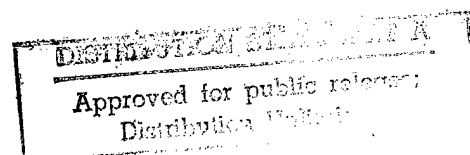
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## PREFACE

### BACKGROUND

This report was performed by the engineering firm of Carter & Burgess, Inc. under the Energy Engineering Analysis Program (EEAP), for the Fort Worth District Corps of Engineers. The purpose of this report is to identify and analyze energy conservation opportunities (ECO's) related to sixteen (16) dining facilities at Fort Sam Houston and five (5) dining facilities at Camp Bullis.

Energy Conservation opportunities (ECO's) identified in this report have been analyzed using sound, accepted fundamentals of engineering and the current utility rate schedules. Each recommended ECO is fully documented with calculations for energy savings, Savings to Investment Ratio (SIR) and simple payback.

This report is prepared in accordance with the detailed scope of work for Contract No. DACA63-91-D-0048, Delivery Order 0011 (Refer to Appendix F for complete scope of work). The BLAST Life Cycle Cost In Design (LCCID) program with the ECIP option was used to determine the Life Cycle Cost (LCC) and Savings to Investment Ratio (SIR) for each ECO.

### REPORT ORGANIZATION

This report has been organized to provide concise information related to the EEAP program presented herein. The report is broken into five sections. As follows;

|           |                                |  |
|-----------|--------------------------------|--|
| Section 1 | Introduction                   |  |
| Section 2 | Executive Summary              |  |
| Section 3 | Utility Rate Schedule Analysis |  |
| Section 4 | Energy Conservation Analysis   |  |
| Section 5 | Appendices                     |  |

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Section 2 presents a compilation of the data analyzed as well as a summary of the recommended Energy Conservation Opportunities.

Section 3 provides an analysis of the base utility rate structures for natural gas and electricity.

Section 4 presents a description of each facility audited along with the recommended ECO's with calculations for implementation cost, energy savings, maintenance savings and an ECIP summary sheet.

Section 5 is the report appendices which contains the following:

- Utility Rate Schedules
- Non-recommended ECO's
- Maintenance and Operational Recommendations
- Criteria and References
- Lighting Implementation Costs
- Scope of Work
- Symbol, Abbreviations and Conversion Factors
- Sample Software Calculations and Output Descriptions
- Implementation Documentation (DD Form 1391)

#### ACKNOWLEDGMENTS

The engineering staff of Carter & Burgess, Inc. would like to extend its thanks and appreciation to the FWD-COE and the DEH staff for assistance in gathering the building data and operating schedules necessary to complete this report.

## **EXECUTIVE SUMMARY**

### **INTRODUCTION**

This report was conducted to identify Energy Conservation Opportunities (ECO's) for twenty one (21) dining and kitchen facilities at Fort Sam Houston and Camp Bullis. All sources of energy consumption were considered in this report, including electricity, natural gas, and steam.

### **BUILDINGS/FACILITIES AUDITED**

#### **FORT SAM HOUSTON**

The dining/kitchen facilities at Fort Sam Houston analyzed for this report range in age from late 19th century to less than 10 years old. Construction types also vary widely. The majority of the facilities are constructed of concrete block walls with face brick, although wood frame, stone and stucco construction was also observed.

#### **CAMP BULLIS**

The dining/kitchen facilities at Camp Bullis are all of similar construction and were built in the early 1900's. These facilities are wood frame construction with lapboard exteriors.

### **PRESENT ENERGY CONSUMPTION**

Electricity and gas are not sub-metered to the building level. The gas supply is sub-metered randomly with some buildings having multiple meters and some meters feeding multiple buildings. The electrical usage is primarily metered thru two central sub-stations for the entire base. Therefore, the energy consumption information is based on the total base consumption as metered thru the two main sub-stations. (Refer to Table 1 for Base Year Utility Consumption).

**TABLE 1. BASE YEAR ENERGY CONSUMPTION DATA (Individual Meter)**

For prior 12 month period beginning September, 1992 and ending August, 1993.

| Months        | Electrical         |                                   |                                   |                 |                              |                                  |                  | Natural Gas         |         |
|---------------|--------------------|-----------------------------------|-----------------------------------|-----------------|------------------------------|----------------------------------|------------------|---------------------|---------|
|               | Consumption<br>KWH | Demand<br>Metered<br>KW or<br>KVA | Demand<br>Charged<br>KW or<br>KVA | Power<br>Factor | Fuel<br>Adjustment<br>\$/KWH | PCR or<br>Cogeneration<br>\$/KWH | Total<br>Cost \$ | Consumption<br>Unit | Cost \$ |
| January, 93   | 10,253,600         | 18,984                            | N/A                               | N/A             | N/A                          | N/A                              | 472,867          | N/A                 | N/A     |
| February, 93  | 9,085,600          | 18,984                            | N/A                               | N/A             | N/A                          | N/A                              | 417,992          | N/A                 | N/A     |
| March, 93     | 9,643,200          | 19,032                            | N/A                               | N/A             | N/A                          | N/A                              | 457,489          | N/A                 | N/A     |
| April, 93     | 10,156,000         | 22,912                            | N/A                               | N/A             | N/A                          | N/A                              | 510,107          | N/A                 | N/A     |
| May, 93       | 12,276,800         | 25,680                            | N/A                               | N/A             | N/A                          | N/A                              | 579,119          | N/A                 | N/A     |
| June, 93      | 15,378,400         | 30,336                            | N/A                               | N/A             | N/A                          | N/A                              | 756,066          | N/A                 | N/A     |
| July, 93      | 16,056,000         | 29,952                            | N/A                               | N/A             | N/A                          | N/A                              | 784,822          | N/A                 | N/A     |
| August, 93    | 16,658,400         | 30,960                            | N/A                               | N/A             | N/A                          | N/A                              | 801,535          | N/A                 | N/A     |
| September, 92 | 16,269,600         | 31,616                            | N/A                               | N/A             | N/A                          | N/A                              | 760,361          | N/A                 | N/A     |
| October, 92   | 13,277,600         | 31,312                            | N/A                               | N/A             | N/A                          | N/A                              | 629,878          | N/A                 | N/A     |
| November, 92  | 11,700,00          | 28,672                            | N/A                               | N/A             | N/A                          | N/A                              | 514,344          | N/A                 | N/A     |
| December, 92  | 9,788,800          | 19,800                            | N/A                               | N/A             | N/A                          | N/A                              | 445,411          | N/A                 | N/A     |
| Total         | 140,014,000.00     | 308,240.00                        | N/A                               | N/A             | N/A                          | N/A                              | 7,129,991.00     | N/A                 | N/A     |

| Company Name: | Electricity            |  | Natural Gas         |  |
|---------------|------------------------|--|---------------------|--|
|               | City Public Service    |  | City Public Service |  |
|               | Company Rate Schedule: |  | Large Volume        |  |

## COMPOSITE PROJECT SUMMARY

Listed in Table 2A is a compilation of all recommended ECO's. Tables 3A and 3B are compilations of all recommended ECO's studied as well as the analysis results for each ECO. Table 3A is sorted by building number and Table 3B is sorted by descending SIR. Also, shown in Table 2A is the ECO numbers and ECO descriptions analyzed for this report. A detailed summary of each ECO may be found with each building description and analysis.

## SUMMARY OF PROJECT

(All recommended ECO's included - see Table 4 for ECIP summary calculations)

|                                       |                        |        |
|---------------------------------------|------------------------|--------|
| KWH Savings:                          | <u>2,263.894</u>       | KWH/yr |
| Demand Savings:                       | <u>7,241.9</u>         | KW     |
| Gas Savings:                          | <u>1,648.4</u>         | MCF/yr |
| Cost Savings:                         | <u>\$ 140,319.00</u>   | /Year  |
| Implementation Cost:                  | <u>\$ 1,187,540.00</u> |        |
| Simple Payback:                       | <u>6.2</u>             | Years  |
| Savings to Investment:<br>Ratio (SIR) | <u>2.43</u>            |        |

This report identified capital intensive projects which, if implemented, will result in the savings and costs summarized above. The savings for the recommended composite project listed above account for interdependence of savings of individual ECO's.

## SPECIAL CONSIDERATIONS

### UTILITY REBATES

City Public Service does not currently offer any utility rebate incentives for energy retrofit measures.

### MAINTENANCE AND OPERATION OF RETROFITTED SYSTEMS.

The combination of ECO's identified in this report will result in an overall decrease in maintenance labor and cost. This is due primarily to the installation of new lighting systems with increased service lives and a reduction in operating hours for mechanical equipment with the addition of automatic stop/start functions. Addition of automatic stop/start functions will also extend the useful life of the equipment.

TABLE 2A. SUMMARY OF RECOMMENDED ECO'S AND M &amp; O'S

| ENERGY CONSERVATION OPPORTUNITIES                       |  | BUILDING #    |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
|---------------------------------------------------------|--|---------------|----|----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| I. ENVELOPE                                             |  | ECO/<br>M & O | 44 | 48 | 368 | 407 | 1350 | 1387 | 1395 | 1462 | 1520 | 1630 | 2265 | 2369 | 2521 | 2530 | 2652 | 2841 | 5105 | 5106 | 5107 | 5114 | 5124 | GEN |
| A. ADDITIONAL INSULATION/SEALING                        |  | M & O         |    | X  |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. INSULATED GLASS OR GLAZING                           |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. WEATHER STRIPING AND CAULKING                        |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| II. HOT WATER                                           |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. SHUTDOWN ENERGY TO WATER HEATER                      |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. ADDITION OF BOOSTER HEATERS AT MAJOR HW USERS        |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. ADDITION OF INSTANTANEOUS WATER HEATERS              |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| III. HEAT RECOVERY                                      |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. HEAT RECOVERY FROM DISHWASHERS HOT WATER             |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. HEAT RECLAIM FROM KITCHEN EXHAUST                    |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. WASTE HEAT RECOVERY                                  |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| IV. HVAC                                                |  | ECO           | X  | X  |     |     |      |      |      |      |      |      |      | X    | X    |      |      | X    |      |      |      |      |      |     |
| A. NIGHT SETBACK/SETUP THERMOSTAT                       |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. ECONOMIZER CYCLE(DRY BULB) 0                         |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. UPGRADE HVAC CONTROLS                                |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| 1) ADD STOP/START FUNCTION TO HVAC EQUIPMENT            |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| D. IMPROVE EFFICIENCY OF OPERATIONS                     |  | ECO           |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| 1) REPLACE CHILLER WITH HIGHER EFF/CFC FREE CHILLER     |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| 2) REPLACE RTU WITH HIGHER EFFICIENCY UNIT              |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| E. BALANCE HVAC SYSTEM                                  |  | M & O         |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| F. INSTALL MAKE - UP AIR SUPPLY FOR KITCHEN AREAS       |  | ECO           |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| G. SHUT - OFF RANGE HOOD                                |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| H. THERMAL STORAGE                                      |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| V. BOILER/STEAM                                         |  | M & O         |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. STEAM TRAP INSPECTION                                |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. INSULATE STEAM AND CONDENSATE LINES                  |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| VI. POWER                                               |  | M & O         |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. CONVERT TO ENERGY EFFICIENT SMALLER MOTORS           |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. PHOTOCELLS FOR LIGHTING                              |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. TIMERS FOR LIGHTING                                  |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. REMOVE UNNEEDED LAMPS OR FIXTURES                    |  | ECO           |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| D. REDUCE INDOOR/OUTDOOR LIGHTING TO AEL LEVELS         |  | ECO           | X  | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |     |
| E. LOWER LIGHT FIXTURES                                 |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| F. IMPROVE REFLECTION WITH LIGHT COLORED CEILING/WALLS  |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| VIII. IMPROVE LIGHTING CONTROLS                         |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. INSTALL OCCUPANCY SENSORS                            |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. SEPARATE SWITCHES TO CONTROL LIGHTING                |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| IX. IMPROVE LIGHTING EFFICIENCY                         |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. REPLACE INCANDESCENT LAMPS WITH COMPACT FLUORESCENTS |  | ECO           |    | X  | X   |     |      | X    | X    |      | X    | X    |      |      |      |      |      | X    | X    |      | X    | X    |      |     |
| B. REPLACE INCANDESCENT EXIT FIXTURES WITH LED          |  | ECO           |    |    |     |     |      |      |      | X    | X    |      | X    | X    |      |      |      | X    | X    |      | X    | X    |      |     |
| C. REPLACE STANDARD LAMPS WITH ENERGY SAVING LAMPS      |  | ECO           | X  |    | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |     |
| D. REPLACE STANDARD BALLAST WITH ENERGY SAVING BALLAST  |  | ECO           | X  |    | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |     |
| E. REPLACE EXISTING FIXTURES WITH HIGH EFF. FIXTURES    |  | ECO           |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| X. REFRIGERATION EQUIPMENT                              |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. IMPROVE EFFICIENCY OF REFRIGERATION EQUIPMENT        |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. ADD PLASTIC AIR CURTAINS TO PREVENT INFILTRATION     |  | M & O         |    | X  | X   |     |      | X    | X    |      |      |      |      |      |      |      |      | X    |      |      |      |      |      |     |
| XI. OTHER                                               |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| A. REPLACE BOILERS WITH 99% EFFICIENT BOILER            |  |               |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| B. REDUCE HW TEMPERATURE TO 140 °F                      |  | M & O         |    |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| C. RESTORE OPERATION OF VENTILATION UNIT                |  | M & O         |    | X  |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |

TABLE 2B. SUMMARY OF NONRECOMMENDED ECO'S

| ENERGY CONSERVATION OPPORTUNITIES                       |  | BUILDING # |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------------------------------------|--|------------|----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| I. ENVELOPE                                             |  | 44         | 48 | 368 | 407 | 1350 | 1367 | 1395 | 1462 | 1520 | 1630 | 2265 | 2399 | 2521 | 2530 | 2652 | 2841 | 5105 | 5106 | 5107 | 5114 | 5124 |
| A. ADDITIONAL INSULATION/SEALING                        |  | X          | X  |     | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. INSULATED GLASS OR GLAZING                           |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| C. WEATHER STRIPING AND CAULKING                        |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| II. HOT WATER                                           |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. SHUTDOWN ENERGY TO WATER HEATER                      |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. ADDITION OF BOOSTER HEATERS AT MAJOR HW USERS        |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| C. ADDITION OF INSTANTANEOUS WATER HEATERS              |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| III. HEAT RECOVERY                                      |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. HEAT RECOVERY FROM DISHWASHERS HOT WATER             |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. HEAT RECLAIM FROM KITCHEN EXHAUST                    |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| C. WASTE HEAT RECOVERY                                  |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| IV. HVAC                                                |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. NIGHT SETBACK/SETUP THERMOSTAT                       |  |            | X  | X   | X   | X    | A    | X    | A    | X    | X    | A    |      |      | X    | X    |      | X    | X    | X    | X    | X    |
| B. ECONOMIZER CYCLE(DRY BULB)                           |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    |      | X    | X    | X    | X    | X    | X    | X    | X    |
| C. UPGRADE HVAC CONTROLS                                |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| D. IMPROVE EFFICIENCY OF OPERATIONS                     |  | X          | X  | X   |     | A    | X    | A    | X    | X    | X    | X    | X    | X    | X    | X    |      | X    | X    |      | X    | X    |
| 1) ADD STOP/START FUNCTION TO HVAC EQUIPMENT            |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 1) REPLACE CHILLER WITH HIGHER EFF/CFC FREE CHILLER     |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 2) REPLACE RTU WITH HIGHER EFFICIENCY UNIT              |  | X          | X  | A   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| E. BALANCE HVAC SYSTEM                                  |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| F. INSTALL MAKE-UP AIR SUPPLY FOR KITCHEN AREAS         |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| G. SHUT-OFF RANGE HOOD                                  |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| H. THERMAL STORAGE                                      |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| V. BOILER/STEAM                                         |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. STEAM TRAP INSPECTION                                |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. INSULATE STEAM AND CONDENSATE LINES                  |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| VI. POWER                                               |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. CONVERT TO ENERGY EFFICIENT/SMALLER MOTORS           |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| VII. REDUCE/ENHANCE LIGHTING                            |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. PHOTOCELLS FOR LIGHTING                              |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. TIMERS FOR LIGHTING                                  |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| C. REMOVE UNEEDED LAMPS OR FIXTURES                     |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| D. REDUCE INDOOR/OUTDOOR LIGHTING TO AEI LEVELS         |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| E. LOWER LIGHT FIXTURES                                 |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| F. IMPROVE REFLECTION WITH LIGHT COLORED CEILINGS/WALLS |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| VIII. IMPROVE LIGHTING CONTROLS                         |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. INSTALL OCCUPANCY SENSORS                            |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| B. SEPARATE SWITCHES TO CONTROL LIGHTING                |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| IX. IMPROVE LIGHTING EFFICIENCY                         |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. REPLACE INCANDESCENT LAMPS WITH COMPACT FLUORESCENTS |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| B. REPLACE INCANDESCENT EXIT FIXTURES WITH LED          |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| C. REPLACE STANDARD LAMPS WITH ENERGY SAVING LAMPS      |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| D. REPLACE STANDARD BALLAST WITH ENERGY SAVING BALLAST  |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| E. REPLACE EXISTING FIXTURES WITH HIGH EFF. FIXTURES    |  | A          | A  | A   | A   | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    | A    |
| X. REFRIGERATION EQUIPMENT                              |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. IMPROVE EFFICIENCY OF REFRIGERATION EQUIPMENT        |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. ADD PLASTIC AIR CURTAINS TO PREVENT INFILTRATION     |  | X          | X  |     | X   |      |      |      | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| XI. OTHER                                               |  |            |    |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| A. REPLACE BOILERS WITH 99% EFFICIENT BOILER            |  | X          | X  | X   | A   | A    | X    | X    | X    | X    | X    | A    | A    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| B. REDUCE HW TEMPERATURE TO 140 °F                      |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| C. RESTORE OPERATION OF VENTILATION UNIT                |  | X          | X  | X   | X   | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |

A - NOT RECOMMENDED DUE TO ANALYSIS RESULTS

X - NOT RECOMMENDED DUE TO FIELD OBSERVATIONS/EXPERIENCE

A - NOT RECOMMENDED DUE TO ANALYSIS RESULTS

X = NOT RECOMMENDED DUE TO FIELD OBSERVATIONS/EXPERIENCE

A = NOT RECOMMENDED DUE TO ANALYSIS RESULTS

TABLE 3A. COMPOSITE ECO SUMMARY (BY BUILDING)

| BUILDING NUMBER | ECO NUMBER               | USAGE SAVINGS (KWH/YR) | DEMAND SAVINGS (KW/YR) | GAS SAVINGS (MCF/YR) | MAINT. SAVINGS (\$/YR) | COST SAVINGS (\$/YR) | IMPLEMENTATION COST (\$) | SIMPLE PAYBACK (YEARS) | SAVING TO INV. RATIO (SIR) |
|-----------------|--------------------------|------------------------|------------------------|----------------------|------------------------|----------------------|--------------------------|------------------------|----------------------------|
| BUILDING 44     | IV.A                     | 472                    | 0                      | 3.5                  | -\$5.00                | \$29.00              | \$122.00                 | 5.1                    | 2.7                        |
| BUILDING 44     | VII.C,D & IX.C, D        | 8,409                  | 18.6                   | N/A                  | \$33.00                | \$460.00             | \$2,117.00               | 4.6                    | 2.28                       |
| BUILDING 48     | IX.A                     | 709                    | 2.6                    | N/A                  |                        | \$54.00              | \$89.00                  | 1.7                    | 5.41                       |
| BUILDING 368    | IV.A                     | 2,649                  | 0.0                    | 19.8                 | -\$15.00               | \$164.00             | \$363.00                 | 2.4                    | 5.5                        |
| BUILDING 368    | VII.C,D & IX.A, C, D     | 19,807                 | 43.9                   | N/A                  | \$110.00               | \$1,116.00           | \$2,244.00               | 2                      | 5.07                       |
| BUILDING 407    | IV.C.1                   | 181,265                | 0.0                    | 660.6                | -\$45.00               | \$8,781.00           | \$2,233.00               | 0.3                    | 34.9                       |
| BUILDING 407    | VII.C, D & IX.A, B, C, D | 12,315                 | 53.2                   | N/A                  | \$214.00               | \$1,012.00           | \$4,557.00               | 4.5                    | 1.97                       |
| BUILDING 1350   | IV.D.1)                  | 126,750                | 528.0                  | 0.0                  |                        | \$8,084.00           | \$231,987.00             | 11.8                   | 1.05                       |
| BUILDING 1350   | VII.C,D, & IX.B,C,D.     | 23,724                 | 67.0                   | N/A                  | \$289.00               | \$2,783.00           | \$9,130.00               | 3.3                    | 3.45                       |
| BUILDING 1387   | VII.C,D, & IX.A,B,C,D    | 19,311                 | 29.9                   | N/A                  | \$127.00               | \$1,022.00           | \$2,592.00               | 2.5                    | 4.46                       |
| BUILDING 1395   | IV.D.1)                  | 123,020                | 1,152.0                | N/A                  |                        | \$12,302.00          | \$159,262.00             | 8.2                    | 1.81                       |
| BUILDING 1395   | VII.C,D & IX.A,B,C,D     | 42,637                 | 53.7                   | N/A                  | \$286.00               | \$2,179.00           | \$4,950.00               | 2.2                    | 5.08                       |
| BUILDING 1462   | VII.C,D & IX.B,C,D       | 8,760                  | 15.4                   | N/A                  | \$37.00                | \$455.00             | \$1,037.00               | 2.3                    | 4.96                       |
| BUILDING 1520   | VII.C, D, & IX.A,B,C,D   | 12,030                 | 26.8                   | N/A                  | \$52.00                | \$664.00             | \$2,447.00               | 3.7                    | 3.08                       |
| BUILDING 1630   | VII.C,D & IX.A,C,D       | 2,397                  | 5.5                    | N/A                  | \$10.00                | \$139.00             | \$357.00                 | 2.7                    | 4.21                       |
| BUILDING 2265   | IV.D.1)                  | 424,595                | 1,740.0                | N/A                  |                        | \$26,888.00          | \$338,516.00             | 7.7                    | 2.02                       |
| BUILDING 2265   | VII.C,D, & IX.B,C,D      | 49,856                 | 46.7                   | N/A                  | \$242.00               | \$2,349.00           | \$2,723.00               | 1.2                    | 9.77                       |
| BUILDING 2399   | IV.A                     | 7,528                  | 0.0                    | 89.1                 | -\$15.00               | \$575.00             | \$363.00                 | 0.6                    | 21.15                      |
| BUILDING 2399   | IV.D.1)                  | 826,098                | 3,182.0                | N/A                  |                        | \$54,626.00          | \$365,824.00             | 5.1                    | 3.02                       |
| BUILDING 2399   | IV.F.1.                  | 41,614                 | 0.0                    | 617.0                |                        | \$3,604.00           | \$31,268.00              | 8.7                    | 2.09                       |
| BUILDING 2399   | IV.F.2.                  | 4,776                  | 0.0                    | 70.8                 |                        | \$414.00             | \$3,976.00               | 9.6                    | 1.89                       |
| BUILDING 2399   | VII.C,D & IX.A,B,C,D     | 18,019                 | 28.4                   | N/A                  | \$269.00               | \$1,574.00           | \$8,895.00               | 5.7                    | 2                          |
| BUILDING 2521   | IV.A                     | 278                    | 0.0                    | 2.1                  | -\$5.00                | \$17.00              | \$122.00                 | 10                     | 1.42                       |
| BUILDING 2521   | VII.C,D & IX.A,C,D       | 2,994                  | 13.3                   | N/A                  | \$15.00                | \$212.00             | \$666.00                 | 4.1                    | 2.75                       |
| BUILDING 2530   | VII.C,D & IX.B,C,D       | 5,444                  | 9.1                    | N/A                  | \$23.00                | \$280.00             | \$591.00                 | 2.1                    | 5.98                       |
| BUILDING 2652   | IV.C.1)                  | 41,114                 | 0.0                    | 39.0                 |                        | \$1,613.00           | \$2,292.00               | 1.4                    | 8.49                       |
| BUILDING 2652   | VII.C,D & IX.A,B,C,D     | 8,090                  | 11.7                   | N/A                  | \$36.00                | \$406.00             | \$1,588.00               | 3.9                    | 2.89                       |
| BUILDING 2841   | IV.A                     | 2,000                  | 0.0                    | 23.5                 | -\$10.00               | \$152.00             | \$242.00                 | 1.7                    | 8.13                       |
| BUILDING 2841   | VII.C,D, & IX.A,B,C,D,E  | 111,658                | 185.9                  | N/A                  | \$1,703.00             | \$6,903.00           | \$4,343.00               | 0.6                    | 18.1                       |
| BUILDING 5105   | N/A                      |                        | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| BUILDING 5107   | IV.C.1)                  | 22,613                 | 0.0                    | N/A                  | -\$15.00               | \$814.00             | \$425.00                 | 0.5                    | 22.17                      |
| BUILDING 5107   | VII.C,D, & IX.A,B,C,D    | 12,962                 | 18.2                   | N/A                  | \$66.00                | \$654.00             | \$2,119.00               | 3.2                    | 3.49                       |
| BUILDING 5114   | N/A                      |                        | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| BUILDING 5124   | N/A                      |                        | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| TOTAL           |                          | 2,263,894              | 7,241.9                | 1,525.2              | \$3,402.00             | \$140,319.00         | \$1,187,540.00           | 6.20                   | 2.43                       |



TABLE 3B. COMPOSITE ECO SUMMARY (BY SIR)

| BUILDING NUMBER | ECO NUMBER               | USAGE SAVINGS (KWH/YR) | DEMAND SAVINGS (KW/YR) | GAS SAVINGS (MCF/YR) | MAINT. SAVINGS (\$/YR) | COST SAVINGS (\$/YR) | IMPLEMENTATION COST (\$) | SIMPLE PAYBACK (YEARS) | SAVING TO INV. RATIO (SIR) |
|-----------------|--------------------------|------------------------|------------------------|----------------------|------------------------|----------------------|--------------------------|------------------------|----------------------------|
| BUILDING 407    | IV.C.1                   | 181,265                | 0.0                    | 660.6                | -\$45.00               | \$8,781.00           | \$2,233.00               | 0.3                    | 34.9                       |
| BUILDING 5107   | IV.C.1                   | 22,613                 | 0.0                    | N/A                  | -\$15.00               | \$814.00             | \$425.00                 | 0.5                    | 22.17                      |
| BUILDING 2399   | IV.A                     | 7,528                  | 0.0                    | 89.1                 | -\$15.00               | \$575.00             | \$363.00                 | 0.6                    | 21.15                      |
| BUILDING 2841   | VII.C.D. & IX.A,B,C,D,E  | 111,658                | 185.9                  | N/A                  | \$1,703.00             | \$6,903.00           | \$4,343.00               | 0.6                    | 18.1                       |
| BUILDING 2652   | VII.C.D. & IX.B,C,D      | 49,856                 | 46.7                   | N/A                  | \$242.00               | \$2,349.00           | \$2,723.00               | 1.2                    | 9.77                       |
| BUILDING 2652   | IV.C.1                   | 41,114                 | 0.0                    | 39.0                 |                        | \$1,613.00           | \$2,292.00               | 1.4                    | 8.49                       |
| BUILDING 2841   | IV.A                     | 2,000                  | 0.0                    | 23.5                 | -\$10.00               | \$152.00             | \$242.00                 | 1.7                    | 8.13                       |
| BUILDING 368    | IV.A                     | 2,649                  | 0.0                    | 19.6                 | -\$15.00               | \$184.00             | \$363.00                 | 2.4                    | 5.5                        |
| BUILDING 48     | IX.A                     | 709                    | 2.6                    | N/A                  |                        | \$54.00              | \$89.00                  | 1.7                    | 5.41                       |
| BUILDING 2530   | VII. C,D & IX.B,C,D      | 5,444                  | 9.1                    | N/A                  | \$23.00                | \$280.00             | \$591.00                 | 2.1                    | 5.38                       |
| BUILDING 1395   | VII.C,D & IX.A,B,C,D     | 42,637                 | 53.7                   | N/A                  | \$286.00               | \$2,179.00           | \$4,850.00               | 2.2                    | 5.08                       |
| BUILDING 368    | VII.C,D & IX.A, C, D     | 19,807                 | 43.9                   | N/A                  | \$116.00               | \$1,116.00           | \$2,244.00               | 2                      | 5.07                       |
| BUILDING 1462   | VII.C,D & IX.B,C,D       | 8,760                  | 15.4                   | N/A                  | \$37.00                | \$455.00             | \$1,037.00               | 2.3                    | 4.98                       |
| BUILDING 1387   | VII.C,D & IX.A,B,C,D     | 19,311                 | 29.3                   | N/A                  | \$127.00               | \$1,022.00           | \$2,592.00               | 2.5                    | 4.46                       |
| BUILDING 1630   | VII.C,D & IX.A,C,D       | 2,397                  | 5.5                    | N/A                  | \$10.00                | \$133.00             | \$357.00                 | 2.7                    | 4.21                       |
| BUILDING 5107   | VII.C,D & IX.A,B,C,D     | 12,962                 | 18.2                   | N/A                  | \$66.00                | \$654.00             | \$2,119.00               | 3.2                    | 3.49                       |
| BUILDING 1350   | VII.C,D & IX.B,C,D       | 23,724                 | 67.0                   | N/A                  | \$289.00               | \$2,783.00           | \$9,130.00               | 3.3                    | 3.45                       |
| BUILDING 1520   | VII.C, D, & IX.A,B,C,D   | 12,030                 | 26.8                   | N/A                  | \$52.00                | \$684.00             | \$2,447.00               | 3.7                    | 3.06                       |
| BUILDING 2399   | IV. D, 1)                | 926,098                | 3,192.0                | N/A                  |                        | \$54,626.00          | \$365,824.00             | 5.1                    | 3.02                       |
| BUILDING 2652   | VIII.C,D & IX.A,B,C,D    | 8,080                  | 11.7                   | N/A                  | \$36.00                | \$406.00             | \$1,586.00               | 3.9                    | 2.89                       |
| BUILDING 2521   | VII.C,D & IX.A,C,D       | 2,994                  | 13.3                   | N/A                  | \$15.00                | \$212.00             | \$866.00                 | 4.1                    | 2.75                       |
| BUILDING 44     | IV.A                     | 472                    | 0                      | 3.5                  | -\$5.00                | \$29.00              | \$122.00                 | 5.1                    | 2.7                        |
| BUILDING 44     | VII.C,D & IX.C, D        | 8,409                  | 18.6                   | N/A                  | \$33.00                | \$460.00             | \$2,117.00               | 4.6                    | 2.28                       |
| BUILDING 2399   | IV. F. 1.                | 41,614                 | 0.0                    | 617.0                |                        | \$3,604.00           | \$31,268.00              | 8.7                    | 2.09                       |
| BUILDING 2265   | IV.D 1)                  | 424,595                | 1,740.0                | N/A                  |                        | \$26,888.00          | \$338,516.00             | 7.7                    | 2.02                       |
| BUILDING 2399   | VII.C,D & IX.A,B,C,D     | 18,019                 | 28.4                   | N/A                  | \$269.00               | \$1,574.00           | \$8,895.00               | 5.7                    | 2                          |
| BUILDING 407    | VII.C, D & IX.A, B, C, D | 12,315                 | 53.2                   | N/A                  | \$214.00               | \$1,012.00           | \$4,557.00               | 4.5                    | 1.97                       |
| BUILDING 2399   | IV. F. 2.                | 4,776                  | 0.0                    | 70.8                 |                        | \$414.00             | \$3,976.00               | 8.6                    | 1.89                       |
| BUILDING 1395   | IV.D. 1)                 | 123,020                | 1,152.0                | N/A                  |                        | \$12,302.00          | \$159,262.00             | 8.2                    | 1.81                       |
| BUILDING 2521   | IV.A                     | 278                    | 0.0                    | 2.1                  | -\$5.00                | \$17.00              | \$122.00                 | 10                     | 1.42                       |
| BUILDING 1350   | IV.D.1)                  | 126,750                | 528.0                  | 0.0                  |                        | \$8,084.00           | \$231,987.00             | 11.8                   | 1.05                       |
| BUILDING 5114   | N/A                      | N/A                    | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| BUILDING 5105   | N/A                      | N/A                    | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| BUILDING 5124   | N/A                      | N/A                    | N/A                    | N/A                  | N/A                    | N/A                  | N/A                      | N/A                    | N/A                        |
| TOTAL           |                          | 2,263,894              | 7,241.9                | 1,525.2              | \$3,402.00             | \$140,319.00         | \$1,187,540.00           | 6.20                   | 2.43                       |

# TABLE 4. ECIP SUMMARY

## LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: COMPOSITE ECO SUMMARY  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| A. CONSTRUCTION COST                   | <u>\$1,065,058</u> |                    |
| B. SIOH                                | <u>\$58,578</u>    |                    |
| C. DESIGN COST                         | <u>\$63,903</u>    |                    |
| D. TOTAL COST (1A+1B+1C)               | <u>\$1,187,540</u> |                    |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | <u>\$0</u>         |                    |
| F. PUBLIC UTILITY COMPANY REBATE       | <u>\$0</u>         |                    |
| G. TOTAL INVESTMENT (1D-1E-1F)         |                    | <u>\$1,187,540</u> |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS:

'NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | <u>\$10.55</u>  | <u>7726.67</u>     | <u>\$81,516</u>      | <u>14.65</u>       | <u>\$1,194,215</u>    |
| B. DIST           |                 |                    | <u>\$0</u>           | <u>17.70</u>       | <u>\$0</u>            |
| C. RESID          |                 |                    | <u>\$0</u>           | <u>20.99</u>       | <u>\$0</u>            |
| D. NG             | <u>\$3.31</u>   | <u>1699.50</u>     | <u>\$5,625</u>       | <u>20.60</u>       | <u>\$115,882</u>      |
| E. PPG            |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| F. COAL           |                 |                    | <u>\$0</u>           | <u>16.32</u>       | <u>\$0</u>            |
| G. SOLAR          |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| H. GEOTH          |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| I. BIOMA          |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| J. REFUS          |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| K. WIND           |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| L. OTHER          |                 |                    | <u>\$0</u>           | <u>13.59</u>       | <u>\$0</u>            |
| M. DEMAND SAVINGS |                 |                    | <u>\$48,279</u>      | <u>13.59</u>       | <u>\$656,109</u>      |
| N. TOTAL          |                 | <u>9426.17</u>     | <u>\$135,421</u>     |                    | <u>\$1,966,206</u>    |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |                |                 |
|---------------------------------------|----------------|-----------------|
| A. ANNUAL RECURRING (+/-)             | <u>\$3,402</u> |                 |
| 1. DISCOUNT FACTOR (TABLE A)          |                | <u>13.59</u>    |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |                | <u>\$46,233</u> |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM       | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|------------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A     | \$429,288             | 1                 | 0.96               | \$412,116                       |
| b. N/A     | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A     | \$338,516             | 3                 | 0.89               | \$301,279                       |
| d. N/A     | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A     | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A     | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A     | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A     | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A     | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A     | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A     | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A     | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A     | \$51,000              | 13                | 0.6                | \$30,600                        |
| n. N/A     | \$0                   | 14                | 0.58               | \$0                             |
| o. Chiller | \$231,987             | 15                | 0.56               | \$129,913                       |
| p. TOTAL   | \$1,050,791           |                   |                    | \$873,908                       |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$920,142

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 6.2 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$2,886,347

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 2.43

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 8.7%

## METHODOLOGY

This analysis was conducted with the use of four different software packages. These packages are SimpCalc, Flex, Trace and Lotus. Each software package was utilized for different ECO types. The following is a description of the software packages and the corresponding ECO's which were analyzed. Refer to Appendix H for example software output summaries with descriptions of the results as well as sample calculations.

### **SIMPCALC**

Simplified Energy Conservation Opportunity Calculation System which was developed for the Texas LoanSTAR (Saving Taxes And Resources) program through the Governor's Energy Office and the Department of Energy. This software was utilized to perform energy savings calculations for the following ECO types:

#### **IV. HVAC**

- A. Night setback/setup thermostat.
- C. Upgrade HVAC controls.
  - 1. Add stop/start function to HVAC equipment.
- D. Improve efficiency of operations.
  - 2. Replace RTU with higher efficiency unit.

#### **VI. Power**

- A. Convert to energy efficient/smaller motors.

### **FLEX**

Federal Lighting Energy eXpert (FLEX) program which was developed by the National Renewable Energy Laboratory for the Department of Energy. This software was developed to analyze lighting retrofit systems and is capable of calculating lighting energy savings, HVAC energy savings, implementation cost (refer to Appendix E for input lighting implementation costs), and maintenance savings. This software will also calculate the footcandle levels before and after retrofit. This software was utilized to perform energy savings calculations for the following ECO type:

#### **VII. Reduce/Enhance Lighting**

- C. Remove unneeded lamps or fixtures.
- D. Reduce indoor/outdoor lighting to AEI levels.

## **IX. Improve Lighting Efficiency**

- A. Replace incandescent lamps with compact fluorescents.
- B. Replace incandescent exit fixtures with LED.
- C. Replace standard lamps with energy saving lamps.
- D. Replace standard ballasts with energy saving ballasts.
- E. Replace existing fixtures with high efficiency fixtures.

## **TRACE**

Trace is a building energy analysis program. It is designed to calculate energy consumption, operating costs and equipment paybacks for HVAC systems. This software was utilized to perform energy savings calculations for the following ECO types:

### **IV. HVAC**

- C. Upgrade HVAC controls.
  - 1. Add stop/start function to HVAC equipment.
- D. Improve efficiency of operations.
  - 1. Replace chiller with higher efficiency.

## **LOTUS**

Lotus is a spreadsheet program. This software was utilized to perform calculations for the Bin Method (refer to Appendix H) for ECO type as follows:

### **IV. HVAC**

- F. Install make-up air supply for kitchen areas.

## **RECOMMENDED ECO'S**

All recommended ECO's are listed after each building description. All calculations, references, manufacturers data, implementation costs and ECIP summary calculations are included for each ECO.

## **NON-RECOMMENDED ECO'S**

All non-recommended ECO's and justification references are included in Appendix B.

## **ASSUMPTIONS**

All assumptions are listed with each individual ECO.

## CONCLUSIONS

The results of this analysis indicate that the ECO's recommended result in a project which is eligible of ECIP funding. The approximate implementation cost for the project is \$1,187,540.00 with a simple payback of 6.2 years and an SIR of 2.43. The adjusted internal rate of return is 8.7%.

## UTILITY RATE SCHEDULE ANALYSIS

### ELECTRIC UTILITY RATE SCHEDULE ANALYSIS

NAME OF UTILITY: City Public Service

RATE SCHEDULE ANALYZED: Large Lighting and Power Service  
(See Appendix A)

#### SUMMARY OF BILLING COMPONENT CHARGES:

Customer Charge: \$130.00

|                | <u>On-Peak Months</u> | <u>Off-Peak Months</u> |
|----------------|-----------------------|------------------------|
| Energy Charge: | \$ .036 /KWH          | \$ .036 /KWH           |
| Demand Charge: | \$7.50 /KW            | \$6.25 /KW             |

#### AVOIDED COST OF ENERGY TO BE USED IN CALCULATIONS:

| CHARGE        | PEAK     | UTILITY COST | SITE COST    |
|---------------|----------|--------------|--------------|
| Energy Charge | On-Peak  | \$.036/KWH   | \$10.55/MBTU |
|               | Off-Peak | \$.036/KWH   |              |
| Demand Charge | On-Peak  | \$7.50/KW    | --           |
|               | Off-Peak | \$6.25/KW    |              |

Site Cost was obtained using a conversion factor of .003413 MBTU/KWH.

#### COMMENTS:

No incentive or rebates for energy retrofit measures.

## GAS UTILITY RATE SCHEDULE ANALYSIS

NAME OF UTILITY: City Public Service

RATE SCHEDULE ANALYZED: Large Volume Gas

(See Appendix A)

### SUMMARY OF BILLING COMPONENT CHARGES:

Minimum Charge: \$325.00/month per meter

|                | <u>December-March</u> | <u>April-November</u> |
|----------------|-----------------------|-----------------------|
| Demand Charge: | \$0.80 per CCF/Day    | \$.64 per CCF/Day     |
| Energy Charge: | \$.265 per CCF        | \$.265 per CCF        |

### AVOIDED COST OF ENERGY TO BE USED IN CALCULATIONS:

| Charge    | Utility Cost | Site Cost   |
|-----------|--------------|-------------|
| Gas Usage | \$ 3.41/KCF* | \$3.31/MBTU |

Site cost was obtained using a conversion factor of 1.031 MBTU/KCF.

\*Utility cost was based on an average cost of gas based on Historical Billings (See Appendix A).



## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 44 - SNACK BAR**

Building 44 is primarily a one story building with a total of 95,000 square feet. The snack bar is contained within this facility and consists of approximately 2,000 square feet.

The operating hours are from 6:00 am to 2:00 pm, 5 days per week.

The lighting system is primarily fluorescent.

The mechanical system consists of a 3 ton packaged DX rooftop unit with gas heating and a kitchen exhaust hood.

Hot water is supplied by the central building, gas fired, domestic hot water boiler. There is no dishwashing equipment and all dishes and utensils are disposable.

The following ECO's are recommended for Building 44:

1. IV. A - Night setback/setup thermostat
2. VII. D - Reduce indoor/outdoor lighting to AEI levels
3. IX. C - Replace standard lamps with energy saving lamps
4. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 44

ECO NO: IV.A.

ECO NAME: Night setback/setup thermostat.

#### SUMMARY DATA (DEPENDENT):

|                                        |                  |        |
|----------------------------------------|------------------|--------|
| KWH Savings:                           | <u>472</u>       | KWH/yr |
| Demand Savings:                        | <u>0</u>         | KW/yr  |
| Gas Savings:                           | <u>3.5</u>       | MCF/yr |
| Cost Savings:                          | <u>\$ 29.00</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 122.00</u> |        |
| Simple Payback:                        | <u>4.2</u>       | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>3.15</u>      |        |

#### ECO DESCRIPTION:

Currently, a manual thermostat is used to control the packaged DX rooftop unit which serves the snack bar. This ECO analyzes the installation of a programmable night setback/setup thermostat to reduce energy consumption during unoccupied periods.

#### COST SAVINGS CALCULATIONS:

(Refer to following SimpCalc Calculations)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### MAINTENANCE COSTS:

Maintenance costs of \$5.00/year is included in the LCCA for programming, battery replacement and failures.

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

TEXAS LoanSTAR Program - ECRM Simplified Calculation Ver 2.0

11/08/93

SimpCalc 2.0 SUMMARY (by FORM) - FORT SAM HOUSTON

Page 1

| Form  | Facility            | ECRM Desc.        | Page | KWH/Yr | KW  | MCF/yr | mmBtu/Yr | \$/Yr | Imp.Cost | PayBack |
|-------|---------------------|-------------------|------|--------|-----|--------|----------|-------|----------|---------|
| C7-01 | BLDG 0044 SNACK BAR | Prog Thermostat   | 1    | 472    | .00 | 3.5    | 5.2      | 29    | 122      | 4.2     |
|       |                     | *** SUB-TOTAL *** |      | 472    | .00 | 3.5    | 5.2      | 29    | 122      | 4.2     |
|       |                     | ** GRAND TOTAL ** |      | 472    | .00 | 3.5    | 5.2      | 29    | 122      | 4.2     |

11/08/93

Consolidated ECRM Detail - FORT SAM HOUSTON

Page 1

C7-001 Programmable Thermostats - BLDG 0044 SNACK BAR

(G)

Cost Source: means cost estimating

Description: Install night setback/setup thermostat.

A) .15 BTU/hr-ft-F U-Value of Walls  
 B) 0 Sq.Ft. Wall Area (includes windows and doors)  
 C) .05 BTU/hr-ft-F U-Value of Roof  
 D) 2074 Sq.Ft. Roof Area  
 E) 70 Degree/F Heating Season Thermostat Setpoint  
 F) 55 Degree/F Heating Season Thermostat Setback Setpoint  
 G) 1800 Hours/yr Heating Season Setback Hours  
     = 12 Hrs/day x 150 Days/yr  
 H) 74 Degree/F Cooling Season Thermostat Setpoint  
 I) 90 Degree/F Cooling Season Thermostat Setback Setpoint  
 J) 2400 Hours/yr Cooling Season Setback Hours  
     = 12 Hrs/day x 200 Days/yr  
 K) .7500 Heating Equipment Efficiency (Table 2)  
 L) \$ 3.41 /MCF Cost per MCF  
 M) 8.57 BTUH/Watt EER of Air Conditioning Unit (Table 1)  
 N) \$ .0360 /KWH Cost per KWH - Summer  
 O) \$ 122 Installed Cost = 1 Thermostats x \$ 122/stat  
  
 P) 104 BTU/hf-F Total Envelope UA-Value  
 Q) 2.8 mmBTU/yr Heating Load Reduction  
 R) \$ 12 Heating Cost Reduction  
 S) 4.0 mmBTU/yr Cooling Load Reduction  
 T) \$ 17 /year Cooling Cost Reduction  
 U) \$ 29 /year Annual Cost Savings  
 V) 4.2 years Simple Payback

[illegible]

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0044 - ECO IV. A. - NIGHT SETBACK/SETUP THERMOSTAT  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |              |              |
|----------------------------------------|--------------|--------------|
| A. CONSTRUCTION COST                   | <u>\$109</u> |              |
| B. SIOH                                | <u>\$6</u>   |              |
| C. DESIGN COST                         | <u>\$7</u>   |              |
| D. TOTAL COST (1A+1B+1C)               | <u>\$122</u> |              |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | <u>\$0</u>   |              |
| F. PUBLIC UTILITY COMPANY REBATE       | <u>\$0</u>   |              |
| G. TOTAL INVESTMENT (1D-1E-1F)         |              | <u>\$122</u> |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | <u>\$10.55</u>  | <u>1.61</u>        | <u>\$17</u>          | <u>11.77</u>       | <u>\$200</u>          |
| B. DIST           |                 |                    | <u>\$0</u>           | <u>13.83</u>       | <u>\$0</u>            |
| C. RESID          |                 |                    | <u>\$0</u>           | <u>16.15</u>       | <u>\$0</u>            |
| D. NG             | <u>\$3.31</u>   | <u>3.61</u>        | <u>\$12</u>          | <u>15.34</u>       | <u>\$183</u>          |
| E. PPG            |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| F. COAL           |                 |                    | <u>\$0</u>           | <u>12.82</u>       | <u>\$0</u>            |
| G. SOLAR          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| H. GEOTH          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| I. BIOMA          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| J. REFUS          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| K. WIND           |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| L. OTHER          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| M. DEMAND SAVINGS |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| N. TOTAL          |                 | <u>5.22</u>        | <u>\$29</u>          |                    | <u>\$383</u>          |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |             |              |
|---------------------------------------|-------------|--------------|
| A. ANNUAL RECURRING (+/-)             | <u>-\$5</u> |              |
| 1. DISCOUNT FACTOR (TABLE A)          |             | <u>11.1</u>  |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |             | <u>-\$56</u> |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** - \$56

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 5.1 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$328

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 2.70

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 11.1%



## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 44

ECO NO: VII. D. & IX C.,D.

ECO NAME: Improve lighting efficiency

#### SUMMARY DATA (DEPENDENT):

KWH Savings: 8.409 KWH/yr  
Demand Savings: 18.6 KW/yr  
Gas Savings: N/A MCF/yr  
Cost Savings: \$ 460.00 /yr  
Implementation Cost: \$ 2,117.00  
Simple Payback: 4.6 Years  
Savings to Investment:  
Ratio (SIR): 2.28

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting system to improve efficiency while maintaining or increasing lighting levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                       |
|-----|-------------------|----------------------------------------------|
| 12  | 2-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 8   | 4-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 20  | 2-Lamp, 8' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned} \text{Demand Savings} &= [(4.49 \text{ KW} - 2.94 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (4.49 \text{ KW} - 2.94 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW}] \\ &= \$124.00/\text{yr} \end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD0044A                | 6610                 | 8808                    | 22942                         | 1688                         | 3492                         | 4.160                          | 3.515                              | 2117                     | 945                           | 19880                          | 70                           | 1463                          |
| *BLD0044B               | 10101                | 0                       | 31750                         | 2336                         | 0                            | 0.000                          | 0.000                              | 0                        | 1395                          | 30355                          | 103                          | 2234                          |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD0044A   | POST RETROFIT CONDITIONS |
| BLD0044B   | EXISTING CONDITIONS      |

=====

| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044A.WBR  
 Date: 10/16/1993

Lighting Annual : 6610 kWh  
 Lighting Capacity : 2.938 kW  
 Annual Cooling Effect : 9322 kWh  
 Annual Heating Effect : 944 kWh  
 Total Surveyed Floor Area: 2199 Sqft  
 Percent Survey Completed : 219900 %  
 Lighting Power Density : 1.336 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2117    | 8447   | 945    | 11595   | -162    | 22942 |
| AVLCC \$ | 156     | 622    | 70     | 853     | -12     | 1688  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044A.LLR

Date: 10/16/1993

| Room         |       |       |       |       |           |           |
|--------------|-------|-------|-------|-------|-----------|-----------|
| Foot Candles | MAX   | MIN   | AVG   | SDEV  | MAX Room  | MIN Room  |
| -----        | ----- | ----- | ----- | ----- | -----     | -----     |
| Calculated   | 44.7  | 5.3   | 23.3  | 16.77 | 5-kitchen | 1-storage |
| Measured     | 45.7  | 0.0   | 16.8  | 19.06 | 5-kitchen | 2-Corr    |
| Required     | 50.0  | 5.0   | 26.0  | 22.75 | 3-stor    | 1-storage |

| Foot Candle |       |       |       |       |          |          |
|-------------|-------|-------|-------|-------|----------|----------|
| Comparison  | MAX   | MIN   | AVG   | SDEV  | MAX Room | MIN Room |
| -----       | ----- | ----- | ----- | ----- | -----    | -----    |
| Calc - Req. | 24.5  | -20.2 | -2.7  | 17.07 | 4-dining | 3-stor   |
| Meas - Req. | 18.6  | -50.0 | -9.2  | 27.05 | 4-dining | 3-stor   |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044A.LSR  
Date: 10/16/1993

System Number: 1      Descrip: suspended wrap

Rooms Served: 1  
Floor Area: 272 SqFt  
Possible kW: 0.126  
Working kW: 0.126  
Capacity kW: 0.126  
Lighting: 283 Annual kWh  
Heating: 40 Annual kWh  
Cooling: 401 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.462 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 361    | 35     | 505     | -7      | 976   |
| AVLCC \$ | 27     | 3      | 37      | -1      | 72    |

System Number: 2      Descrip: 2x4 lay-in

Rooms Served: 2  
Floor Area: 1556 SqFt  
Possible kW: 0.628  
Working kW: 0.628  
Capacity kW: 0.628  
Lighting: 1413 Annual kWh  
Heating: 202 Annual kWh  
Cooling: 2004 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.404 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 20    | 10.0     |
| Working       | 10       | 20    | 10.0     |
| Capacity      | 10       | 20    | 10.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1806   | 177    | 2524    | -35     | 4882  |
| AVLCC \$ | 133    | 13     | 186     | -3      | 359   |

System Number: 3      Descrip: 2x4 recessed, acrylic

Rooms Served: 2  
 Floor Area: 371 SqFt  
 Possible kW: 0.928  
 Working kW: 0.899  
 Capacity kW: 0.928  
 Lighting: 2088 Annual kWh  
 Heating: 298 Annual kWh  
 Cooling: 2910 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 2.423 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 8        | 32    | 8.0      |
| Working       | 8        | 31    | 7.0      |
| Capacity      | 8        | 32    | 8.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 1     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2668   | 221    | 3520    | -51     | 6782  |
| AVLCC \$ | 196    | 16     | 259     | -4      | 499   |

System Number: 4      Descrip: 8' industrial w/ 1/2' plastic

Rooms Served: 1  
 Floor Area: 1360 SqFt  
 Possible kW: 1.256  
 Working kW: 1.256  
 Capacity kW: 1.256  
 Lighting: 2826 Annual kWh  
 Heating: 404 Annual kWh  
 Cooling: 4007 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 0.924 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 20       | 40    | 20.0     |
| Working       | 20       | 40    | 20.0     |
| Capacity      | 20       | 40    | 20.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3612   | 512    | 5047    | -69     | 10302 |
| AVLCC \$ | 266    | 38     | 371     | -5      | 758   |

Room-By-Room Summary Report

Project: FT SAM HOUSTON EEAP  
 File: M:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044A.RRR  
 Date: 10/16/1993

| Room Name | Floor | # | Total Area | SYSTEM1       | Work  | Pot.  | Watt | SYSTEM2    | Work  | Pot.  | Watt | SYSTEM3 | Work  | Pot.  | Watt | Work  | Pot.  | Watt | Meas. | Calc. | Req.  |
|-----------|-------|---|------------|---------------|-------|-------|------|------------|-------|-------|------|---------|-------|-------|------|-------|-------|------|-------|-------|-------|
|           |       |   |            | #Pr Name      | Watts | Watts | sqft | Watts      | Watts | Watts | sqft | Watts   | Watts | Watts | sqft | Watts | Watts | sqft | FootC | FootC | FootC |
| 1-storage | 1     | 1 | 272        | 1 suspended   | 126   | 126   | 0.46 |            |       |       |      |         |       |       |      | 126   | 126   | 0.46 | 14.5  | 5.3   | 5.0   |
| 2-Corr    | 1     | 1 | 196        | 2 2x4 lay-in  | 126   | 126   | 0.64 |            |       |       |      |         |       |       |      | 126   | 126   | 0.64 | 0.0   | 7.1   | 20.0  |
| 3-stor    | 1     | 1 | 147        | 1 2x4 recess  | 319   | 348   | 2.37 |            |       |       |      |         |       |       |      | 319   | 348   | 2.37 | 0.0   | 29.8  | 50.0  |
| 4-dining  | 1     | 1 | 1360       | 15 2x4 lay-in | 502   | 502   | 0.37 | 8' industr | 1256  | 1256  | 0.92 |         |       |       |      | 1758  | 1758  | 1.29 | 23.6  | 29.5  | 5.0   |
| 5-kitchen | 1     | 1 | 224        | 1 2x4 recess  | 580   | 580   | 2.59 |            |       |       |      |         |       |       |      | 580   | 580   | 2.59 | 45.7  | 44.7  | 50.0  |

Total Rooms : 5  
 Total Area Sqft : 2199  
 Total People : 20  
 Total Working kW : 2.909  
 Total Potential kW : 2.938  
 Power Density W/sqft : 1.336



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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044B.WBR

Date: 10/16/1993

Lighting Annual : 10101 kWh  
 Lighting Capacity : 4.490 kW  
 Annual Cooling Effect : 14240 kWh  
 Annual Heating Effect : 1443 kWh  
 Total Surveyed Floor Area: 2199 SqFt  
 Percent Survey Completed : 220 %  
 Lighting Power Density : 2.042 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
|          | -----   | -----  | -----  | -----   | -----   | ----- |
| PVLCC \$ | 0       | 12909  | 1395   | 17694   | -248    | 31750 |
| AVLCC \$ | 0       | 950    | 103    | 1302    | -18     | 2336  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0044\BLD0044B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: suspended wrap

Rooms Served: 1  
Floor Area: 272 SqFt  
Possible kW: 0.159  
Working kW: 0.159  
Capacity kW: 0.159  
Lighting: 358 Annual kWh  
Heating: 51 Annual kWh  
Cooling: 507 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.585 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 457    | 61     | 639     | -9      | 1148  |
| AVLCC \$ | 34     | 4      | 47      | -1      | 84    |

System Number: 2      Descrip: 2x4 lay-in

Rooms Served: 2  
Floor Area: 1556 SqFt  
Possible kW: 0.875  
Working kW: 0.716  
Capacity kW: 0.875  
Lighting: 1968 Annual kWh  
Heating: 281 Annual kWh  
Cooling: 2790 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.460 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 11       | 22    | 11.0     |
| Working       | 10       | 18    | 8.0      |
| Capacity      | 11       | 22    | 11.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 1        | 2     | 1.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2515   | 334    | 3514    | -48     | 6314  |
| AVLCC \$ | 185    | 25     | 259     | -4      | 465   |

System Number: 3      Descrip: 2x4 recessed, acrylic

Rooms Served: 2  
 Floor Area: 371 SqFt  
 Possible kW: 1.536  
 Working kW: 1.488  
 Capacity kW: 1.536  
 Lighting: 3456 Annual kWh  
 Heating: 494 Annual kWh  
 Cooling: 4817 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 4.011 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 8        | 32    | 8.0      |
| Working       | 8        | 31    | 7.0      |
| Capacity      | 8        | 32    | 8.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 1     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4417   | 404    | 5826    | -85     | 10561 |
| AVLCC \$ | 325    | 30     | 429     | -6      | 777   |

System Number: 5      Descrip: 8' industrial w/ 1/2'plastic

Rooms Served: 1  
 Floor Area: 1360 SqFt  
 Possible kW: 1.920  
 Working kW: 1.824  
 Capacity kW: 1.920  
 Lighting: 4320 Annual kWh  
 Heating: 617 Annual kWh  
 Cooling: 6126 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 1.341 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 20       | 40    | 20.0     |
| Working       | 20       | 38    | 19.0     |
| Capacity      | 20       | 40    | 20.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 2     | 1.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5521   | 597    | 7715    | -106    | 13727 |
| AVLCC \$ | 406    | 44     | 568     | -8      | 1010  |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0044 - ECO VII. D. & IX C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |     |         |
|----------------------------------------|---------|-----|---------|
| A. CONSTRUCTION COST                   | \$1,899 |     |         |
| B. SIOH                                | \$104   |     |         |
| C. DESIGN COST                         | \$114   |     |         |
| D. TOTAL COST (1A+1B+1C)               | \$2,117 |     |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |         |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     | \$2,117 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 11.91              | \$126                | 11.77              | \$1,479               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             |                 |                    | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 16.79              | \$177                | 11.12              | \$1,970               |
| M. DEMAND SAVINGS |                 |                    | \$124                | 11.12              | \$1,379               |
| N. TOTAL          |                 | 28.7               | \$427                |                    | \$4,828               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |      |      |       |
|---------------------------------------|------|------|-------|
| A. ANNUAL RECURRING (+/-)             | \$33 |      |       |
| 1. DISCOUNT FACTOR (TABLE A)          |      | 11.1 |       |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |      |      | \$366 |

**LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$366

**4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bp1/ECONOMIC LIFE)):** 4.6 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$5,194

**6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G:** 2.45

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 10.4%

## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 48 - VIP GUEST HOUSE DINING**

Building 48 is a historic two story, wood frame building with a total of 8,600 square feet. The dining and kitchen facilities are located on the first floor and consist of approximately 500 square feet.

The operating hours are from 5:30 am to 11:00 am, 5 days per week.

The lighting system is primarily incandescent with chandeliers in the dining room and recessed incandescent fixtures in the kitchen.

The mechanical system consists of a wall mounted fan coil unit which is provided with chilled water by an air cooled chiller. Heating is provided by a gas fired boiler located in the basement.

Hot water is supplied by a gas fired water heater located in the basement. All dishes are washed by hand.

The following ECO's are recommended for Building 48:

1. IV. A - Night setback/setup thermostat
2. IX. A - Replace incandescent lamps with compact fluorescents

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 48

ECO NO: IX.A

ECO NAME: Replace incandescent lamps with compact fluorescents

#### SUMMARY DATA (DEPENDENT):

KWH Savings: 709 KWH/yr

Demand Savings: 2.59 KW/yr

Gas Savings: N/A MCF/yr

Cost Savings: \$ 54.00 /yr

Implementation Cost: \$ 89.00

Simple Payback: 1.7 Years

Savings to Investment:  
Ratio (SIR): 5.41

#### ECO DESCRIPTION:

Currently, recessed incandescent fixtures are utilized in the kitchen area. This ECO replaces the incandescent lamps with 27W compact fluorescent lamps. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE           | ACTION                      |
|-----|------------------------|-----------------------------|
| 1   | Fan/Chandelier         | None.                       |
| 3   | Incandescent downlight | Replace with compact fluor. |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned} \text{Demand Savings} &= (.34 \text{ KW} - 1.24 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (.34 \text{ KW} - .124 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$17.28/\text{yr} \end{aligned}$$

**IMPLEMENTATION COSTS:**

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)



| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD0048A                | 171                  | 874                     | 717                           | 53                           | 297                          | 10.911                         | -1.573                             | 80                       | 125                           | 512                            | 9                            | 38                            |
| *BLD0048B               | 467                  | 0                       | 1590                          | 117                          | 0                            | 0.000                          | 0.000                              | 0                        | 268                           | 1322                           | 20                           | 97                            |

Project Description: FT SAM HOUSTON EEAP

| File Name | Case Description         |
|-----------|--------------------------|
| BLD0048A  | POST RETROFIT CONDITIONS |
| BLD0048B  | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0048\BLD0048A.WBR  
 Date: 10/25/1993

Lighting Annual : 171 kWh  
 Lighting Capacity : 0.124 kW  
 Annual Cooling Effect : 243 kWh  
 Annual Heating Effect : 49 kWh  
 Total Surveyed Floor Area: 504 Sqft  
 Percent Survey Completed : 50400 %  
 Lighting Power Density : 0.246 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 80      | 224    | 125    | 297     | -8      | 717   |
| AVLCC \$ | 6       | 16     | 9      | 22      | -1      | 53    |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0048\BLD0048A.LLR  
 Date: 10/25/1993

| Room                   |       |       |       |       |           |           |
|------------------------|-------|-------|-------|-------|-----------|-----------|
| Foot Candles           | MAX   | MIN   | AVG   | SDEV  | MAX Room  | MIN Room  |
| Calculated             | 27.3  | 0.5   | 13.9  | 18.93 | 2-kitchen | 1-dinding |
| Measured               | 6.4   | 2.7   | 4.6   | 2.59  | 1-dinding | 2-kitchen |
| Required               | 75.0  | 21.0  | 48.0  | 38.18 | 2-kitchen | 1-dinding |
| Foot Candle Comparison | MAX   | MIN   | AVG   | SDEV  | MAX Room  | MIN Room  |
| Calc - Req.            | -20.5 | -47.7 | -34.1 | 19.25 | 1-dinding | 2-kitchen |
| Meas - Req.            | -14.6 | -72.3 | -43.4 | 40.78 | 1-dinding | 2-kitchen |

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Lighting System Survey Summary

One Page for Each Defined System

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0048\BLD0048A.LSR  
 Date: 10/25/1993

System Number: 1      Descrip: fan/chandelier

=====

Rooms Served: 1  
 Floor Area: 336 SqFt  
 Possible kW: 0.040  
 Working kW: 0.040  
 Capacity kW: 0.040  
 Lighting: 55 Annual kWh  
 Heating: 16 Annual kWh  
 Cooling: 78 Annual kWh  
 Op Hours/Year: 1375 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time: 8.7 Months  
 Power Density: 0.119 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 72     | 55     | 96      | -3      | 222   |
| AVLCC \$ | 5      | 4      | 7       | -0      | 16    |

System Number: 3      Descrip: COMPACT FLUORESCENT

=====

Rooms Served: 1  
 Floor Area: 168 SqFt  
 Possible kW: 0.084  
 Working kW: 0.084  
 Capacity kW: 0.084  
 Lighting: 116 Annual kWh  
 Heating: 33 Annual kWh  
 Cooling: 164 Annual kWh  
 Op Hours/Year: 1375 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time: 101.7 Months  
 Power Density: 0.500 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 3     | 3.0      |
| Working       | 3        | 3     | 3.0      |
| Capacity      | 3        | 3     | 3.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 151    | 70     | 201     | -6      | 495   |
| AVLCC \$ | 11     | 5      | 15      | -0      | 36    |



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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0048\BLD0048B.WBR

Date: 10/16/1993

Lighting Annual : 467 kWh  
 Lighting Capacity : 0.340 kW  
 Annual Cooling Effect : 657 kWh  
 Annual Heating Effect : 135 kWh  
 Total Surveyed Floor Area: 504 SqFt  
 Percent Survey Completed : 50400 %  
 Lighting Power Density : 0.675 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 0       | 613    | 268    | 732     | -23     | 1590  |
| AVLCC \$ | 0       | 45     | 20     | 54      | -2      | 117   |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0048\BLD00488.LSR  
Date: 10/16/1993

System Number: 1 Descrip: fan/chandelier

Rooms Served: 1  
Floor Area: 336 SqFt  
Possible kW: 0.040  
Working kW: 0.040  
Capacity kW: 0.040  
Lighting: 55 Annual kWh  
Heating: 16 Annual kWh  
Cooling: 78 Annual kWh  
Op Hours/Year: 1375 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 8.7 Months  
Power Density: 0.119 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 72     | 55     | 96      | -3      | 220   |
| AVLCC \$ | 5      | 4      | 7       | -0      | 16    |

System Number: 2 Descrip: incand

Rooms Served: 1  
Floor Area: 168 SqFt  
Possible kW: 0.300  
Working kW: 0.300  
Capacity kW: 0.300  
Lighting: 413 Annual kWh  
Heating: 119 Annual kWh  
Cooling: 578 Annual kWh  
Op Hours/Year: 1375 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 6.5 Months  
Power Density: 1.786 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 3     | 0.0      |
| Working       | 3        | 3     | 0.0      |
| Capacity      | 3        | 3     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 541    | 214    | 636     | -20     | 1370  |
| AVLCC \$ | 40     | 16     | 47      | -2      | 101   |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BLDG 0048 - ECO IX A - REPLACE INCANDESCENT LAMPS W/COMPACT FLUOR.  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |      |     |  |      |  |
|----------------------------------------|------|-----|--|------|--|
| A. CONSTRUCTION COST                   | \$80 |     |  |      |  |
| B. SIOH                                | \$4  |     |  |      |  |
| C. DESIGN COST                         | \$5  |     |  |      |  |
| D. TOTAL COST (1A+1B+1C)               | \$89 |     |  |      |  |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |      | \$0 |  |      |  |
| F. PUBLIC UTILITY COMPANY REBATE       |      | \$0 |  |      |  |
| G. TOTAL INVESTMENT (1D-1E-1F)         |      |     |  | \$89 |  |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 1.01               | \$11                 | 11.77              | \$125                 |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             |                 |                    | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 1.41               | \$15                 | 11.12              | \$165                 |
| M. DEMAND SAVINGS |                 |                    | \$17                 | 11.12              | \$192                 |
| N. TOTAL          |                 | 2.42               | \$43                 |                    | \$483                 |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |      |      |       |  |  |
|---------------------------------------|------|------|-------|--|--|
| A. ANNUAL RECURRING (+/-)             | \$11 |      |       |  |  |
| 1. DISCOUNT FACTOR (TABLE A)          |      | 11.1 |       |  |  |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |      |      | \$122 |  |  |



# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                             |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                             |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL | \$0                   |                   |                    | \$0                             |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$122

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bp1/ECONOMIC LIFE)): 1.7 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$605

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 6.78

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 18.2%

## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 368 - CAFETERIA**

Building 368 is a one story stucco building consisting of 5,700 square feet. This facility consists of full service kitchen and a large dining area.

The operating hours are from 6:00 am to 2:0 pm, 5 days per week.

The lighting system is primarily fluorescent with some decorative incandescent fixtures.

The mechanical system consists of 3 DX packaged rooftop units. Heating is provided by gas furnaces in the rooftop units.

Hot water is provided by a gas fired water heater. Dishwashing is accomplished using an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 368:

1. IV. A - Night setback/setup thermostat
2. VII. D - Reduce indoor/outdoor lighting to AEI levels
3. IX. A - Replace incandescent lamps with compact fluorescents
4. IX. C - Replace standard lamps with energy saving lamps
5. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING 368

ECO NO: IV.A.

ECO NAME: Night setback/setup thermostat

#### SUMMARY DATA (DEPENDENT):

|                                        |                  |        |
|----------------------------------------|------------------|--------|
| KWH Savings:                           | <u>2.649</u>     | KWH/yr |
| Demand Savings:                        | <u>0</u>         | KW/yr  |
| Gas Savings:                           | <u>19.6</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 164</u>    | /yr    |
| Implementation Cost:                   | <u>\$ 363.00</u> |        |
| Simple Payback:                        | <u>2.2</u>       | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>5.96</u>      |        |

#### ECO DESCRIPTION:

Currently, three manual thermostats are used to control the three packaged rooftop units that serve the cafeteria and office areas. This ECO analyzes the installation of programmable night setback/setup thermostats to reduce energy consumption during unoccupied periods.

#### COST SAVINGS CALCULATIONS:

(Refer to following SimpCalc Calculations)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### MAINTENANCE COSTS:

Maintenance costs of \$5.00/year is included in the LCCA for programming, battery replacement and failures.

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

TEXAS LoanSTAR Program - ECRM Simplified Calculation Ver 2.0

11/08/93

SimpCalc 2.0 SUMMARY (by FORM) - FORT SAM HOUSTON

Page 1

| Form  | Facility            | ECRM Desc.        | Page | KWH/Yr | KW  | MCF/yr | mmBtu/Yr | \$/Yr | Imp.Cost | PayBack |
|-------|---------------------|-------------------|------|--------|-----|--------|----------|-------|----------|---------|
| C7-01 | BLDG 0368 CAFETERIA | Prog Thermostat   | 1    | 2694   | .00 | 19.6   | 29.4     | 164   | 363      | 2.2     |
|       |                     | *** SUB-TOTAL *** |      | 2694   | .00 | 19.6   | 29.4     | 164   | 363      | 2.2     |
|       |                     | ** GRAND TOTAL ** |      | 2694   | .00 | 19.6   | 29.4     | 164   | 363      | 2.2     |

11/08/93

Consolidated ECRM Detail - FORT SAM HOUSTON

Page 1

C7-001 Programmable Thermostats - BLDG 0368 CAFETERIA

(G)

Cost Source:

Description:

A) .20 BTU/hr-ft-F U-Value of Walls  
 B) 2070 Sq.Ft. Wall Area (includes windows and doors)  
 C) .05 BTU/hr-ft-F U-Value of Roof  
 D) 2108 Sq.Ft. Roof Area  
 E) 70 Degree/F Heating Season Thermostat Setpoint  
 F) 55 Degree/F Heating Season Thermostat Setback Setpoint  
 G) 1950 Hours/yr Heating Season Setback Hours  
     = 13 Hrs/day x 150 Days/yr  
 H) 74 Degree/F Cooling Season Thermostat Setpoint  
 I) 90 Degree/F Cooling Season Thermostat Setback Setpoint  
 J) 2600 Hours/yr Cooling Season Setback Hours  
     = 13 Hrs/day x 200 Days/yr  
 K) .7500 Heating Equipment Efficiency (Table 2)  
 L) \$ 3.41 /MCF Cost per MCF  
 M) 8.00 BTUH/Watt EER of Air Conditioning Unit (Table 1)  
 N) \$ .0360 /KWH Cost per KWH - Summer  
 O) \$ 363 Installed Cost = 3 Thermostats x \$ 121/stat  
  
 P) 519 BTU/hf-F Total Envelope UA-Value  
 Q) 15.2 mmBTU/yr Heating Load Reduction  
 R) \$ 67 Heating Cost Reduction  
 S) 21.6 mmBTU/yr Cooling Load Reduction  
 T) \$ 97 /year Cooling Cost Reduction  
 U) \$ 164 /year Annual Cost Savings  
 V) 2.2 years Simple Payback

|                                      |                       |
|--------------------------------------|-----------------------|
| PROJECT NAME: FORT SAM HOUSTON EEAP  | PROJECT NO: 91109912F |
| PROJECT LOCATION: SAN ANTONIO, TEXAS | ESTIMATOR: S.P. CLARK |
| SUBMITTAL: 35.0%                     | DATE: 25-Oct-93       |
| ECO NO/ BUILDING: IV. A. / BLDG 0368 | CHECKED BY: DJY       |

JOBNUMCE.WK1 55 25-Oct-93

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0368 - ECO IV. A. - NIGHT SETBACK/SETUP THERMOSTAT  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |       |     |  |       |  |
|----------------------------------------|-------|-----|--|-------|--|
| A. CONSTRUCTION COST                   | \$326 |     |  |       |  |
| B. SIOH                                | \$18  |     |  |       |  |
| C. DESIGN COST                         | \$20  |     |  |       |  |
| D. TOTAL COST (1A+1B+1C)               | \$363 |     |  |       |  |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |       | \$0 |  |       |  |
| F. PUBLIC UTILITY COMPANY REBATE       |       | \$0 |  |       |  |
| G. TOTAL INVESTMENT (1D-1E-1F)         |       |     |  | \$363 |  |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 9.19               | \$97                 | 11.77              | \$1,141               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 20.21              | \$67                 | 15.34              | \$1,026               |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 11.12              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$0                  | 11.12              | \$0                   |
| N. TOTAL          |                 | 29.4               | \$164                |                    | \$2,167               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |  |        |      |         |  |
|---------------------------------------|--|--------|------|---------|--|
| A. ANNUAL RECURRING (+/-)             |  | (\$15) |      |         |  |
| 1. DISCOUNT FACTOR (TABLE A)          |  |        | 11.1 |         |  |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |  |        |      | (\$167) |  |



**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** (\$167)

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 2.4 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$2,001

**6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G:** 5.50

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 16.5%

## **ENERGY CONSERVATION ANALYSIS**

### **ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 368**

ECO NO: VII. D & IX A, C, D

ECO NAME: Improve lighting efficiency.

#### **SUMMARY DATA (DEPENDENT):**

KWH Savings: 19.807 KWH/yr  
Demand Savings: 43.9 KW/yr  
Gas Savings: N/A MCF/yr  
Cost Savings: \$ 1.116 /yr  
Implementation Cost: \$ 2.244  
Simple Payback: 2.0 Years  
Savings to Investment:  
Ratio (SIR): 5.07

#### **ECO DESCRIPTION:**

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing current lighting levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE             | ACTION                                      |
|-----|--------------------------|---------------------------------------------|
| 21  | Decorative incandescents | Retrofit with compact fluor. lamps.         |
| 11  | 2-Lamp, 2' Fluor.        | Retrofit with T8 lamps and elect. ballasts. |
| 32  | 2-Lamp, 4' Fluor.        | Retrofit with T8 lamps and elect. ballasts. |

#### **COST SAVINGS CALCULATIONS:**

(Refer to following Flex Output)

$$\begin{aligned} \text{KWH Demand Savings} &= [(7.41 \text{ KW} - 3.75 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (7.41 \text{ KW} - 3.75 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW}] \\ &= \$292.80/\text{yr} \end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy kWh | Net Present Value \$ | Present Value Total LCC \$ | Annual Value Total LCC \$ | Annual Energy Savings kWh | Savings Invest. Ratio (SIR) | Levelized Energy Cost cnts/kWh | Total Initial Cost \$ | Present Value Maint LCC \$ | Present Value Energy LCC \$ | Annual Value Maint LCC \$ | Annual Value Energy LCC \$ |
|-------------------------|-------------------|----------------------|----------------------------|---------------------------|---------------------------|-----------------------------|--------------------------------|-----------------------|----------------------------|-----------------------------|---------------------------|----------------------------|
| BLD0368A                | 8437              | 24037                | 29744                      | 2189                      | 8242                      | 11.939                      | 0.455                          | 2013                  | 2753                       | 24977                       | 203                       | 1838                       |
| *BLD0368B               | 16678             | 0                    | 53780                      | 3957                      | 0                         | 0.000                       | 0.000                          | 0                     | 4257                       | 49523                       | 313                       | 3644                       |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD0368A   | POST RETROFIT CONDITIONS |
| BLD0368B   | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD0368A.WBR  
 Date: 10/17/1993

Lighting Annual : 8437 kWh  
 Lighting Capacity : 3.750 kW  
 Annual Cooling Effect : 11802 kWh  
 Annual Heating Effect : 1205 kWh  
 Total Surveyed Floor Area: 2248 SqFt  
 Percent Survey Completed : 224800 %  
 Lighting Power Density : 1.668 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
|          | -----   | -----  | -----  | -----   | -----   | ----- |
| PVLCC \$ | 2013    | 10782  | 2753   | 14402   | -207    | 29744 |
| AVLCC \$ | 148     | 793    | 203    | 1060    | -15     | 2189  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD0368A.LLR  
 Date: 10/17/1993

| Room                   |      |       |      |       |           |          |
|------------------------|------|-------|------|-------|-----------|----------|
| Foot Candles           | MAX  | MIN   | AVG  | SDEV  | MAX Room  | MIN Room |
| Calculated             | 77.6 | 11.6  | 35.2 | 24.96 | 7-stor    | 4-office |
| Measured               | 50.3 | 0.0   | 30.2 | 20.37 | 2-dining  | 7-stor   |
| Required               | 50.0 | 5.0   | 24.3 | 15.92 | 5-kitchen | 2-dining |
| Foot Candle Comparison | MAX  | MIN   | AVG  | SDEV  | MAX Room  | MIN Room |
| Calc - Req.            | 72.6 | -18.4 | 10.9 | 29.66 | 7-stor    | 4-office |
| Meas - Req.            | 45.3 | -16.1 | 6.0  | 21.13 | 2-dining  | 3-toil   |

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Lighting System Survey Summary

One Page for Each Defined System

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD0368A.LSR  
 Date: 10/17/1993

System Number: 1      Descrip: decor, pendant, incand

=====

Rooms Served: 2  
 Floor Area: 1070 SqFt  
 Possible kW: 0.693  
 Working kW: 0.693  
 Capacity kW: 0.693  
 Lighting: 1559 Annual kWh  
 Heating: 223 Annual kWh  
 Cooling: 2211 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 71.0 Months  
 Power Density: 0.648 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 21       | 42    | 42.0     |
| Working       | 21       | 42    | 42.0     |
| Capacity      | 21       | 42    | 42.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1993   | 1790   | 2785    | -38     | 6712  |
| AVLCC \$ | 147    | 132    | 205     | -3      | 494   |

System Number: 2      Descrip: 2x2 lay-in

=====

Rooms Served: 4  
 Floor Area: 1736 SqFt  
 Possible kW: 0.775  
 Working kW: 0.775  
 Capacity kW: 0.775  
 Lighting: 1745 Annual kWh  
 Heating: 249 Annual kWh  
 Cooling: 2432 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 85.2 Months  
 Power Density: 0.447 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 11       | 22    | 11.0     |
| Working       | 11       | 22    | 11.0     |
| Capacity      | 11       | 22    | 11.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2230   | 261    | 2941    | -43     | 5847  |
| AVLCC \$ | 164    | 19     | 216     | -3      | 430   |

System Number: 3      Descrip: 2x4 lay-in

Rooms Served: 2  
 Floor Area: 370 SqFt  
 Possible kW: 1.355  
 Working kW: 1.355  
 Capacity kW: 1.355  
 Lighting: 3048 Annual kWh  
 Heating: 435 Annual kWh  
 Cooling: 4248 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 3.661 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 19       | 38    | 19.0     |
| Working       | 19       | 38    | 19.0     |
| Capacity      | 19       | 38    | 19.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3895   | 437    | 5138    | -75     | 10175 |
| AVLCC \$ | 287    | 32     | 378     | -5      | 749   |

System Number: 4      Descrip: 2x4 lay-in

Rooms Served: 2  
 Floor Area: 870 SqFt  
 Possible kW: 0.816  
 Working kW: 0.816  
 Capacity kW: 0.816  
 Lighting: 1837 Annual kWh  
 Heating: 262 Annual kWh  
 Cooling: 2560 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 0.938 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 13       | 26    | 13.0     |
| Working       | 13       | 26    | 13.0     |
| Capacity      | 13       | 26    | 13.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2348   | 231    | 3096    | -45     | 6162  |
| AVLCC \$ | 173    | 17     | 228     | -3      | 453   |



System Number: 5      Descrip: 8' strip

=====

Rooms Served: 1  
Floor Area: 32 SqFt  
Possible kW: 0.110  
Working kW: 0.110  
Capacity kW: 0.110  
Lighting: 248 Annual kWh  
Heating: 35 Annual kWh  
Cooling: 351 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 85.2 Months  
Power Density: 3.438 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 2     | 1.0      |
| Working       | 1        | 2     | 1.0      |
| Capacity      | 1        | 2     | 1.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 316    | 34     | 442     | -6      | 846   |
| AVLCC \$ | 23     | 3      | 33      | -0      | 62    |

=====

Room-By-Room Summary Report

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD0368A.RRR  
 Date: 10/17/1993

| Room Name | Floor | # | Total Area | SYSTEM1 #Pr Name | Work Watts | Pot. Watts | Watt SYSTEM2 Name | Work Watts | Pot. Watts | Watt SYSTEM3 Name | Work Watts | Pot. Watts | Watt Work sqft | Pot. Watts | Watt Mess. FootC | Calc. FootC | Req. FootC |
|-----------|-------|---|------------|------------------|------------|------------|-------------------|------------|------------|-------------------|------------|------------|----------------|------------|------------------|-------------|------------|
| 1-serving | 1     | 1 | 310        | 15               | 528        | 528        | 0.69              | 282        | 282        | 2x4 lay-in        | 165        | 165        | 0.53           | 1377       | 4.44             | 29.2        | 32.1       |
| 2-dining  | 1     | 1 | 760        | 120 decor, pen   | 282        | 282        | 2x2 lay-in        | 282        | 282        | 2x4 lay-in        | 282        | 282        | 0.37           | 810        | 1.07             | 50.3        | 12.4       |
| 3-toil    | 1     | 2 | 216        | 3 2x2 lay-in     | 143        | 143        | 2x2 lay-in        | 143        | 143        | 2x4 lay-in        | 282        | 282        | 0.37           | 282        | 1.31             | 13.9        | 16.7       |
| 4-office  | 1     | 1 | 60         | 1 2x4 lay-in     | 691        | 691        | 2x2 lay-in        | 691        | 691        | 2x4 lay-in        | 143        | 143        | 0.28           | 902        | 2.38             | 49.3        | 11.6       |
| 5-kitchen | 1     | 1 | 760        | 4 2x4 lay-in     | 126        | 126        | 2x2 lay-in        | 126        | 126        | 2x4 lay-in        | 126        | 126        | 0.28           | 126        | 1.19             | 50.3        | 57.7       |
| 6-office  | 1     | 1 | 110        | 1 2x4 lay-in     | 110        | 110        | 2x2 lay-in        | 110        | 110        | 2x4 lay-in        | 110        | 110        | 0.28           | 110        | 1.14             | 18.7        | 38.1       |
| 7-stor    | 1     | 1 | 32         | 0 8' strip       | 110        | 110        | 2x2 lay-in        | 110        | 110        | 2x4 lay-in        | 110        | 110        | 0.28           | 110        | 3.44             | 0.0         | 77.6       |

Total Rooms : 8  
 Total Area Sqft : 2248  
 Total People : 147  
 Total Working kW : 3.750  
 Total Potential kW : 3.750  
 Power Density W/sqft : 1.668

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD0368B.WBR

Date: 10/16/1993

Lighting Annual : 16678 kWh  
 Lighting Capacity : 7.412 kW  
 Annual Cooling Effect : 23367 kWh  
 Annual Heating Effect : 2383 kWh  
 Total Surveyed Floor Area: 2248 SqFt  
 Percent Survey Completed : 224800 %  
 Lighting Power Density : 3.297 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 0       | 21314  | 4257   | 28618   | -409    | 53780 |
| AVLCC \$ | 0       | 1568   | 313    | 2106    | -30     | 3957  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0368\BLD03688.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 2x4 lay-in, acrylic lens

Rooms Served: 1  
Floor Area: 310 Sqft  
Possible kW: 2.385  
Working kW: 2.305  
Capacity kW: 2.385  
Lighting: 5366 Annual kWh  
Heating: 767 Annual kWh  
Cooling: 7479 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 142.1 Months  
Power Density: 7.437 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 15       | 60    | 15.0     |
| Working       | 15       | 58    | 14.0     |
| Capacity      | 15       | 60    | 15.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 2     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 6858   | 771    | 9045    | -132    | 16543 |
| AVLCC \$ | 505    | 57     | 666     | -10     | 1217  |

System Number: 2      Descrip: decor, pendant, incand

Rooms Served: 2  
Floor Area: 1070 Sqft  
Possible kW: 2.100  
Working kW: 1.900  
Capacity kW: 2.100  
Lighting: 4725 Annual kWh  
Heating: 675 Annual kWh  
Cooling: 6700 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 4.0 Months  
Power Density: 1.776 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 21       | 21    | 0.0      |
| Working       | 21       | 19    | 0.0      |
| Capacity      | 21       | 21    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 2     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 6038   | 2447   | 8439    | -116    | 16808 |
| AVLCC \$ | 444    | 180    | 621     | -9      | 1237  |

System Number: 3      Descrip: 2x2 lay-in

Rooms Served: 4  
 Floor Area: 1736 SqFt  
 Possible kW: 1.062  
 Working kW: 1.062  
 Capacity kW: 1.062  
 Lighting: 2388 Annual kWh  
 Heating: 341 Annual kWh  
 Cooling: 3329 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 85.2 Months  
 Power Density: 0.611 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 11       | 22    | 11.0     |
| Working       | 11       | 22    | 11.0     |
| Capacity      | 11       | 22    | 11.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3052   | 501    | 4026    | -59     | 7520  |
| AVLCC \$ | 225    | 37     | 296     | -4      | 553   |

System Number: 4      Descrip: 2x4 lay-in

Rooms Served: 2  
 Floor Area: 370 SqFt  
 Possible kW: 0.480  
 Working kW: 0.288  
 Capacity kW: 0.480  
 Lighting: 1080 Annual kWh  
 Heating: 154 Annual kWh  
 Cooling: 1505 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 0.778 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 5        | 10    | 2.0      |
| Working       | 4        | 6     | 0.0      |
| Capacity      | 5        | 10    | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 1        | 2     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1380   | 108    | 1820    | -26     | 3282  |
| AVLCC \$ | 102    | 8      | 134     | -2      | 242   |

System Number: 7      Descrip: 2x4 lay-in

Rooms Served: 2  
 Floor Area: 870 SqFt  
 Possible kW: 1.248  
 Working kW: 1.104  
 Capacity kW: 1.248  
 Lighting: 2808 Annual kWh  
 Heating: 401 Annual kWh  
 Cooling: 3913 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 1.269 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 13       | 26    | 13.0     |
| Working       | 13       | 23    | 11.0     |
| Capacity      | 13       | 26    | 13.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 3     | 1.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3589   | 388    | 4733    | -69     | 8641  |
| AVLCC \$ | 264    | 29     | 348     | -5      | 636   |

System Number: 8      Descrip: 8' strip

Rooms Served: 1  
 Floor Area: 32 SqFt  
 Possible kW: 0.138  
 Working kW: 0.138  
 Capacity kW: 0.138  
 Lighting: 310 Annual kWh  
 Heating: 44 Annual kWh  
 Cooling: 440 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 85.2 Months  
 Power Density: 4.313 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 2     | 1.0      |
| Working       | 1        | 2     | 1.0      |
| Capacity      | 1        | 2     | 1.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 397    | 42     | 555     | -8      | 986   |
| AVLCC \$ | 29     | 3      | 41      | -1      | 73    |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0368 - ECO VII. D. & IX C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |         |
|----------------------------------------|---------|---------|
| A. CONSTRUCTION COST                   | \$2,013 |         |
| B. SIOH                                | \$111   |         |
| C. DESIGN COST                         | \$121   |         |
| D. TOTAL COST (1A+1B+1C)               | \$2,244 |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0     |         |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0     |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         | \$2,244 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: 'NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 28.13              | \$297                | 11.77              | \$3,493               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             |                 |                    | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 39.47              | \$416                | 11.12              | \$4,630               |
| M. DEMAND SAVINGS |                 |                    | \$293                | 11.12              | \$3,256               |
| N. TOTAL          |                 | 67.6               | \$1,006              |                    | \$11,379              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |         |
|---------------------------------------|-------|---------|
| A. ANNUAL RECURRING (+/-)             | \$110 |         |
| 1. DISCOUNT FACTOR (TABLE A)          | 11.1  |         |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       | \$1,221 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$1,221

4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ : 2.0 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$12,600

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 5.61

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 16.7%



## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 407 - OFFICERS CLUB DINING**

Building 407 is a two story stucco building consisting of 41,000 square feet. This facility contains a full service kitchen and a large dining area which consists of 7,800 square feet.

The operating hours are from 6:00 am to 10:00 pm Wednesday thru Saturday and 6:00 am to 3:00 pm Sunday thru Tuesday.

The lighting system is a combination of incandescent and fluorescent fixtures. The dining areas use incandescent downlights and chandeliers. The kitchen uses fluorescent fixtures.

The mechanical system consists of a rooftop multizone air handling unit for the main dining and kitchen areas served by an air cooled chiller. The auxiliary dining rooms and the remainder of the building are served by Direct Expansion (DX) fan coil units with water cooled reciprocating compressors.

Hot water is provided to the kitchen via a steam to hot water converter located in the basement. Steam is provided by a gas fire boiler. Dishwashing is accomplished using an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 407:

1. IV. C. 1) - Add stop//start function to HVAC equipment
2. VII. C - Remove unneeded lamps or fixtures
3. VII. D - Remove unneeded indoor/outdoor lighting to AEI levels
- 4 IX. A - Replace incandescent lamps with compact fluorescents
5. IX. B - Replace incandescent exit fixtures with LED
6. IX. C - Replace standard lamps with energy savings lamps
3. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's)- BUILDING NO. 407

ECO NO: IV.C.1

ECO NAME: Add stop/start function for HVAC systems.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>181.265</u>  | KWH/yr |
| Demand Savings:                        | <u>0</u>        | KW/yr  |
| Gas Savings:                           | <u>660.6</u>    | MCF/yr |
| Cost Savings:                          | <u>\$ 8.761</u> | /yr    |
| Implementation Cost:                   | <u>\$ 2.233</u> |        |
| Simple Payback:                        | <u>.3</u>       | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>49.88</u>    |        |

#### ECO DESCRIPTION:

Presently, the mechanical systems are not controlled by the existing basewide EMCS system. This ECO analyzes the addition of time clocks and relays to shut-down the HVAC systems during unoccupied hours.

#### COST SAVINGS CALCULATIONS:

(Refer to following Trace Output)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### MAINTENANCE COSTS:

Maintenance costs of \$15/year for each timeclock included in the LCCA for adjustments and failures.

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

| LINE # |                                     |
|--------|-------------------------------------|
| 1      | JOB - 1                             |
| 2      | 01/FORT SAM HOUSTON EEAP            |
| 3      | 01/SAN ANTONIO, TEXAS               |
|        | 01/FWD-COE                          |
|        | 01/SCOTT CLARK                      |
| 6      | 01/                                 |
| 7      | 08/SANANTON                         |
| 8      | 09/JAN/DEC                          |
| 9      | 10/CLTD-CLF                         |
| 10     | 11/JAN/DEC                          |
| 11     | LOAD - 1                            |
| 12     | 19/1/ENERGY CONSERVATION SIMULATION |
| 13     | 20/1/1/SW WING, 1ST FL/98/32//4//14 |
| 14     | 20/2/2/SE WING, 1ST FL/98/32//4//14 |
| 15     | 20/3/3/OLD BALLROOM/144/50//4//14   |
| 16     | 20/4/4/NEW DINING/84/48//4//16      |
| 17     | 20/5/5/KITCHEN/90/54//4//16         |
| 18     | 20/6/6/SW WING, 2ND FL/98/32//4//14 |
| 19     | 20/7/7/SE WING, 2ND FL/98/30//4//14 |
| 20     | 20/8/8/ABOVE BALLROOM/144/50//4//14 |
| 21     | 21/M/78/50/85//70/60                |
| 22     | 22/4/1/YES///.07                    |
| 23     | 22/5/1/YES///.07                    |
| 24     | 22/6/1/YES///.07                    |
| 25     | 22/7/1/YES///.07                    |
| 26     | 22/8/1/YES///.07                    |
| 27     | 24/1/1/98/14/.15//90                |
| 28     | 24/1/2/32/14/.15//180               |
| 29     | 24/1/3/98/14/.15//270               |
| 30     | 24/2/1/98/14/.15//90                |
| 31     | 24/2/2/30/14/.15//180               |
|        | 24/2/3/98/14/.15//270               |
|        | 24/3/1/82/14/.15//180               |
| 34     | 24/3/2/50/14/.15//90                |
| 35     | 24/3/3/50/14/.15//270               |
| 36     | 24/4/1/48/14/.15//90                |
| 37     | 24/4/2/84/14/.15//0                 |
| 38     | 24/5/1/42/14/.15//90                |
| 39     | 24/5/2/54/14/.15//0                 |
| 40     | 24/5/3/90/14/.15//270               |
| 41     | 25/1/1///50/1.07/.95                |
| 42     | 25/1/2///50/1.07/.95                |
| 43     | 25/1/3///50/1.07/.95                |
| 44     | 25/2/1///50/1.07/.95                |
| 45     | 25/2/2///50/1.07/.95                |
| 46     | 25/2/3///50/1.07/.95                |
| 47     | 25/3/1///50/1.07/.95                |
| 48     | 25/3/2///50/1.07/.95                |
| 49     | 25/3/3///50/1.07/.95                |
| 50     | 25/4/1///50/1.07/.95                |
| 51     | 25/4/2///50/1.07/.95                |
| 52     | 25/4/3///50/1.07/.95                |
| 53     | 25/6/1///50/1.07/.95                |
| 54     | 25/6/2///50/1.07/.95                |
| 55     | 25/6/3///50/1.07/.95                |
| 56     | 25/7/1///50/1.07/.95                |
| 57     | 25/7/2///50/1.07/.95                |
| 58     | 25/7/3///50/1.07/.95                |

CONTENTS OF : H:\JOB\911099\12F\TRACE\EQUIPECO\0407.TM

LINE # -----

59 25/8/1///50/1.07/.95

60 25/8/2///50/1.07/.95

61 25/8/3///50/1.07/.95

62 26/M/0407PLP/0407LT

63 27/1/150/SF-PERS/255/255/2.5/WATT-SF///30

64 27/2/150/SF-PERS/255/255/2.5/WATT-SF///30

65 27/3/75/SF-PERS/255/255/2.5/WATT-SF///30

66 27/4/75/SF-PERS/255/255/2.5/WATT-SF///30

67 27/5/100/SF-PERS/255/255/2.5/WATT-SF///30

68 27/6/150/SF-PERS/255/255/2.5/WATT-SF///30

69 27/7/150/SF-PERS/255/255/2.5/WATT-SF///30

70 27/8/150/SF-PERS/255/255/2.5/WATT-SF///30

71 28/M/1/MISC/.5/WATT-SF/0407LT

72 28/5/1/MISC/4.0/WATT-SF

73 29/M/15/CFM-P/15/CFM-P

74 30/M/1/CFM-SF/1/CFM-SF

75 SYSTEM - 1

76 39/1/EXISTING CONDITIONS

77 40/1/VTCV

78 41/1/1/3/6/8

79 42/1/2.5/2.5

80 40/2/RTMZ

81 41/2/4/5

82 42/2/2.5/2.5

83 EQUIPMENT - 1

84 60/1/1/PKPLANT/1/1

85 60/2/2/PKPLANT/2/2

86 61/1/1

87 61/2/2

88 62/1/EQ1131L/1/100/TONS/1.01/KW-TON

62/2/EQ1100S/1/37/TONS/1.34/KW-TON

63/1///5/HP

91 63/2/3/HP

92 65/1/1/1/2

93 66/1/1

94 67/1/EQ2002/1/5/HP

95 SYSTEM - 2

96 39/2/EXISTING CONDITIONS WITH STOP-START

97 40/1/VTCV

98 41/1/1/3/6/8

99 42/1/2.5/2.5

100 45/1/0407EX

101 46/1///START2/STOP2

102 40/2/RTMZ

103 41/2/4/5

104 42/2/2.5/2.5

105 45/2/0407EX

106 46/2///START2/STOP2

107 EQUIPMENT - 2

108 60/1/1/PKPLANT/1/1

109 60/2/2/PKPLANT/2/2

110 61/1/1

111 61/2/2

112 62/1/EQ1131L/1/100/TONS/1.01/KW-TON

113 62/2/EQ1100S/1/37/TONS/1.34/KW-TON

114 63/1///5/HP

115 63/2/3/HP

116 65/1/1/1/2

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LINE # -----

117 66/1/1

118 67/1/EQ2002/1/5/HP

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TRACE 600 ANALYSIS \*\*  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO, TEXAS  
FWD-COE  
SCOTT CLARK

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 12:18:40 10/23/93  
Dataset Name: 0407 .TM

AIRFLOW - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 3,395                       | 51,352                      | 51,352                      | 51,352                     | 3,395                       | 0                                    | 0                                   |
| 2                | RTMZ           | 1,535                       | 12,573                      | 12,579                      | 12,579                     | 1,535                       | 0                                    | 0                                   |
| Totals           |                | 4,930                       | 63,925                      | 63,931                      | 63,931                     | 4,930                       | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

| System<br>Number | System<br>Type | Cooling                         |                                 |                                 |                             |                                 | Heating                         |                               |                              |                                |                                 |                             |
|------------------|----------------|---------------------------------|---------------------------------|---------------------------------|-----------------------------|---------------------------------|---------------------------------|-------------------------------|------------------------------|--------------------------------|---------------------------------|-----------------------------|
|                  |                | Main Sys.<br>Capacity<br>(Tons) | Aux. Sys.<br>Capacity<br>(Tons) | Opt. Vent<br>Capacity<br>(Tons) | Cooling<br>Totals<br>(Tons) | Main Sys.<br>Capacity<br>(Btuh) | Aux. Sys.<br>Capacity<br>(Btuh) | Preheat<br>Capacity<br>(Btuh) | Reheat<br>Capacity<br>(Btuh) | Humidif.<br>Capacity<br>(Btuh) | Opt. Vent<br>Capacity<br>(Btuh) | Heating<br>Totals<br>(Btuh) |
| 1                | VTCV           | 84.7                            | 0.0                             | 0.0                             | 84.7                        | -415,906                        | 0                               | 0                             | 0                            | 0                              | 0                               | -415,906                    |
| 2                | RTMZ           | 30.4                            | 0.0                             | 0.0                             | 30.4                        | -237,040                        | 0                               | 0                             | 0                            | 0                              | 0                               | -237,040                    |
| Totals           |                | 115.2                           | 0.0                             | 0.0                             | 115.2                       | -652,945                        | 0                               | 0                             | 0                            | 0                              | 0                               | -652,945                    |

The building peaked at hour 17 month 8 with a capacity of 109.8 tons

ENGINEERING CHECKS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 6.61                      | 1.92          | 605.9       | 315.6         | 38.02          | 1.92          | -15.55         | 26,748              |
| 2                | Main               | RTMZ           | 12.21                     | 1.41          | 413.5       | 292.4         | 41.04          | 1.41          | -26.66         | 8,892               |



System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK ***** |          |          |         |           |        | CLG SPACE PEAK ***** |        | ***** HEATING COIL PEAK ***** |           |        |  |
|-------------------------------|----------|----------|---------|-----------|--------|----------------------|--------|-------------------------------|-----------|--------|--|
| Peak at Time ==>              |          |          |         |           |        | Mo/Hr: 8/17          |        | Mo/Hr: 13/ 1                  |           |        |  |
| Outside Air ==>               |          |          |         |           |        | OADB: 94             |        | OADB: 30                      |           |        |  |
| Space                         | Ret. Air | Ret. Air | Net     | Perct     |        | Space                | Perct  | Space Peak                    | Coil Peak | Perct  |  |
| Sens.+Lat.                    | Sensible | Latent   | Total   | Of Tot    |        | Sensible             | Of Tot | Space Sens                    | Tot Sens  | Of Tot |  |
| (Btuh)                        | (Btuh)   | (Btuh)   | (Btuh)  | (%)       |        | (Btuh)               | (%)    | (Btuh)                        | (Btuh)    | (%)    |  |
| Envelope Loads                |          |          |         |           |        |                      |        |                               |           |        |  |
| Skylite Solr                  | 0        | 0        | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Skylite Cond                  | 0        | 0        | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Roof Cond                     | 0        | 48,109   | 48,109  | 4.73      | *      | 0                    | 0.00   | 0                             | -36,427   | 8.76   |  |
| Glass Solar                   | 308,420  | 0        | 308,420 | 30.33     | *      | 339,304              | 51.39  | 0                             | 0         | 0.00   |  |
| Glass Cond                    | 71,862   | 0        | 71,862  | 7.07      | *      | 61,511               | 9.32   | -209,124                      | -209,124  | 50.28  |  |
| Wall Cond                     | 12,614   | 16,082   | 28,696  | 2.82      | *      | 13,078               | 1.98   | -11,448                       | -26,406   | 6.35   |  |
| Partition                     | 0        | 0        | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Exposed Floor                 | 0        | 0        | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Infiltration                  | 0        | 0        | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Sub Total==>                  | 392,896  | 64,191   | 457,087 | 44.94     | *      | 413,893              | 62.69  | -220,572                      | -271,957  | 65.39  |  |
| Internal Loads                |          |          |         |           |        |                      |        |                               |           |        |  |
| Lights                        | 137,250  | 58,821   | 196,071 | 19.28     | *      | 145,568              | 22.05  | 0                             | 0         | 0.00   |  |
| People                        | 83,927   |          | 83,927  | 8.25      | *      | 38,403               | 5.82   | 0                             | 0         | 0.00   |  |
| Misc                          | 41,616   | 0        | 41,616  | 4.09      | *      | 43,417               | 6.58   | 0                             | 0         | 0.00   |  |
| Sub Total==>                  | 262,793  | 58,821   | 321,614 | 31.62     | *      | 227,388              | 34.44  | 0                             | 0         | 0.00   |  |
| Ceiling Load                  | 16,375   | -16,375  | 0       | 0.00      | *      | 18,928               | 2.87   | -6,802                        | 0         | 0.00   |  |
| Outside Air                   | 0        | 0        | 0       | 15.15     | *      | 0                    | 0.00   | 0                             | -146,896  | 35.32  |  |
| Sup. Fan Heat                 |          |          | 91,292  | 8.98      | *      |                      | 0.00   |                               | 0         | 0.00   |  |
| Ret. Fan Heat                 |          | 0        | 0       | 0.00      | *      |                      | 0.00   |                               | 0         | 0.00   |  |
| Duct Heat Pkup                |          | 0        | 0       | 0.00      | *      |                      | 0.00   |                               | 0         | 0.00   |  |
| OV/UNDR Sizing                | 0        |          | 0       | 0.00      | *      | 0                    | 0.00   | 0                             | 0         | 0.00   |  |
| Heat                          |          | -7,095   | -7,095  | -0.70     | *      |                      | 0.00   |                               | 2,947     | -0.71  |  |
| Minimal Bypass                |          | 0        | 0       | 0.00      | *      |                      | 0.00   |                               | 0         | 0.00   |  |
| Grand Total==>                | 672,064  | 99,542   | 0       | 1,016,993 | 100.00 | 660,210              | 100.00 | -227,374                      | -415,906  | 100.00 |  |

| -----COOLING COIL SELECTION----- |           |            |                   |        |       |                  |       |       |             | -----AREAS----- |        |          |
|----------------------------------|-----------|------------|-------------------|--------|-------|------------------|-------|-------|-------------|-----------------|--------|----------|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |        |       | Leaving DB/WB/HR |       |       | Gross Total | Glass (sf)      | (%)    |          |
| (Tons)                           | (Mbh)     | (Mbh)      | (cfm)             | Deg F  | Deg F | Grains           | Deg F | Deg F | Grains      | Floor           |        |          |
| Main Clg                         | 84.7      | 1,017.0    | 880.0             | 51,352 | 80.9  | 67.3             | 81.6  | 64.5  | 61.3        | 78.8            | 26,748 |          |
| Aux Clg                          | 0.0       | 0.0        | 0.0               | 0      | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | 0      |          |
| Opt Vent                         | 0.0       | 0.0        | 0.0               | 0      | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | 0      |          |
| Totals                           | 84.7      | 1,017.0    |                   |        |       |                  |       |       |             |                 | 13,276 | 0 0      |
|                                  |           |            |                   |        |       |                  |       |       |             |                 | 8,904  | 4,452 50 |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------|--------|-----------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA               | 6.6    | Type                  | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     | 3,395   | 3,395   | Clg Cfm/Sqft           | 1.92   | SADB                  | 66.1 | 74.1 |
| Main Htg                         | -415.9   | 51,352     | 66.6  | 74.1  | Infil                    | 0       | 0       | Clg Cfm/Ton            | 605.93 | Plenum                | 79.9 | 69.2 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 51,352  | 51,352  | Clg Sqft/Ton           | 315.61 | Return                | 79.9 | 69.2 |
| Preheat                          | -0.0     | 51,352     | 66.6  | 64.5  | Mincfm                   | 0       | 0       | Clg Btuh/Sqft          | 38.02  | Ret/OA                | 80.9 | 66.6 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 51,352  | 51,352  | No. People             | 226    | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 3,395   | 3,395   | Htg % OA               | 6.6    | Fn MtrTD              | 0.4  | 0.4  |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 0       | 0       | Htg Cfm/SqFt           | 1.92   | Fn BldTD              | 0.3  | 0.3  |
| Total                            | -415.9   |            |       |       | Auxil                    | 0       | 0       | Htg Btuh/SqFt          | -15.55 | Fn Frict              | 0.9  | 0.9  |

System 2 Peak RTMZ - ROOFTOP MULTIZONE

| ***** COOLING COIL PEAK *****            |            |          |          |         |        | CLG SPACE PEAK ***** |          |        | HEATING COIL PEAK ***** |           |        |
|------------------------------------------|------------|----------|----------|---------|--------|----------------------|----------|--------|-------------------------|-----------|--------|
| Peak at Time ==> Mo/Hr: 8/14             |            |          |          |         |        | Mo/Hr: 7/18          |          |        | Mo/Hr: 13/ 1            |           |        |
| Outside Air ==> OADB/WB/HR: 96/ 79/126.0 |            |          |          |         |        | OADB: 93             |          |        | OADB: 30                |           |        |
|                                          | Space      | Ret. Air | Ret. Air | Net     | Percnt |                      | Space    | Percnt | Space Peak              | Coil Peak | Percnt |
|                                          | Sens.+Lat. | Sensible | Latent   | Total   | Of Tot |                      | Sensible | Of Tot | Space Sens              | Tot Sens  | Of Tot |
|                                          | (Btuh)     | (Btuh)   | (Btuh)   | (Btuh)  | (%)    |                      | (Btuh)   | (%)    | (Btuh)                  | (Btuh)    | (%)    |
| Envelope Loads                           |            |          |          |         |        |                      |          |        |                         |           |        |
| Skylite Solr                             | 0          | 0        |          | 0       | 0.00   |                      | 0        | 0.00   | 0                       | 0         | 0.00   |
| Skylite Cond                             | 0          | 0        |          | 0       | 0.00   |                      | 0        | 0.00   | 0                       | 0         | 0.00   |
| Roof Cond                                | 0          | 31,319   |          | 31,319  | 8.58   |                      | 0        | 0.00   | 0                       | -23,756   | 12.22  |
| Glass Solar                              | 37,884     | 0        |          | 37,884  | 10.38  |                      | 41,580   | 19.13  | 0                       | 0         | 0.00   |
| Glass Cond                               | 14,534     | 0        |          | 14,534  | 3.98   |                      | 15,226   | 7.01   | -43,403                 | -43,403   | 22.32  |
| Wall Cond                                | 10,568     | 4,348    |          | 14,916  | 4.09   |                      | 16,565   | 7.62   | -14,490                 | -20,862   | 10.73  |
| Partition                                | 0          |          |          | 0       | 0.00   |                      | 0        | 0.00   | 0                       | 0         | 0.00   |
| Exposed Floor                            | 0          |          |          | 0       | 0.00   |                      | 0        | 0.00   | 0                       | 0         | 0.00   |
| Infiltration                             | 0          |          |          | 0       | 0.00   |                      | 0        | 0.00   | 0                       | 0         | 0.00   |
| Sub Total==>                             | 62,985     | 35,667   |          | 98,652  | 27.04  |                      | 73,371   | 33.76  | -57,893                 | -88,021   | 45.27  |
| Internal Loads                           |            |          |          |         |        |                      |          |        |                         |           |        |
| Lights                                   | 44,322     | 18,995   |          | 63,317  | 17.35  |                      | 46,354   | 21.33  | 0                       | 0         | 0.00   |
| People                                   | 37,600     |          |          | 37,600  | 10.30  |                      | 17,338   | 7.98   | 0                       | 0         | 0.00   |
| Misc                                     | 65,174     | 0        | 0        | 65,174  | 17.86  |                      | 69,155   | 31.82  | 0                       | 0         | 0.00   |
| Sub Total==>                             | 147,096    | 18,995   | 0        | 166,091 | 45.52  |                      | 132,847  | 61.13  | 0                       | 0         | 0.00   |
| Ceiling Load                             | 9,380      | -9,380   |          | 0       | 0.00   |                      | 11,106   | 5.11   | -5,170                  | 0         | 0.00   |
| Outside Air                              | 0          | 0        | 0        | 83,332  | 22.84  |                      | 0        | 0.00   | 0                       | -66,438   | 34.17  |
| Sup. Fan Heat                            |            |          |          | 22,352  | 6.13   |                      |          | 0.00   |                         | 0         | 0.00   |
| Ret. Fan Heat                            |            | 0        |          | 0       | 0.00   |                      |          | 0.00   |                         | 0         | 0.00   |
| Duct Heat Pkup                           |            | 0        |          | 0       | 0.00   |                      |          | 0.00   |                         | 0         | 0.00   |
| OV/UNDR Sizing                           | 0          |          |          | 0       | 0.00   |                      | 0        | 0.00   | -43,043                 | -43,043   | 22.14  |
| Reheat                                   |            | -5,530   | 0        | -5,530  | -1.52  |                      |          | 0.00   |                         | 3,047     | -1.57  |
| Terminal Bypass                          |            | 0        | 0        | 0       | 0.00   |                      |          | 0.00   |                         | 0         | 0.00   |
| Grand Total==>                           | 219,461    | 39,752   | 0        | 364,897 | 100.00 |                      | 217,324  | 100.00 | -106,106                | -194,455  | 100.00 |

| -----COOLING COIL SELECTION----- |       |           |            |                   |       |        |                  |       |        | -----AREAS----- |            |        |
|----------------------------------|-------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|--------|
| Total Capacity                   |       | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)    |
| (Tons)                           | (Mbh) | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |            |        |
| Main Clg                         | 30.4  | 364.9     | 289.9      | 12,573            | 83.1  | 67.7   | 80.4             | 60.4  | 58.8   | 74.0            | 8,892      |        |
| Aux Clg                          | 0.0   | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |        |
| Opt Vent                         | 0.0   | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |        |
| Totals                           | 30.4  | 364.9     |            |                   |       |        |                  |       |        | Roof            | 8,892      | 0 0    |
|                                  |       |           |            |                   |       |        |                  |       |        | Wall            | 4,452      | 924 21 |

| -----HEATING COIL SELECTION----- |            |        |       |      | -----AIRFLOWS (cfm)----- |         |          | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------|--------|-------|------|--------------------------|---------|----------|------------------------|--------|-----------------------|------|------|
| Capacity                         | Coil Airfl | Ent    | Lvg   | Type | Cooling                  | Heating | Clg % OA |                        |        | Type                  | Clg  | Htg  |
| (Mbh)                            | (cfm)      | Deg F  | Deg F | Vent |                          |         |          |                        |        |                       |      |      |
| Main Htg                         | -237.0     | 12,579 | 60.4  | 77.8 | Infil                    | 1,535   | 1,535    | Clg Cfm/Sqft           | 1.41   | SADB                  | 62.0 | 77.8 |
| Aux Htg                          | 0.0        | 0      | 0.0   | 0.0  | Supply                   | 12,573  | 12,579   | Clg Cfm/Ton            | 413.47 | Plenum                | 81.3 | 68.2 |
| Preheat                          | -0.0       | 12,573 | 63.5  | 60.4 | Mincfm                   | 0       | 0        | Clg Sqft/Ton           | 292.42 | Return                | 81.3 | 68.2 |
| Reheat                           | 0.0        | 0      | 0.0   | 0.0  | Return                   | 12,573  | 12,579   | Clg Btuh/Sqft          | 41.04  | Ret/OA                | 83.1 | 63.5 |
| Humidif                          | 0.0        | 0      | 0.0   | 0.0  | Exhaust                  | 1,535   | 1,535    | No. People             | 102    | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0        | 0      | 0.0   | 0.0  | Rm Exh                   | 0       | 0        | Htg % OA               | 12.2   | Fn MtrTD              | 0.4  | 0.4  |
| Total                            | -237.0     |        |       |      | Auxil                    | 0       | 0        | Htg Cfm/Sqft           | 1.41   | Fn BldTD              | 0.3  | 0.3  |
|                                  |            |        |       |      |                          |         |          | Htg Btuh/Sqft          | -26.66 | Fn Frict              | 0.9  | 0.9  |

MAIN SYSTEM COOLING - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

PEAK COOLING LOADS  
(Main System)

|        |                 | Space |       |     |       |        |         |        | Coil  |       |     |       |        |         |         |
|--------|-----------------|-------|-------|-----|-------|--------|---------|--------|-------|-------|-----|-------|--------|---------|---------|
| Room   |                 | Peak  | OA    | Rm  | Supp. | Space  | Space   | Space  | Peak  | OA    | Rm  | Supp. | Coil   | Coil    | Coil    |
| Number | Description     | Time  | Cond. | Dry | Dry   | Air    | Sens.   | Lat.   | Time  | Cond. | Dry | Dry   | Air    | Sens.   | Lat.    |
|        |                 | Mo/Hr | DB/WB | Blb | Bulb  | Flow   | Load    | Load   | Mo/Hr | DB/WB | Blb | Bulb  | Flow   | Load    | Load    |
|        |                 |       | (F)   | (F) | (F)   | (Cfm)  | (Btuh)  | (Btuh) |       | (F)   | (F) | (F)   | (Cfm)  | (Btuh)  | (Btuh)  |
| 1      | SW WING, 1ST FL | 8/17  | 94 74 | 78  | 66.0  | 13,769 | 178,242 | 4,265  | 8/17  | 94 74 | 78  | 66.1  | 13,769 | 218,709 | 9,375   |
| Zone   | 1 Total/Ave.    |       | 94 74 | 78  | 66.0  | 13,769 | 178,242 | 4,265  |       | 94 74 | 78  | 66.1  | 13,769 | 218,709 | 9,375   |
| Zone   | 1 Block         | 8/17  | 94 74 | 78  | 66.0  | 13,769 | 178,242 | 4,265  | 8/17  | 94 74 | 78  | 66.1  | 13,769 | 218,709 | 9,375   |
| 2      | SE WING, 1ST FL | 7/18  | 93 71 | 78  | 66.0  | 13,722 | 177,685 | 4,265  | 8/17  | 94 74 | 78  | 66.1  | 13,722 | 217,277 | 9,375   |
| Zone   | 2 Total/Ave.    |       | 93 71 | 78  | 66.0  | 13,722 | 177,685 | 4,265  |       | 94 74 | 78  | 66.1  | 13,722 | 217,277 | 9,375   |
| Zone   | 2 Block         | 7/18  | 93 71 | 78  | 66.0  | 13,722 | 177,685 | 4,265  | 8/17  | 94 74 | 78  | 66.1  | 13,722 | 217,277 | 9,375   |
| 3      | OLD BALLROOM    | 9/17  | 87 73 | 78  | 61.8  | 10,584 | 185,860 | 19,584 | 8/14  | 96 79 | 78  | 63.9  | 10,584 | 219,778 | 70,478  |
| Zone   | 3 Total/Ave.    |       | 87 73 | 78  | 61.8  | 10,584 | 185,860 | 19,584 |       | 96 79 | 78  | 63.9  | 10,584 | 219,778 | 70,478  |
| Zone   | 3 Block         | 9/17  | 87 73 | 78  | 61.8  | 10,584 | 185,860 | 19,584 | 8/14  | 96 79 | 78  | 63.9  | 10,584 | 219,778 | 70,478  |
| 6      | SW WING, 2ND FL | 7/18  | 93 71 | 78  | 69.8  | 3,136  | 27,974  | 4,265  | 8/14  | 96 79 | 78  | 70.4  | 3,136  | 52,979  | 11,272  |
| Zone   | 6 Total/Ave.    |       | 93 71 | 78  | 69.8  | 3,136  | 27,974  | 4,265  |       | 96 79 | 78  | 70.4  | 3,136  | 52,979  | 11,272  |
| Zone   | 6 Block         | 7/18  | 93 71 | 78  | 69.8  | 3,136  | 27,974  | 4,265  | 8/14  | 96 79 | 78  | 70.4  | 3,136  | 52,979  | 11,272  |
| 7      | SE WING, 2ND FL | 7/18  | 93 71 | 78  | 69.8  | 2,940  | 26,225  | 3,998  | 8/14  | 96 79 | 78  | 70.4  | 2,940  | 49,668  | 10,567  |
| Zone   | 7 Total/Ave.    |       | 93 71 | 78  | 69.8  | 2,940  | 26,225  | 3,998  |       | 96 79 | 78  | 70.4  | 2,940  | 49,668  | 10,567  |
| Zone   | 7 Block         | 7/18  | 93 71 | 78  | 69.8  | 2,940  | 26,225  | 3,998  | 8/14  | 96 79 | 78  | 70.4  | 2,940  | 49,668  | 10,567  |
| 8      | ABOVE BALLROOM  | 7/18  | 93 71 | 78  | 69.8  | 7,200  | 64,224  | 9,792  | 8/14  | 96 79 | 78  | 70.4  | 7,200  | 121,635 | 25,879  |
| Zone   | 8 Total/Ave.    |       | 93 71 | 78  | 69.8  | 7,200  | 64,224  | 9,792  |       | 96 79 | 78  | 70.4  | 7,200  | 121,635 | 25,879  |
| Zone   | 8 Block         | 7/18  | 93 71 | 78  | 69.8  | 7,200  | 64,224  | 9,792  | 8/14  | 96 79 | 78  | 70.4  | 7,200  | 121,635 | 25,879  |
| tem    | 1 Total/Ave.    |       | 94 74 | 78  | 66.1  | 51,352 | 660,210 | 46,169 |       | 96 79 | 78  | 66.7  | 51,352 | 880,046 | 136,947 |
| tem    | 1 Block         | 8/17  | 94 74 | 78  | 69.8  | 51,352 | 649,877 | 46,169 | 8/14  | 96 79 | 78  | 69.8  | 51,352 | 803,775 | 148,893 |
| 4      | NEW DINING      | 7/14  | 96 77 | 78  | 62.0  | 5,746  | 99,316  | 10,967 | 8/14  | 96 79 | 78  | 62.9  | 5,746  | 137,057 | 39,468  |
| Zone   | 4 Total/Ave.    |       | 96 77 | 78  | 62.0  | 5,746  | 99,316  | 10,967 |       | 96 79 | 78  | 62.9  | 5,746  | 137,057 | 39,468  |
| Zone   | 4 Block         | 7/14  | 96 77 | 78  | 62.0  | 5,746  | 99,316  | 10,967 | 8/14  | 96 79 | 78  | 62.9  | 5,746  | 137,057 | 39,468  |
| 5      | KITCHEN         | 7/18  | 93 71 | 78  | 62.0  | 6,827  | 118,008 | 9,790  | 8/14  | 96 79 | 78  | 63.8  | 6,827  | 152,817 | 35,556  |
| Zone   | 5 Total/Ave.    |       | 93 71 | 78  | 62.0  | 6,827  | 118,008 | 9,790  |       | 96 79 | 78  | 63.8  | 6,827  | 152,817 | 35,556  |
| Zone   | 5 Block         | 7/18  | 93 71 | 78  | 62.0  | 6,827  | 118,008 | 9,790  | 8/14  | 96 79 | 78  | 63.8  | 6,827  | 152,817 | 35,556  |
| System | 2 Total/Ave.    |       | 93 71 | 78  | 62.0  | 12,573 | 217,324 | 20,758 |       | 96 79 | 78  | 63.4  | 12,573 | 289,874 | 75,023  |
| System | 2 Block         | 7/18  | 93 71 | 78  | 62.5  | 12,573 | 211,002 | 20,758 | 8/14  | 96 79 | 78  | 63.4  | 12,573 | 289,874 | 75,023  |

MAIN SYSTEM HEATING - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- P E A K   H E A T I N G   L O A D S -----  
(Main System)

| Room<br>Number | Description     | Floor<br>Area<br>(Sq Ft) | Space                 |                             |                         |                             |                               | Coil                             |                       |                             |                         |                             | Coil<br>Air<br>Flow<br>(Cfm) | Coil<br>Sens.<br>Load<br>(Btuh) |
|----------------|-----------------|--------------------------|-----------------------|-----------------------------|-------------------------|-----------------------------|-------------------------------|----------------------------------|-----------------------|-----------------------------|-------------------------|-----------------------------|------------------------------|---------------------------------|
|                |                 |                          | Peak<br>Time<br>Mo/Hr | OA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Air<br>Flow<br>(Cfm) | Space<br>Sens.<br>Load<br>(Btuh) | Peak<br>Time<br>Mo/Hr | OA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) |                              |                                 |
| 1              | SW WING, 1ST FL | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 75.4                        | 13,769                        | -79,870                          | 13/ 1                 | 30 26                       | 70                      | 75.4                        | 13,769                       | -105,122                        |
| Zone           | 1 Total/Ave.    | 3,136                    |                       | 30 26                       | 70                      | 75.4                        | 13,769                        | -79,870                          |                       | 30 26                       | 70                      | 75.4                        | 13,769                       | -105,122                        |
| Zone           | 1 Block         | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 75.4                        | 13,769                        | -79,870                          | 13/ 1                 | 30 26                       | 70                      | 75.4                        | 13,769                       | -105,122                        |
| 2              | SE WING, 1ST FL | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 75.3                        | 13,722                        | -79,177                          | 13/ 1                 | 30 26                       | 70                      | 75.3                        | 13,722                       | -104,388                        |
| Zone           | 2 Total/Ave.    | 3,136                    |                       | 30 26                       | 70                      | 75.3                        | 13,722                        | -79,177                          |                       | 30 26                       | 70                      | 75.3                        | 13,722                       | -104,388                        |
| Zone           | 2 Block         | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 75.3                        | 13,722                        | -79,177                          | 13/ 1                 | 30 26                       | 70                      | 75.3                        | 13,722                       | -104,388                        |
| 3              | OLD BALLROOM    | 7,200                    | 13/ 1                 | 30 26                       | 70                      | 75.7                        | 10,584                        | -64,951                          | 13/ 1                 | 30 26                       | 70                      | 75.7                        | 10,584                       | -135,200                        |
| Zone           | 3 Total/Ave.    | 7,200                    |                       | 30 26                       | 70                      | 75.7                        | 10,584                        | -64,951                          |                       | 30 26                       | 70                      | 75.7                        | 10,584                       | -135,200                        |
| Zone           | 3 Block         | 7,200                    | 13/ 1                 | 30 26                       | 70                      | 75.7                        | 10,584                        | -64,951                          | 13/ 1                 | 30 26                       | 70                      | 75.7                        | 10,584                       | -135,200                        |
| 6              | SW WING, 2ND FL | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 3,136                         | -798                             | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 3,136                        | -16,818                         |
| Zone           | 6 Total/Ave.    | 3,136                    |                       | 30 26                       | 70                      | 70.2                        | 3,136                         | -798                             |                       | 30 26                       | 70                      | 70.2                        | 3,136                        | -16,818                         |
| Zone           | 6 Block         | 3,136                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 3,136                         | -798                             | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 3,136                        | -16,818                         |
| 7              | SE WING, 2ND FL | 2,940                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 2,940                         | -748                             | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 2,940                        | -15,767                         |
| Zone           | 7 Total/Ave.    | 2,940                    |                       | 30 26                       | 70                      | 70.2                        | 2,940                         | -748                             |                       | 30 26                       | 70                      | 70.2                        | 2,940                        | -15,767                         |
| Zone           | 7 Block         | 2,940                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 2,940                         | -748                             | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 2,940                        | -15,767                         |
| 8              | ABOVE BALLROOM  | 7,200                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 7,200                         | -1,831                           | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 7,200                        | -38,612                         |
| Zone           | 8 Total/Ave.    | 7,200                    |                       | 30 26                       | 70                      | 70.2                        | 7,200                         | -1,831                           |                       | 30 26                       | 70                      | 70.2                        | 7,200                        | -38,612                         |
| Zone           | 8 Block         | 7,200                    | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 7,200                         | -1,831                           | 13/ 1                 | 30 26                       | 70                      | 70.2                        | 7,200                        | -38,612                         |
| System         | 1 Total/Ave.    | 26,748                   |                       | 30 26                       | 70                      | 74.1                        | 51,352                        | -227,374                         |                       | 30 26                       | 70                      | 74.1                        | 51,352                       | -415,906                        |
| System         | 1 Block         | 26,748                   | 13/ 1                 | 30 26                       | 70                      | 74.1                        | 51,352                        | -227,374                         | 13/ 1                 | 30 26                       | 70                      | 74.1                        | 51,352                       | -415,906                        |
| 4              | NEW DINING      | 4,032                    | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 5,752                         | -48,519                          | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 5,752                        | -108,392                        |
| Zone           | 4 Total/Ave.    | 4,032                    |                       | 30 26                       | 70                      | 77.8                        | 5,752                         | -48,519                          |                       | 30 26                       | 70                      | 77.8                        | 5,752                        | -108,392                        |
| Zone           | 4 Block         | 4,032                    | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 5,752                         | -48,519                          | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 5,752                        | -108,392                        |
| 5              | KITCHEN         | 4,860                    | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 6,827                         | -57,587                          | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 6,827                        | -128,648                        |
| Zone           | 5 Total/Ave.    | 4,860                    |                       | 30 26                       | 70                      | 77.8                        | 6,827                         | -57,587                          |                       | 30 26                       | 70                      | 77.8                        | 6,827                        | -128,648                        |
| Zone           | 5 Block         | 4,860                    | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 6,827                         | -57,587                          | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 6,827                        | -128,648                        |
| System         | 2 Total/Ave.    | 8,892                    |                       | 30 26                       | 70                      | 77.8                        | 12,579                        | -106,106                         |                       | 30 26                       | 70                      | 77.8                        | 12,579                       | -237,040                        |
| System         | 2 Block         | 8,892                    | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 12,579                        | -106,106                         | 13/ 1                 | 30 26                       | 70                      | 77.8                        | 12,579                       | -237,040                        |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| January |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|---------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour    | QADB | QAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1       | 41.3 | 36.7 | -108,436           | 6.6     | -180,557            | 12.5    | -176,995            | 11.9    | -152,194           | 9.2     | -157,590           | 9.6     |
| 2       | 40.0 | 36.0 | -107,511           | 6.3     | -178,257            | 11.8    | -175,691            | 11.0    | -148,885           | 8.5     | -152,050           | 9.1     |
| 3       | 39.5 | 35.9 | -105,415           | 5.9     | -176,703            | 11.2    | -171,526            | 10.3    | -143,436           | 7.9     | -151,788           | 8.7     |
| 4       | 39.9 | 36.4 | -102,337           | 5.5     | -169,377            | 10.6    | -163,153            | 9.7     | -136,315           | 7.4     | -145,235           | 8.4     |
| 5       | 40.8 | 37.6 | -98,539            | 5.1     | -166,649            | 10.2    | -160,074            | 9.2     | -131,283           | 7.0     | -144,358           | 8.1     |
| 6       | 42.4 | 39.4 | -94,291            | 4.8     | -156,622            | 9.9     | -151,615            | 8.9     | -123,573           | 6.8     | -138,432           | 7.9     |
| 7       | 44.4 | 41.5 | -523,176           | 5.4     | -348,072            | 10.1    | -437,162            | 9.2     | -380,688           | 7.4     | -326,425           | 8.6     |
| 8       | 46.9 | 44.1 | -329,112           | 6.4     | -198,152            | 10.4    | -246,063            | 9.7     | -244,981           | 8.3     | -223,261           | 9.5     |
| 9       | 49.5 | 46.6 | -138,962           | 8.2     | -141,857            | 11.6    | -139,521            | 11.0    | -147,785           | 9.9     | -138,617           | 10.9    |
| 10      | 52.2 | 48.2 | -143,204           | 10.2    | -136,247            | 12.8    | -142,047            | 12.3    | -139,159           | 11.4    | -141,606           | 12.3    |
| 11      | 54.9 | 49.2 | -141,634           | 16.4    | -115,612            | 14.1    | -133,928            | 13.7    | -141,485           | 13.0    | -128,143           | 15.5    |
| 12      | 57.3 | 50.1 | -139,860           | 29.1    | -107,233            | 26.1    | -109,978            | 17.8    | -134,274           | 17.4    | -107,504           | 25.9    |
| 13      | 59.4 | 50.4 | -132,507           | 41.2    | -98,257             | 34.9    | -100,571            | 30.9    | -100,762           | 32.6    | -98,454            | 34.7    |
| 14      | 60.9 | 50.0 | -88,055            | 47.4    | -92,527             | 46.0    | -94,500             | 45.1    | -94,671            | 45.0    | -92,688            | 45.9    |
| 15      | 61.9 | 50.3 | -85,061            | 51.7    | -89,750             | 49.1    | -126,278            | 40.1    | -126,409           | 40.0    | -89,875            | 49.0    |
| 16      | 62.2 | 49.8 | -82,134            | 64.1    | -86,476             | 52.2    | -132,402            | 16.5    | -132,402           | 16.4    | -86,573            | 52.1    |
| 17      | 61.8 | 49.3 | -78,702            | 68.1    | -82,097             | 54.1    | -133,157            | 16.1    | -133,157           | 16.1    | -82,171            | 54.0    |
| 18      | 60.4 | 48.6 | -80,089            | 61.1    | -82,139             | 51.5    | -134,024            | 18.7    | -134,024           | 18.7    | -82,197            | 51.5    |
| 19      | 58.3 | 48.2 | -107,846           | 47.0    | -107,413            | 40.3    | -139,595            | 16.9    | -139,595           | 16.9    | -107,458           | 40.3    |
| 20      | 55.6 | 46.8 | -116,946           | 39.1    | -114,789            | 34.7    | -146,756            | 13.7    | -146,756           | 13.6    | -114,824           | 34.7    |
| 21      | 52.5 | 44.9 | -126,166           | 31.5    | -124,221            | 28.6    | -153,364            | 12.7    | -153,061           | 12.7    | -124,248           | 28.6    |
| 22      | 49.3 | 42.5 | -132,372           | 26.2    | -131,022            | 23.9    | -155,830            | 11.8    | -155,543           | 11.8    | -131,043           | 23.8    |
| 23      | 46.2 | 40.4 | -171,688           | 14.2    | -171,688            | 13.9    | -157,412            | 10.9    | -157,140           | 10.8    | -171,688           | 13.9    |
| 24      | 43.5 | 38.5 | -175,402           | 13.5    | -177,960            | 13.1    | -157,262            | 10.0    | -156,974           | 10.0    | -177,825           | 13.1    |

| Hour | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
|      | OADB               | QAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1    | 45.2               | 40.8 | -178,479 | 12.6    | -174,341            | 13.2    | -171,994            | 12.5    | -154,054           | 10.0    | -157,289           | 10.3    |
| 2    | 43.4               | 39.0 | -172,596 | 12.0    | -175,633            | 12.4    | -169,899            | 11.6    | -149,257           | 9.3     | -154,405           | 9.8     |
| 3    | 41.9               | 37.4 | -169,860 | 11.4    | -173,655            | 11.7    | -167,086            | 10.7    | -145,848           | 8.6     | -152,108           | 9.3     |
| 4    | 40.8               | 36.7 | -166,461 | 10.7    | -170,782            | 11.0    | -163,565            | 9.9     | -137,566           | 7.9     | -148,613           | 8.8     |
| 5    | 40.1               | 36.1 | -162,288 | 10.2    | -167,083            | 10.3    | -161,443            | 9.2     | -133,839           | 7.3     | -146,696           | 8.3     |
| 6    | 39.8               | 36.0 | -157,214 | 9.7     | -165,154            | 9.8     | -154,537            | 8.6     | -127,536           | 6.7     | -142,182           | 7.9     |
| 7    | 40.3               | 36.6 | -311,440 | 9.8     | -366,416            | 9.8     | -438,826            | 8.7     | -377,687           | 7.1     | -318,189           | 8.3     |
| 8    | 41.6               | 38.2 | -190,395 | 10.0    | -228,024            | 9.9     | -267,279            | 9.0     | -266,675           | 7.8     | -250,279           | 8.9     |
| 9    | 43.8               | 40.1 | -148,513 | 11.3    | -150,559            | 11.0    | -147,608            | 10.2    | -144,135           | 9.2     | -147,799           | 10.3    |
| 10   | 46.4               | 41.5 | -132,604 | 12.7    | -120,002            | 12.1    | -147,611            | 11.6    | -144,954           | 10.7    | -148,148           | 11.7    |
| 11   | 49.4               | 42.9 | -123,359 | 22.7    | -131,916            | 13.2    | -119,252            | 12.9    | -148,392           | 12.3    | -113,205           | 13.9    |
| 12   | 52.4               | 45.0 | -107,020 | 38.5    | -113,130            | 21.4    | -112,979            | 14.0    | -121,618           | 13.8    | -110,944           | 21.3    |
| 13   | 55.0               | 46.4 | -97,102  | 51.4    | -104,843            | 32.7    | -107,254            | 28.0    | -107,488           | 29.5    | -105,054           | 32.6    |
| 14   | 57.2               | 47.2 | -90,771  | 57.0    | -98,226             | 40.1    | -100,268            | 38.7    | -100,429           | 38.5    | -98,392            | 40.0    |
| 15   | 58.5               | 47.9 | -88,145  | 61.6    | -95,016             | 47.0    | -131,598            | 37.9    | -131,734           | 37.8    | -95,144            | 46.9    |
| 16   | 59.0               | 47.6 | -85,157  | 65.7    | -91,105             | 50.2    | -140,747            | 16.1    | -140,747           | 16.1    | -91,204            | 50.1    |
| 17   | 58.8               | 47.7 | -80,906  | 68.1    | -86,106             | 52.9    | -141,154            | 15.9    | -141,154           | 15.8    | -86,183            | 52.9    |
| 18   | 58.0               | 47.2 | -81,549  | 64.4    | -84,765             | 51.7    | -140,390            | 19.4    | -140,390           | 19.4    | -84,825            | 51.6    |
| 19   | 56.9               | 47.1 | -107,856 | 49.4    | -108,210            | 40.6    | -143,308            | 17.6    | -143,308           | 17.6    | -108,256           | 40.5    |
| 20   | 55.4               | 47.2 | -117,437 | 40.4    | -114,807            | 35.8    | -147,286            | 14.5    | -147,286           | 14.5    | -114,843           | 35.8    |
| 21   | 53.6               | 46.7 | -127,001 | 32.7    | -122,661            | 30.2    | -152,061            | 13.1    | -152,061           | 13.1    | -122,689           | 30.1    |
| 22   | 51.5               | 45.7 | -132,887 | 27.0    | -128,206            | 26.1    | -154,342            | 12.3    | -154,097           | 12.2    | -128,227           | 26.1    |
| 23   | 49.4               | 44.5 | -173,280 | 14.3    | -163,201            | 14.4    | -154,711            | 11.5    | -154,479           | 11.5    | -163,201           | 14.4    |
| 24   | 47.3               | 42.7 | -176,197 | 13.6    | -168,771            | 13.6    | -154,587            | 10.7    | -154,368           | 10.7    | -168,771           | 13.6    |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| Month | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|-------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour  | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 59.0               | 53.6 | -154,828 | 14.6    | -137,738            | 15.6    | -137,738 | 14.8    | -137,738            | 12.1    | -137,738 | 12.5    | -137,738           | 12.1    | -137,738 | 12.5    | -137,738           | 12.5    | -137,738 | 12.5    |
| 2     | 56.7               | 51.7 | -152,591 | 13.9    | -143,838            | 14.6    | -143,838 | 13.7    | -143,838            | 11.5    | -141,718 | 12.1    | -143,396           | 11.5    | -143,396 | 12.1    | -143,396           | 12.1    | -143,396 | 12.1    |
| 3     | 54.6               | 50.0 | -154,978 | 13.2    | -149,408            | 13.7    | -149,408 | 12.8    | -149,408            | 10.9    | -142,815 | 11.6    | -145,535           | 10.9    | -145,535 | 11.6    | -145,535           | 11.6    | -145,535 | 11.6    |
| 4     | 52.8               | 48.6 | -156,003 | 12.7    | -154,183            | 12.9    | -151,949 | 12.0    | -151,949            | 10.4    | -141,293 | 11.2    | -146,560           | 10.4    | -146,560 | 11.2    | -146,560           | 11.2    | -146,560 | 11.2    |
| 5     | 51.5               | 47.5 | -154,021 | 12.2    | -155,939            | 12.3    | -150,811 | 11.3    | -150,811            | 9.8     | -137,907 | 10.7    | -146,370           | 9.8     | -146,370 | 10.7    | -146,370           | 10.7    | -146,370 | 10.7    |
| 6     | 50.7               | 47.0 | -150,709 | 11.7    | -154,378            | 11.7    | -148,747 | 10.7    | -148,747            | 9.4     | -134,109 | 10.3    | -145,132           | 9.4     | -145,132 | 10.3    | -145,132           | 10.3    | -145,132 | 10.3    |
| 7     | 50.4               | 46.9 | -168,379 | 11.9    | -156,590            | 15.8    | -150,898 | 10.7    | -150,898            | 18.3    | -137,409 | 20.4    | -148,164           | 18.3    | -148,164 | 20.4    | -148,164           | 20.4    | -148,164 | 20.4    |
| 8     | 51.0               | 47.8 | -148,334 | 13.7    | -156,015            | 12.8    | -149,842 | 10.9    | -149,842            | 14.7    | -141,622 | 19.5    | -148,708           | 14.7    | -148,708 | 19.5    | -148,708           | 19.5    | -148,708 | 19.5    |
| 9     | 52.5               | 48.7 | -140,125 | 25.2    | -152,334            | 18.5    | -145,875 | 14.4    | -145,875            | 17.4    | -138,308 | 25.0    | -144,132           | 17.4    | -144,132 | 25.0    | -144,132           | 25.0    | -144,132 | 25.0    |
| 10    | 55.0               | 49.4 | -131,372 | 39.7    | -148,347            | 28.9    | -148,347 | 25.3    | -148,347            | 27.4    | -141,198 | 32.8    | -147,184           | 27.4    | -147,184 | 32.8    | -147,184           | 32.8    | -147,184 | 32.8    |
| 11    | 58.0               | 50.7 | -120,195 | 53.5    | -119,370            | 35.5    | -140,390 | 34.3    | -140,390            | 38.6    | -140,390 | 41.1    | -140,390           | 38.6    | -140,390 | 41.1    | -140,390           | 41.1    | -140,390 | 41.1    |
| 12    | 61.4               | 52.5 | -84,765  | 61.8    | -98,165             | 46.5    | -110,547 | 42.5    | -110,547            | 45.3    | -131,372 | 46.6    | -102,322           | 45.3    | -102,322 | 46.6    | -102,322           | 46.6    | -102,322 | 46.6    |
| 13    | 64.9               | 54.4 | -76,170  | 66.1    | -87,587             | 52.0    | -90,024  | 51.2    | -90,024             | 50.9    | -94,636  | 51.8    | -87,946            | 50.9    | -87,946  | 51.8    | -87,946            | 51.8    | -87,946  | 51.8    |
| 14    | 67.9               | 56.1 | -71,182  | 70.9    | -79,811             | 57.3    | -81,933  | 56.6    | -81,933             | 56.4    | -82,241  | 57.2    | -80,149            | 56.4    | -80,149  | 57.2    | -80,149            | 57.2    | -80,149  | 57.2    |
| 15    | 70.4               | 57.9 | -57,894  | 75.3    | -75,498             | 61.4    | -108,562 | 52.3    | -108,562            | 52.2    | -108,562 | 61.3    | -75,770            | 52.2    | -75,770  | 61.3    | -75,770            | 61.3    | -75,770  | 61.3    |
| 16    | 71.9               | 58.5 | -56,005  | 79.2    | -72,316             | 64.5    | -113,391 | 19.0    | -113,391            | 18.9    | -113,391 | 64.4    | -72,484            | 18.9    | -72,484  | 64.4    | -72,484            | 64.4    | -72,484  | 64.4    |
| 17    | 72.5               | 58.8 | -50,256  | 81.1    | -66,869             | 67.4    | -108,562 | 26.4    | -108,562            | 26.3    | -108,562 | 67.3    | -66,998            | 26.3    | -66,998  | 67.3    | -66,998            | 67.3    | -66,998  | 67.3    |
| 18    | 72.2               | 59.0 | -53,258  | 78.3    | -64,300             | 67.1    | -108,562 | 31.7    | -108,562            | 31.6    | -108,562 | 67.0    | -64,400            | 31.6    | -64,400  | 67.0    | -64,400            | 67.0    | -64,400  | 67.0    |
| 19    | 71.4               | 59.4 | -86,526  | 63.8    | -86,464             | 56.6    | -108,562 | 26.6    | -108,562            | 26.6    | -108,562 | 56.5    | -86,541            | 26.6    | -86,541  | 56.5    | -86,541            | 56.5    | -86,541  | 56.5    |
| 20    | 70.1               | 59.9 | -96,865  | 53.5    | -91,314             | 51.0    | -108,562 | 22.8    | -108,562            | 22.8    | -108,562 | 50.9    | -91,374            | 22.8    | -91,374  | 50.9    | -91,374            | 50.9    | -91,374  | 50.9    |
| 21    | 68.3               | 60.0 | -107,184 | 45.5    | -99,240             | 45.5    | -114,685 | 19.7    | -114,685            | 19.7    | -114,685 | 45.4    | -99,286            | 19.7    | -99,286  | 45.4    | -99,286            | 45.4    | -99,286  | 45.4    |
| 22    | 66.2               | 58.8 | -113,795 | 39.4    | -104,914            | 41.3    | -125,647 | 17.0    | -125,647            | 17.0    | -125,647 | 41.2    | -104,950           | 17.0    | -104,950 | 41.2    | -104,950           | 41.2    | -104,950 | 41.2    |
| 23    | 63.9               | 57.5 | -143,308 | 16.6    | -124,741            | 17.2    | -124,741 | 14.4    | -124,741            | 14.4    | -124,741 | 17.2    | -124,741           | 14.4    | -124,741 | 17.2    | -124,741           | 17.2    | -124,741 | 17.2    |
| 24    | 61.4               | 55.5 | -146,756 | 15.7    | -131,372            | 16.1    | -131,372 | 12.8    | -131,372            | 12.8    | -131,372 | 16.1    | -131,372           | 12.8    | -131,372 | 16.1    | -131,372           | 16.1    | -131,372 | 16.1    |

| Month | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|-------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour  | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 62.7               | 58.8 | -125,537 | 16.1    | -127,924            | 16.2    | -127,924 | 15.7    | -127,924            | 13.2    | -127,924 | 14.0    | -127,924           | 13.2    | -127,924 | 14.0    | -127,924           | 14.0    | -127,924 | 14.0    |
| 2     | 61.1               | 57.4 | -128,189 | 15.3    | -132,168            | 15.3    | -132,168 | 14.6    | -132,168            | 12.6    | -132,168 | 13.1    | -132,168           | 12.6    | -132,168 | 13.1    | -132,168           | 13.1    | -132,168 | 13.1    |
| 3     | 60.1               | 56.5 | -130,311 | 14.5    | -134,820            | 14.5    | -134,820 | 13.7    | -134,820            | 12.0    | -134,820 | 12.7    | -134,820           | 12.0    | -134,820 | 12.7    | -134,820           | 12.7    | -134,820 | 12.7    |
| 4     | 59.7               | 56.2 | -131,903 | 13.9    | -135,881            | 13.9    | -135,881 | 13.1    | -135,881            | 11.7    | -135,881 | 12.4    | -135,881           | 11.7    | -135,881 | 12.4    | -135,881           | 12.4    | -135,881 | 12.4    |
| 5     | 60.1               | 56.5 | -132,433 | 13.4    | -134,820            | 13.4    | -134,820 | 12.6    | -134,820            | 11.4    | -134,723 | 12.2    | -134,820           | 11.4    | -134,820 | 12.2    | -134,820           | 12.2    | -134,820 | 12.2    |
| 6     | 61.1               | 57.6 | -131,372 | 13.0    | -132,168            | 13.0    | -132,168 | 12.2    | -132,168            | 11.3    | -131,670 | 12.0    | -132,168           | 11.3    | -132,168 | 12.0    | -132,168           | 12.0    | -132,168 | 12.0    |
| 7     | 62.7               | 59.2 | -128,720 | 35.4    | -127,924            | 33.0    | -127,924 | 24.3    | -127,924            | 39.6    | -127,924 | 48.1    | -127,924           | 39.6    | -127,924 | 48.1    | -127,924           | 48.1    | -127,924 | 48.1    |
| 8     | 64.7               | 61.1 | -123,945 | 31.7    | -122,619            | 27.4    | -122,619 | 21.0    | -122,619            | 30.9    | -122,619 | 33.3    | -122,619           | 30.9    | -122,619 | 33.3    | -122,619           | 33.3    | -122,619 | 33.3    |
| 9     | 67.1               | 62.3 | -117,049 | 46.8    | -116,254            | 40.3    | -116,254 | 34.3    | -116,254            | 42.2    | -116,254 | 44.4    | -116,254           | 42.2    | -116,254 | 44.4    | -116,254           | 44.4    | -116,254 | 44.4    |
| 10    | 69.7               | 63.6 | -109,092 | 56.6    | -109,357            | 49.5    | -109,357 | 48.0    | -109,357            | 50.5    | -109,357 | 52.4    | -109,357           | 50.5    | -109,357 | 52.4    | -109,357           | 52.4    | -109,357 | 52.4    |
| 11    | 72.3               | 64.8 | -108,562 | 63.5    | -108,562            | 55.6    | -108,562 | 54.2    | -108,562            | 55.3    | -108,562 | 58.0    | -108,562           | 55.3    | -108,562 | 58.0    | -108,562           | 58.0    | -108,562 | 58.0    |
| 12    | 74.7               | 65.6 | -108,506 | 68.7    | -108,562            | 59.9    | -108,562 | 58.8    | -108,562            | 58.5    | -108,562 | 61.6    | -108,562           | 58.5    | -108,562 | 61.6    | -108,562           | 61.6    | -108,562 | 61.6    |
| 13    | 76.8               | 66.5 | -58,210  | 72.9    | -84,370             | 64.1    | -108,506 | 63.2    | -108,562            | 62.9    | -98,752  | 64.9    | -108,562           | 62.9    | -98,752  | 64.9    | -108,562           | 64.9    | -108,562 | 64.9    |
| 14    | 78.4               | 66.6 | -41,324  | 77.1    | -71,868             | 67.9    | -74,195  | 67.3    | -85,811             | 67.2    | -71,947  | 68.4    | -106,860           | 67.2    | -69,108  | 72.2    | -71,947            | 72.2    | -69,108  | 72.2    |
| 15    | 79.4               | 66.9 | -42,044  | 81.1    | -65,930             | 71.7    | -106,800 | 62.8    | -106,860            | 62.7    | -69,108  | 72.2    | -106,860           | 62.7    | -69,108  | 72.2    | -69,108            | 72.2    | -69,108  | 72.2    |
| 16    | 79.7               | 66.4 | -39,994  | 84.7    | -56,502             | 73.2    | -114,418 | 21.4    | -114,418            | 21.3    | -56,500  | 73.4    | -114,418           | 21.3    | -56,500  | 73.4    | -56,500            | 73.4    | -56,500  | 73.4    |
| 17    | 79.4               | 65.7 | -35,272  | 86.5    | -51,209             | 75.0    | -108,562 | 34.9    | -108,562            | 34.9    | -51,209  | 75.0    | -108,562           | 34.9    | -51,209  | 75.0    | -51,209            | 75.0    | -51,209  | 75.0    |
| 18    | 78.4               | 65.0 | -36,900  | 85.0    | -51,919             | 73.9    | -108,562 | 36.5    | -108,562            | 36.5    | -51,919  | 73.9    | -108,562           | 36.5    | -51,919  | 73.9    | -51,919            | 73.9    | -51,919  | 73.9    |
| 19    | 76.8               | 64.8 | -73,420  | 73.5    | -82,624             | 65.7    | -108,562 | 34.9    | -108,562            | 34.9    | -82,624  | 65.8    | -108,562           | 34.9    | -82,624  | 65.8    | -82,624            | 65.8    | -82,624  | 65.8    |
| 20    | 74.7               | 65.4 | -84,367  | 63.3    | -87,139             | 58.1    | -108,562 | 30.7    | -108,562            | 30.7    | -87,139  | 58.1    | -108,562           | 30.7    | -87,139  | 58.1    | -87,139            | 58.1    | -87,139  | 58.1    |
| 21    | 72.3               | 65.0 | -93,056  | 54.4    | -93,912             | 51.5    | -108,562 | 25.4    | -108,562            | 25.4    | -93,912  | 51.5    | -108,562           | 25.4    | -93,912  | 51.5    | -93,912            | 51.5    | -93,912  | 51.5    |
| 22    | 69.7               | 63.7 | -99,761  | 48.3    | -97,801             | 46.3    | -109,357 | 20.8    | -109,357            | 20.8    | -97,801  | 46.3    | -109,357           | 20.8    | -97,801  | 46.3    | -97,801            | 46.3    | -97,801  | 46.3    |
| 23    | 67.1               | 62.0 | -122,198 | 18.3    | -116,254            | 18.2    | -116,254 | 17.5    | -116,254            | 17.5    | -116,254 | 18.2    | -116,254           | 17.5    | -116,254 | 18.2    | -116,254           | 18.2    | -116,254 | 18.2    |
| 24    | 64.7               | 60.4 | -122,885 | 17.3    | -122,619            | 17.1    | -122,619 | 14.6    | -122,619            | 14.6    | -122,619 | 17.1    | -122,619           | 14.6    | -122,619 | 17.1    | -122,619           | 17.1    | -122,619 | 17.1    |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| Day  | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1    | 73.3               | 68.9 | -108,562 | 17.4    | -108,562            | 19.0    | -108,562            | 18.3    | -108,562           | 19.5    | -108,562           | 22.2    |
| 2    | 71.3               | 67.4 | -110,949 | 16.5    | -108,562            | 20.2    | -108,562            | 18.3    | -108,562           | 17.2    | -108,562           | 20.5    |
| 3    | 69.6               | 66.1 | -113,336 | 15.7    | -109,623            | 18.0    | -109,623            | 16.7    | -109,623           | 15.4    | -109,623           | 18.4    |
| 4    | 68.1               | 64.9 | -114,927 | 15.9    | -113,601            | 15.9    | -113,601            | 14.7    | -113,601           | 13.6    | -113,601           | 15.9    |
| 5    | 67.0               | 64.3 | -115,458 | 14.4    | -116,519            | 14.6    | -116,519            | 14.0    | -116,519           | 13.0    | -116,519           | 13.9    |
| 6    | 66.4               | 63.8 | -114,397 | 14.0    | -118,110            | 13.9    | -118,110            | 13.2    | -118,110           | 12.4    | -118,904           | 13.3    |
| 7    | 66.1               | 63.9 | -111,744 | 64.6    | -118,906            | 63.3    | -118,906            | 57.2    | -118,906           | 70.5    | -118,906           | 73.8    |
| 8    | 66.8               | 63.8 | -108,562 | 44.5    | -117,049            | 37.1    | -117,049            | 34.9    | -117,049           | 38.4    | -117,049           | 42.6    |
| 9    | 68.6               | 63.8 | -108,562 | 58.1    | -112,275            | 47.3    | -112,275            | 42.8    | -112,275           | 48.0    | -112,275           | 49.8    |
| 10   | 71.3               | 64.6 | -108,562 | 65.0    | -108,562            | 55.0    | -108,562            | 51.2    | -108,562           | 55.5    | -108,562           | 57.2    |
| 11   | 74.7               | 66.3 | -108,506 | 70.7    | -108,562            | 59.3    | -108,562            | 57.3    | -108,562           | 60.8    | -108,562           | 62.3    |
| 12   | 78.4               | 68.1 | -82,499  | 75.6    | -108,506            | 64.1    | -108,506            | 63.1    | -108,562           | 65.7    | -108,506           | 67.1    |
| 13   | 81.8               | 69.9 | -37,443  | 79.7    | -85,127             | 69.2    | -108,506            | 68.5    | -108,506           | 70.0    | -97,835            | 71.2    |
| 14   | 84.5               | 70.9 | -26,837  | 83.5    | -46,104             | 74.8    | -57,260             | 74.4    | -71,230            | 75.3    | -49,251            | 76.2    |
| 15   | 86.3               | 71.8 | -27,265  | 87.6    | -43,421             | 78.6    | -92,845             | 69.9    | -92,837            | 73.6    | -43,424            | 79.9    |
| 16   | 87.0               | 71.6 | -25,488  | 90.7    | -42,140             | 80.4    | -108,562            | 23.4    | -108,562           | 23.4    | -42,141            | 81.4    |
| 17   | 86.7               | 72.0 | -19,186  | 92.8    | -36,394             | 82.4    | -108,562            | 41.7    | -108,562           | 41.7    | -36,394            | 83.2    |
| 18   | 86.1               | 71.7 | -19,776  | 91.9    | -35,034             | 82.1    | -108,562            | 43.6    | -108,562           | 43.7    | -35,034            | 82.9    |
| 19   | 85.0               | 71.9 | -54,338  | 82.2    | -66,100             | 74.8    | -108,562            | 45.1    | -108,562           | 45.2    | -66,100            | 75.8    |
| 20   | 83.5               | 72.5 | -70,363  | 72.0    | -76,983             | 67.7    | -108,562            | 39.2    | -108,562           | 39.3    | -76,983            | 69.8    |
| 21   | 81.8               | 72.9 | -88,545  | 62.3    | -90,042             | 61.6    | -108,562            | 34.3    | -108,562           | 34.4    | -90,042            | 62.7    |
| 22   | 79.8               | 72.1 | -93,358  | 56.0    | -93,413             | 57.3    | -108,562            | 30.4    | -108,562           | 30.5    | -93,413            | 57.6    |
| 23   | 77.6               | 71.2 | -111,868 | 19.8    | -111,841            | 20.9    | -108,562            | 26.3    | -108,562           | 26.4    | -111,840           | 21.1    |
| 24   | 75.5               | 69.9 | -110,879 | 18.7    | -110,867            | 19.8    | -108,562            | 22.8    | -108,562           | 22.9    | -110,867           | 20.0    |

|      | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1    | 78.8               | 73.3 | -108,562 | 21.0    | -108,562            | 27.0    | -108,562            | 26.3    | -108,562           | 28.4    | -108,562           | 33.2    |
| 2    | 76.6               | 71.9 | -108,562 | 23.0    | -108,562            | 24.7    | -108,562            | 23.5    | -108,562           | 24.5    | -108,562           | 28.8    |
| 3    | 74.6               | 70.6 | -108,562 | 20.9    | -108,562            | 22.3    | -108,562            | 21.1    | -108,562           | 21.0    | -108,562           | 24.9    |
| 4    | 73.0               | 69.2 | -108,562 | 19.2    | -108,562            | 19.9    | -108,562            | 18.8    | -108,562           | 18.4    | -108,562           | 21.3    |
| 5    | 71.7               | 68.1 | -108,562 | 17.9    | -108,562            | 18.1    | -108,562            | 16.9    | -108,562           | 16.4    | -108,562           | 18.8    |
| 6    | 71.0               | 67.5 | -108,562 | 17.0    | -108,562            | 16.7    | -108,562            | 15.6    | -109,683           | 15.0    | -108,562           | 17.1    |
| 7    | 70.7               | 67.5 | -108,562 | 79.9    | -108,562            | 77.2    | -108,562            | 74.0    | -108,562           | 79.5    | -108,562           | 81.4    |
| 8    | 71.2               | 67.0 | -108,562 | 51.5    | -108,562            | 44.5    | -108,562            | 40.7    | -108,562           | 47.8    | -108,562           | 50.8    |
| 9    | 72.7               | 66.6 | -108,562 | 64.2    | -108,562            | 52.7    | -108,562            | 50.8    | -108,562           | 53.1    | -108,562           | 54.6    |
| 10   | 75.0               | 66.9 | -108,506 | 72.1    | -108,562            | 61.1    | -108,562            | 59.1    | -108,562           | 61.4    | -108,562           | 62.8    |
| 11   | 77.9               | 67.5 | -91,234  | 78.0    | -108,506            | 66.2    | -108,562            | 62.7    | -108,562           | 66.4    | -108,506           | 67.7    |
| 12   | 81.2               | 68.7 | -67,366  | 81.9    | -108,506            | 70.5    | -108,506            | 67.9    | -108,506           | 70.7    | -108,506           | 71.9    |
| 13   | 84.4               | 69.9 | -23,629  | 84.6    | -56,549             | 74.3    | -90,534             | 73.0    | -97,351            | 74.7    | -71,751            | 75.6    |
| 14   | 87.3               | 71.0 | -17,762  | 88.3    | -36,386             | 78.3    | -39,075             | 77.8    | -46,337            | 78.9    | -36,377            | 79.6    |
| 15   | 89.7               | 71.7 | -18,350  | 91.8    | -35,786             | 82.7    | -85,218             | 73.9    | -85,216            | 78.1    | -35,790            | 83.9    |
| 16   | 91.1               | 72.8 | -16,527  | 95.4    | -34,007             | 85.1    | -108,562            | 24.5    | -108,562           | 24.7    | -34,007            | 86.1    |
| 17   | 91.7               | 72.8 | -10,375  | 97.7    | -26,666             | 87.4    | -108,562            | 46.4    | -108,562           | 46.5    | -26,666            | 88.3    |
| 18   | 91.4               | 72.6 | -8,618   | 96.8    | -24,610             | 87.8    | -108,562            | 50.6    | -108,562           | 50.7    | -24,610            | 88.7    |
| 19   | 90.6               | 73.2 | -41,736  | 88.3    | -55,139             | 81.9    | -108,562            | 51.4    | -108,562           | 51.5    | -55,139            | 82.9    |
| 20   | 89.4               | 74.1 | -59,204  | 77.8    | -66,633             | 74.7    | -108,562            | 45.5    | -108,562           | 45.6    | -66,633            | 76.9    |
| 21   | 87.7               | 75.7 | -79,127  | 68.2    | -81,481             | 68.9    | -108,562            | 40.9    | -108,562           | 41.0    | -81,481            | 70.5    |
| 22   | 85.7               | 76.0 | -91,068  | 61.9    | -90,848             | 64.8    | -108,562            | 37.2    | -108,562           | 37.3    | -90,848            | 65.2    |
| 23   | 83.5               | 75.3 | -112,489 | 21.4    | -112,607            | 23.4    | -108,562            | 34.3    | -108,562           | 35.3    | -112,607           | 23.8    |
| 24   | 81.2               | 74.2 | -111,424 | 20.4    | -111,534            | 22.1    | -108,562            | 32.4    | -108,562           | 32.6    | -111,534           | 22.6    |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| July | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1    | 82.5               | 74.8 | -108,562 | 28.5    | -108,562            | 30.6    | -108,562            | 29.4    | -108,562           | 33.3    | -108,562           | 38.0    |
| 2    | 80.3               | 73.7 | -108,562 | 26.2    | -108,562            | 28.0    | -108,562            | 26.8    | -108,562           | 29.6    | -108,562           | 33.8    |
| 3    | 78.2               | 72.8 | -108,562 | 24.1    | -108,562            | 25.5    | -108,562            | 24.4    | -108,562           | 26.0    | -108,562           | 29.9    |
| 4    | 76.5               | 71.6 | -108,562 | 22.4    | -108,562            | 23.4    | -108,562            | 22.3    | -108,562           | 23.1    | -108,562           | 26.5    |
| 5    | 75.3               | 70.8 | -108,562 | 20.8    | -108,562            | 21.4    | -108,562            | 20.4    | -108,562           | 20.6    | -108,562           | 23.5    |
| 6    | 74.5               | 70.4 | -108,562 | 20.2    | -108,562            | 19.7    | -108,562            | 18.7    | -108,562           | 18.7    | -108,562           | 20.9    |
| 7    | 74.2               | 70.4 | -108,562 | 86.8    | -108,562            | 84.9    | -108,562            | 82.7    | -108,562           | 86.1    | -108,562           | 87.8    |
| 8    | 74.7               | 70.5 | -108,562 | 60.7    | -108,562            | 54.0    | -108,562            | 49.8    | -108,562           | 54.3    | -108,562           | 56.5    |
| 9    | 76.3               | 70.6 | -108,562 | 69.0    | -108,562            | 57.9    | -108,562            | 56.0    | -108,562           | 57.9    | -108,562           | 59.5    |
| 10   | 78.6               | 70.9 | -108,506 | 77.6    | -108,562            | 66.4    | -108,562            | 64.8    | -108,562           | 66.5    | -108,562           | 67.9    |
| 11   | 81.6               | 71.2 | -85,361  | 83.7    | -108,506            | 71.9    | -108,506            | 70.5    | -108,562           | 71.9    | -108,506           | 73.2    |
| 12   | 84.9               | 71.9 | -58,220  | 88.0    | -101,237            | 76.0    | -108,506            | 73.4    | -108,506           | 76.0    | -104,741           | 77.2    |
| 13   | 88.2               | 72.7 | -18,548  | 90.7    | -41,473             | 79.6    | -69,464             | 78.1    | -83,512            | 79.9    | -52,702            | 80.8    |
| 14   | 91.2               | 73.2 | -12,911  | 94.0    | -30,648             | 83.9    | -33,343             | 83.2    | -33,690            | 84.4    | -30,643            | 85.0    |
| 15   | 93.6               | 73.9 | -13,397  | 97.3    | -29,614             | 88.4    | -79,045             | 79.4    | -79,049            | 83.5    | -29,618            | 89.6    |
| 16   | 95.1               | 73.7 | -11,554  | 100.7   | -26,703             | 91.5    | -108,562            | 26.1    | -108,562           | 26.2    | -26,703            | 92.6    |
| 17   | 95.7               | 73.9 | -6,132   | 103.0   | -19,645             | 94.6    | -108,562            | 52.9    | -108,562           | 53.1    | -19,645            | 95.7    |
| 18   | 95.4               | 73.8 | -5,999   | 101.9   | -18,199             | 95.3    | -108,562            | 59.5    | -108,562           | 59.6    | -18,199            | 96.4    |
| 19   | 94.6               | 73.9 | -38,437  | 92.6    | -48,648             | 88.8    | -108,562            | 57.4    | -108,562           | 57.5    | -48,648            | 89.6    |
| 20   | 93.3               | 74.7 | -55,336  | 82.2    | -60,255             | 81.8    | -108,562            | 51.0    | -108,562           | 51.1    | -60,255            | 82.9    |
| 21   | 91.6               | 76.0 | -75,866  | 73.2    | -75,397             | 74.4    | -108,562            | 45.9    | -108,562           | 46.0    | -75,397            | 76.5    |
| 22   | 89.6               | 76.6 | -87,844  | 65.6    | -84,769             | 70.1    | -108,562            | 45.0    | -108,562           | 46.2    | -84,769            | 70.5    |
| 23   | 87.3               | 76.3 | -112,961 | 22.7    | -113,208            | 24.9    | -108,562            | 42.6    | -108,562           | 42.7    | -113,209           | 25.3    |
| 24   | 84.9               | 75.6 | -108,562 | 23.4    | -108,562            | 27.1    | -108,562            | 38.0    | -108,562           | 38.1    | -108,562           | 27.4    |

| August | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|--------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour   | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1      | 82.5               | 75.9 | -108,562 | 29.3    | -108,562            | 31.1    | -108,562            | 30.1    | -108,562           | 33.7    | -108,562           | 38.4    |
| 2      | 80.3               | 74.9 | -108,562 | 27.0    | -108,562            | 28.6    | -108,562            | 27.5    | -108,562           | 30.1    | -108,562           | 34.3    |
| 3      | 78.4               | 73.6 | -108,562 | 24.9    | -108,562            | 25.9    | -108,562            | 24.8    | -108,562           | 26.4    | -108,562           | 30.2    |
| 4      | 76.8               | 72.4 | -108,562 | 23.2    | -108,562            | 24.1    | -108,562            | 23.0    | -108,562           | 23.9    | -108,562           | 27.3    |
| 5      | 75.6               | 71.4 | -108,562 | 22.0    | -108,562            | 21.9    | -108,562            | 20.8    | -108,562           | 20.9    | -108,562           | 23.9    |
| 6      | 74.9               | 70.9 | -108,562 | 21.1    | -108,562            | 20.5    | -108,562            | 19.5    | -108,562           | 19.5    | -108,562           | 21.8    |
| 7      | 74.6               | 71.0 | -108,562 | 87.3    | -108,562            | 85.5    | -108,562            | 83.3    | -108,562           | 86.4    | -108,562           | 87.7    |
| 8      | 75.1               | 71.3 | -108,562 | 61.8    | -108,562            | 53.5    | -108,562            | 49.2    | -108,562           | 54.0    | -108,562           | 56.4    |
| 9      | 76.5               | 71.4 | -108,562 | 68.5    | -108,562            | 57.8    | -108,562            | 55.9    | -108,562           | 57.9    | -108,562           | 59.4    |
| 10     | 78.8               | 71.6 | -108,506 | 77.7    | -108,562            | 66.5    | -108,562            | 64.9    | -108,562           | 66.6    | -108,562           | 68.0    |
| 11     | 81.6               | 72.2 | -103,503 | 85.2    | -108,506            | 72.4    | -108,562            | 70.9    | -108,562           | 72.4    | -108,562           | 73.7    |
| 12     | 84.7               | 73.4 | -65,462  | 90.3    | -108,506            | 77.4    | -108,506            | 74.6    | -108,506           | 77.5    | -108,506           | 78.8    |
| 13     | 87.9               | 74.2 | -22,779  | 93.4    | -52,285             | 81.6    | -86,063             | 80.1    | -97,456            | 82.0    | -67,074            | 83.1    |
| 14     | 90.7               | 75.1 | -18,363  | 97.4    | -35,145             | 86.6    | -37,834             | 86.0    | -41,069            | 87.4    | -35,137            | 88.2    |
| 15     | 92.9               | 75.6 | -18,601  | 101.3   | -34,163             | 91.6    | -83,596             | 81.7    | -83,597            | 86.0    | -34,168            | 93.1    |
| 16     | 94.3               | 75.2 | -16,645  | 103.8   | -32,167             | 92.9    | -108,562            | 26.7    | -108,562           | 26.7    | -32,167            | 94.3    |
| 17     | 94.8               | 74.9 | -11,692  | 105.4   | -24,726             | 96.1    | -108,562            | 53.2    | -108,562           | 53.3    | -24,726            | 97.5    |
| 18     | 94.6               | 74.4 | -13,231  | 103.3   | -24,437             | 95.4    | -108,562            | 59.7    | -108,562           | 59.8    | -24,437            | 96.7    |
| 19     | 93.8               | 74.6 | -49,660  | 90.5    | -56,791             | 87.4    | -108,562            | 55.7    | -108,562           | 55.8    | -56,791            | 88.4    |
| 20     | 92.6               | 75.7 | -64,102  | 81.3    | -66,921             | 80.5    | -108,562            | 49.9    | -108,562           | 50.0    | -66,921            | 82.1    |
| 21     | 91.0               | 77.2 | -81,388  | 72.4    | -80,550             | 74.5    | -108,562            | 45.9    | -108,562           | 46.0    | -80,550            | 76.3    |
| 22     | 89.1               | 77.6 | -90,785  | 65.6    | -88,171             | 69.7    | -108,562            | 42.4    | -108,562           | 43.5    | -88,171            | 70.1    |
| 23     | 87.0               | 77.3 | -112,857 | 23.4    | -113,014            | 25.8    | -108,562            | 42.3    | -108,562           | 42.4    | -113,015           | 26.2    |
| 24     | 84.7               | 76.9 | -108,562 | 23.5    | -108,562            | 26.8    | -108,562            | 37.9    | -108,562           | 38.0    | -108,562           | 27.2    |



BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| September |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|-----------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour      | OADB | OAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1         | 76.3 | 71.3 | -108,562           | 25.9    | -108,562            | 23.3    | -108,562            | 21.4    | -108,562           | 24.2    | -108,562           | 26.8    |
| 2         | 74.7 | 70.5 | -108,562           | 23.6    | -108,562            | 24.3    | -108,562            | 23.1    | -108,562           | 21.4    | -108,562           | 26.7    |
| 3         | 73.2 | 69.4 | -108,562           | 21.7    | -108,562            | 22.1    | -108,562            | 20.9    | -108,562           | 19.4    | -108,562           | 23.5    |
| 4         | 72.0 | 68.6 | -108,562           | 20.3    | -108,562            | 20.4    | -108,562            | 19.2    | -108,562           | 18.0    | -108,562           | 20.9    |
| 5         | 71.1 | 68.0 | -108,562           | 18.8    | -108,562            | 18.7    | -108,562            | 17.6    | -108,562           | 16.5    | -108,562           | 18.8    |
| 6         | 70.6 | 67.7 | -108,562           | 18.2    | -108,562            | 17.4    | -108,562            | 16.3    | -108,562           | 15.5    | -108,562           | 17.3    |
| 7         | 70.4 | 67.9 | -108,562           | 80.9    | -108,562            | 77.9    | -108,562            | 69.7    | -108,562           | 80.9    | -108,562           | 82.9    |
| 8         | 70.9 | 68.6 | -108,562           | 49.3    | -108,562            | 41.9    | -108,562            | 39.7    | -108,562           | 46.1    | -108,562           | 49.4    |
| 9         | 72.4 | 68.5 | -108,562           | 61.9    | -108,562            | 52.4    | -108,562            | 49.9    | -108,562           | 52.9    | -108,562           | 54.5    |
| 10        | 74.7 | 69.3 | -108,562           | 71.6    | -108,562            | 61.4    | -108,562            | 57.3    | -108,562           | 61.8    | -108,562           | 63.3    |
| 11        | 77.4 | 70.7 | -108,506           | 79.4    | -108,562            | 67.4    | -108,562            | 64.1    | -108,562           | 67.8    | -108,562           | 69.2    |
| 12        | 80.4 | 71.5 | -107,954           | 84.5    | -108,562            | 71.1    | -108,562            | 69.5    | -108,562           | 72.3    | -108,562           | 73.7    |
| 13        | 83.2 | 73.2 | -47,802            | 88.7    | -89,613             | 76.8    | -108,506            | 76.0    | -108,506           | 77.8    | -102,583           | 79.1    |
| 14        | 85.4 | 73.8 | -33,513            | 94.2    | -61,438             | 83.5    | -74,852             | 83.1    | -85,702            | 84.4    | -64,758            | 85.4    |
| 15        | 86.9 | 74.0 | -34,114            | 98.1    | -48,013             | 86.5    | -98,502             | 76.6    | -101,302           | 80.8    | -48,015            | 88.2    |
| 16        | 87.4 | 73.6 | -32,568            | 101.1   | -47,245             | 87.7    | -108,562            | 25.8    | -108,562           | 25.8    | -47,247            | 89.0    |
| 17        | 87.2 | 73.5 | -28,157            | 103.3   | -40,611             | 89.2    | -108,562            | 45.7    | -108,562           | 45.7    | -40,611            | 90.4    |
| 18        | 86.7 | 73.0 | -30,761            | 97.1    | -41,257             | 86.8    | -108,562            | 49.7    | -108,562           | 49.7    | -41,257            | 87.8    |
| 19        | 85.8 | 73.7 | -68,612            | 81.7    | -75,286             | 76.3    | -108,562            | 46.1    | -108,562           | 46.1    | -75,286            | 77.6    |
| 20        | 84.6 | 74.6 | -80,546            | 72.4    | -84,230             | 70.3    | -108,562            | 41.5    | -108,562           | 41.5    | -84,230            | 72.8    |
| 21        | 83.2 | 74.7 | -90,253            | 64.5    | -90,578             | 64.5    | -108,562            | 36.9    | -108,562           | 37.0    | -90,578            | 65.4    |
| 22        | 81.5 | 74.9 | -93,779            | 59.7    | -93,618             | 60.9    | -108,562            | 33.7    | -108,562           | 33.8    | -93,618            | 61.2    |
| 23        | 79.8 | 73.5 | -111,985           | 22.3    | -111,927            | 24.1    | -108,562            | 30.2    | -108,562           | 30.3    | -111,927           | 24.3    |
| 24        | 78.0 | 72.7 | -111,043           | 21.3    | -110,987            | 23.1    | -108,562            | 27.0    | -108,562           | 27.1    | -110,988           | 23.3    |

| October |      | ----- Design ----- |          | ----- Weekday ----- |          | ----- Saturday----- |          | ----- Sunday ----- |          | ----- Monday ----- |          |         |
|---------|------|--------------------|----------|---------------------|----------|---------------------|----------|--------------------|----------|--------------------|----------|---------|
| Hour    | OADB | OAWB               | Htg Btuh | Clg Ton             | Htg Btuh | Clg Ton             | Htg Btuh | Clg Ton            | Htg Btuh | Clg Ton            | Htg Btuh | Clg Ton |
| 1       | 59.6 | 54.2               | -140,921 | 16.0                | -136,146 | 16.7                | -136,146 | 16.1               | -136,146 | 13.4               | -136,146 | 13.7    |
| 2       | 56.9 | 53.0               | -144,634 | 15.4                | -143,308 | 15.7                | -143,308 | 14.9               | -142,462 | 12.7               | -143,308 | 13.2    |
| 3       | 54.9 | 51.3               | -147,286 | 14.4                | -148,613 | 14.5                | -148,613 | 13.7               | -143,482 | 11.8               | -146,093 | 12.5    |
| 4       | 53.6 | 50.6               | -149,408 | 13.8                | -152,061 | 13.8                | -151,614 | 13.0               | -142,643 | 11.4               | -146,583 | 12.1    |
| 5       | 53.1 | 50.4               | -149,939 | 13.5                | -153,387 | 13.3                | -149,624 | 12.4               | -139,627 | 10.9               | -145,524 | 11.8    |
| 6       | 53.6 | 50.8               | -148,613 | 13.1                | -150,531 | 12.9                | -146,079 | 12.0               | -138,390 | 10.7               | -142,788 | 11.6    |
| 7       | 54.9 | 52.2               | -145,164 | 24.0                | -151,404 | 20.4                | -151,261 | 12.5               | -137,143 | 21.5               | -139,695 | 26.1    |
| 8       | 56.9 | 54.3               | -139,064 | 22.3                | -146,289 | 15.8                | -142,601 | 14.3               | -132,106 | 21.5               | -139,349 | 25.0    |
| 9       | 59.6 | 55.8               | -130,046 | 37.8                | -136,146 | 27.7                | -136,146 | 23.8               | -132,166 | 30.6               | -136,146 | 37.1    |
| 10      | 62.8 | 55.9               | -119,702 | 52.8                | -127,659 | 37.4                | -127,659 | 34.1               | -127,659 | 39.8               | -127,659 | 44.3    |
| 11      | 66.1 | 56.9               | -108,562 | 61.2                | -118,906 | 50.4                | -118,906 | 47.3               | -118,906 | 48.2               | -118,906 | 51.7    |
| 12      | 69.5 | 58.5               | -101,887 | 68.5                | -95,500  | 56.5                | -109,888 | 55.3               | -109,888 | 54.7               | -109,888 | 56.0    |
| 13      | 72.7 | 60.0               | -75,340  | 75.2                | -78,730  | 62.6                | -92,636  | 61.7               | -108,562 | 61.3               | -83,461  | 62.3    |
| 14      | 75.4 | 61.2               | -70,280  | 82.4                | -74,277  | 69.3                | -76,272  | 68.5               | -77,289  | 68.3               | -74,463  | 68.9    |
| 15      | 77.4 | 62.2               | -55,376  | 87.5                | -72,373  | 71.9                | -108,562 | 62.3               | -108,562 | 62.1               | -72,517  | 71.5    |
| 16      | 78.7 | 62.7               | -51,424  | 90.5                | -69,142  | 74.7                | -114,325 | 21.6               | -114,325 | 21.5               | -69,253  | 74.4    |
| 17      | 79.2 | 62.8               | -47,487  | 89.6                | -63,960  | 76.7                | -108,562 | 34.1               | -108,562 | 33.9               | -64,046  | 76.4    |
| 18      | 78.7 | 62.9               | -53,003  | 79.3                | -62,333  | 72.5                | -108,562 | 34.7               | -108,562 | 34.6               | -62,400  | 72.3    |
| 19      | 77.4 | 63.4               | -83,487  | 65.4                | -85,486  | 62.9                | -108,562 | 34.8               | -108,562 | 34.7               | -85,538  | 62.7    |
| 20      | 75.4 | 63.9               | -91,419  | 56.1                | -89,756  | 56.9                | -108,562 | 29.5               | -108,562 | 29.4               | -89,796  | 56.7    |
| 21      | 72.7 | 63.2               | -101,580 | 48.3                | -95,231  | 51.2                | -108,562 | 25.1               | -108,562 | 25.1               | -95,261  | 51.0    |
| 22      | 69.5 | 61.4               | -108,328 | 42.6                | -99,024  | 46.1                | -109,888 | 20.5               | -109,888 | 20.4               | -99,048  | 45.9    |
| 23      | 66.1 | 59.5               | -133,494 | 17.9                | -118,906 | 19.3                | -118,906 | 17.1               | -118,906 | 17.0               | -118,906 | 19.1    |
| 24      | 62.8 | 56.6               | -137,473 | 16.8                | -127,659 | 17.8                | -127,659 | 14.5               | -127,659 | 14.4               | -127,659 | 17.7    |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1  
EXISTING CONDITIONS

| Month | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|-------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour  | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 58.2               | 54.3 | -147,021 | 15.0    | -139,860            | 15.9    | -139,860 | 15.2    | -137,843            | 12.4    | -138,351 | 12.8    |                    |         |          |         |                    |         |          |         |
| 2     | 56.0               | 52.3 | -149,673 | 14.3    | -145,695            | 15.0    | -145,695 | 14.1    | -139,293            | 11.8    | -141,068 | 12.3    |                    |         |          |         |                    |         |          |         |
| 3     | 54.2               | 50.7 | -151,795 | 13.7    | -150,469            | 14.0    | -150,469 | 13.1    | -139,686            | 11.1    | -142,499 | 11.8    |                    |         |          |         |                    |         |          |         |
| 4     | 52.8               | 49.5 | -153,652 | 13.1    | -154,183            | 13.4    | -149,664 | 12.4    | -137,126            | 10.6    | -142,836 | 11.4    |                    |         |          |         |                    |         |          |         |
| 5     | 51.9               | 49.0 | -152,151 | 12.7    | -153,336            | 12.8    | -147,909 | 11.8    | -133,681            | 10.2    | -142,103 | 11.0    |                    |         |          |         |                    |         |          |         |
| 6     | 51.6               | 48.8 | -148,847 | 12.3    | -151,123            | 12.3    | -145,215 | 11.3    | -129,959            | 9.8     | -140,306 | 10.7    |                    |         |          |         |                    |         |          |         |
| 7     | 52.0               | 49.4 | -149,797 | 16.8    | -153,261            | 15.4    | -147,281 | 11.4    | -146,453            | 18.5    | -143,346 | 20.5    |                    |         |          |         |                    |         |          |         |
| 8     | 53.2               | 50.6 | -145,868 | 14.5    | -149,429            | 13.9    | -142,968 | 11.6    | -137,200            | 11.6    | -140,740 | 19.9    |                    |         |          |         |                    |         |          |         |
| 9     | 55.2               | 52.0 | -138,268 | 23.7    | -145,787            | 19.6    | -139,104 | 14.5    | -134,894            | 17.1    | -138,622 | 18.9    |                    |         |          |         |                    |         |          |         |
| 10    | 57.6               | 53.3 | -130,046 | 41.1    | -141,451            | 24.9    | -141,058 | 21.0    | -134,548            | 25.0    | -138,729 | 31.4    |                    |         |          |         |                    |         |          |         |
| 11    | 60.4               | 53.9 | -121,028 | 54.5    | -128,537            | 35.7    | -134,024 | 32.9    | -134,024            | 37.2    | -134,024 | 40.1    |                    |         |          |         |                    |         |          |         |
| 12    | 63.3               | 55.2 | -96,460  | 60.6    | -96,608             | 45.6    | -121,429 | 42.3    | -126,333            | 43.8    | -114,106 | 45.0    |                    |         |          |         |                    |         |          |         |
| 13    | 66.1               | 56.5 | -78,383  | 66.8    | -87,036             | 50.7    | -89,484  | 49.9    | -106,138            | 49.5    | -87,463  | 50.4    |                    |         |          |         |                    |         |          |         |
| 14    | 68.5               | 57.8 | -74,038  | 73.1    | -79,801             | 55.6    | -81,876  | 54.9    | -82,152             | 54.7    | -80,136  | 55.3    |                    |         |          |         |                    |         |          |         |
| 15    | 70.4               | 58.7 | -71,827  | 78.2    | -76,267             | 59.6    | -108,562 | 50.4    | -108,562            | 50.3    | -76,525  | 59.3    |                    |         |          |         |                    |         |          |         |
| 16    | 71.6               | 59.4 | -68,299  | 80.7    | -73,157             | 63.1    | -112,962 | 19.0    | -112,962            | 18.9    | -73,357  | 62.8    |                    |         |          |         |                    |         |          |         |
| 17    | 72.1               | 59.5 | -63,576  | 79.7    | -68,394             | 64.4    | -108,562 | 21.9    | -108,562            | 21.8    | -68,548  | 64.2    |                    |         |          |         |                    |         |          |         |
| 18    | 71.8               | 60.2 | -64,595  | 68.1    | -67,092             | 60.1    | -108,562 | 26.1    | -108,562            | 26.0    | -67,212  | 59.8    |                    |         |          |         |                    |         |          |         |
| 19    | 70.9               | 61.4 | -92,342  | 55.9    | -90,177             | 51.6    | -108,562 | 23.1    | -108,562            | 23.0    | -90,270  | 51.4    |                    |         |          |         |                    |         |          |         |
| 20    | 69.5               | 61.8 | -100,336 | 48.4    | -94,333             | 47.5    | -109,888 | 20.4    | -109,888            | 20.3    | -94,404  | 47.3    |                    |         |          |         |                    |         |          |         |
| 21    | 67.6               | 61.6 | -109,249 | 42.0    | -101,700            | 43.2    | -114,927 | 18.3    | -114,927            | 18.2    | -101,756 | 43.0    |                    |         |          |         |                    |         |          |         |
| 22    | 65.5               | 60.0 | -114,946 | 37.0    | -106,877            | 39.1    | -120,497 | 15.6    | -120,497            | 15.5    | -106,920 | 38.9    |                    |         |          |         |                    |         |          |         |
| 23    | 63.1               | 58.5 | -140,921 | 16.9    | -126,863            | 18.0    | -126,863 | 14.3    | -126,863            | 14.2    | -126,863 | 17.8    |                    |         |          |         |                    |         |          |         |
| 24    | 60.6               | 55.9 | -144,369 | 15.9    | -133,494            | 16.7    | -133,494 | 13.3    | -133,494            | 13.3    | -133,494 | 16.6    |                    |         |          |         |                    |         |          |         |

| Month | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|-------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour  | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 48.2               | 44.6 | -171,187 | 12.5    | -166,384            | 13.9    | -165,588 | 13.1    | -147,957            | 10.4    | -152,010 | 10.7    |                    |         |          |         |                    |         |          |         |
| 2     | 46.1               | 42.8 | -169,473 | 11.9    | -169,897            | 13.0    | -164,656 | 12.0    | -144,523            | 9.6     | -149,453 | 10.1    |                    |         |          |         |                    |         |          |         |
| 3     | 44.2               | 41.1 | -166,918 | 11.1    | -169,153            | 12.2    | -163,043 | 11.1    | -139,678            | 8.9     | -148,171 | 9.6     |                    |         |          |         |                    |         |          |         |
| 4     | 42.6               | 39.7 | -163,744 | 10.5    | -167,444            | 11.4    | -160,654 | 10.3    | -134,201            | 8.1     | -145,247 | 9.0     |                    |         |          |         |                    |         |          |         |
| 5     | 41.4               | 38.7 | -162,146 | 10.0    | -164,802            | 10.6    | -159,582 | 9.4     | -130,807            | 7.4     | -143,656 | 8.4     |                    |         |          |         |                    |         |          |         |
| 6     | 40.7               | 37.8 | -156,905 | 9.6     | -161,244            | 10.0    | -150,603 | 8.8     | -124,330            | 6.8     | -138,976 | 7.9     |                    |         |          |         |                    |         |          |         |
| 7     | 40.4               | 37.7 | -203,903 | 9.8     | -300,269            | 9.9     | -375,166 | 8.7     | -296,757            | 7.0     | -224,607 | 8.2     |                    |         |          |         |                    |         |          |         |
| 8     | 41.1               | 38.2 | -211,592 | 10.1    | -243,126            | 9.9     | -260,758 | 9.0     | -267,486            | 7.6     | -261,398 | 8.8     |                    |         |          |         |                    |         |          |         |
| 9     | 43.1               | 40.1 | -142,008 | 11.5    | -151,309            | 11.1    | -148,297 | 10.2    | -143,862            | 9.1     | -148,476 | 10.1    |                    |         |          |         |                    |         |          |         |
| 10    | 46.1               | 42.3 | -157,281 | 13.0    | -121,976            | 12.2    | -147,040 | 11.6    | -144,990            | 10.6    | -161,016 | 11.5    |                    |         |          |         |                    |         |          |         |
| 11    | 49.8               | 44.5 | -111,700 | 24.1    | -112,872            | 13.3    | -120,734 | 12.9    | -146,057            | 12.2    | -119,473 | 18.4    |                    |         |          |         |                    |         |          |         |
| 12    | 53.7               | 46.6 | -103,896 | 38.8    | -113,167            | 21.1    | -112,481 | 14.2    | -131,115            | 14.7    | -110,879 | 20.8    |                    |         |          |         |                    |         |          |         |
| 13    | 57.4               | 49.0 | -93,626  | 53.5    | -102,410            | 27.6    | -104,826 | 24.5    | -105,016            | 26.1    | -102,631 | 27.3    |                    |         |          |         |                    |         |          |         |
| 14    | 60.4               | 50.9 | -87,006  | 59.7    | -94,620             | 39.6    | -96,666  | 38.1    | -96,797             | 38.0    | -94,793  | 39.4    |                    |         |          |         |                    |         |          |         |
| 15    | 62.4               | 52.0 | -84,149  | 64.2    | -90,299             | 48.5    | -126,885 | 39.4    | -126,995            | 39.3    | -90,433  | 48.3    |                    |         |          |         |                    |         |          |         |
| 16    | 63.0               | 52.1 | -81,318  | 67.8    | -86,308             | 51.7    | -130,140 | 16.6    | -130,140            | 16.5    | -86,412  | 51.5    |                    |         |          |         |                    |         |          |         |
| 17    | 62.8               | 51.6 | -77,998  | 67.3    | -81,348             | 53.3    | -130,314 | 16.2    | -130,314            | 16.1    | -81,429  | 53.1    |                    |         |          |         |                    |         |          |         |
| 18    | 62.1               | 51.6 | -80,407  | 56.8    | -80,833             | 48.6    | -129,893 | 15.6    | -129,893            | 15.5    | -80,896  | 48.4    |                    |         |          |         |                    |         |          |         |
| 19    | 60.9               | 51.8 | -108,480 | 44.5    | -105,272            | 39.7    | -132,698 | 16.1    | -132,698            | 16.0    | -105,320 | 39.5    |                    |         |          |         |                    |         |          |         |
| 20    | 59.3               | 52.1 | -116,930 | 37.2    | -110,680            | 35.9    | -136,942 | 14.2    | -136,942            | 14.1    | -110,718 | 35.7    |                    |         |          |         |                    |         |          |         |
| 21    | 57.4               | 51.8 | -125,745 | 30.8    | -118,246            | 31.4    | -141,982 | 13.4    | -141,982            | 13.4    | -118,275 | 31.2    |                    |         |          |         |                    |         |          |         |
| 22    | 55.2               | 50.7 | -131,461 | 25.8    | -123,443            | 27.6    | -145,533 | 12.7    | -145,334            | 12.6    | -123,465 | 27.5    |                    |         |          |         |                    |         |          |         |
| 23    | 52.9               | 48.9 | -169,566 | 14.4    | -153,917            | 15.2    | -146,793 | 12.0    | -146,604            | 11.9    | -153,917 | 15.1    |                    |         |          |         |                    |         |          |         |
| 24    | 50.5               | 46.7 | -173,014 | 13.7    | -160,283            | 14.3    | -147,638 | 11.1    | -147,460            | 11.0    | -160,283 | 14.2    |                    |         |          |         |                    |         |          |         |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 GL) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 67,572                   | 194                       | 1,307                     | 36                 | 6                                |
| Feb   | 59,019                   | 192                       | 1,204                     | 31                 | 5                                |
| March | 80,990                   | 208                       | 1,065                     | 67                 | 2                                |
| April | 85,713                   | 218                       | 930                       | 88                 | 2                                |
| May   | 97,768                   | 229                       | 858                       | 113                | 1                                |
| June  | 102,010                  | 235                       | 778                       | 126                | 1                                |
| July  | 109,890                  | 242                       | 796                       | 142                | 1                                |
| Aug   | 112,441                  | 246                       | 798                       | 145                | 1                                |
| Sept  | 98,607                   | 239                       | 837                       | 118                | 1                                |
| Oct   | 86,017                   | 220                       | 1,027                     | 81                 | 2                                |
| Nov   | 76,567                   | 209                       | 1,032                     | 57                 | 2                                |
| Dec   | 66,386                   | 196                       | 1,275                     | 32                 | 5                                |
| Total | 1,042,981                | 246                       | 11,908                    | 1,036              | 6                                |

Building Energy Consumption = 133,290 (Btu/Sq Ft/Year)  
Source Energy Consumption = 334,837 (Btu/Sq Ft/Year)

Floor Area = 35,640 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION -----

| Ref<br>Num | Equip<br>Code | Monthly Consumption                    |       |       |       |       |       |       |       |       |       |       |       | Total   |
|------------|---------------|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|            |               | Jan                                    | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0          | LIGHTS        |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 31114                                  | 28120 | 32183 | 29938 | 31648 | 31007 | 30579 | 32183 | 29938 | 31648 | 29938 | 30579 | 368,874 |
|            | PK            | 89.1                                   | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1    |
| 1          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | GAS           | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | OIL           | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P STEAM       | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|            | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P HOTH2O      | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P CHILL       | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1          | EQ1131L       | WTR-CLD COND COMP W-EVAP COND >30 TONS |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 7917                                   | 6886  | 14472 | 19250 | 24873 | 27467 | 31221 | 31793 | 26010 | 17286 | 12426 | 7017  | 226,617 |
|            | PK            | 49.6                                   | 49.5  | 58.3  | 64.6  | 71.9  | 75.2  | 79.5  | 81.6  | 79.7  | 66.3  | 59.1  | 49.3  | 81.6    |
| 1          | EQ5105        | COOLING TOWER                          |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 4204                                   | 2071  | 8173  | 9824  | 11605 | 12976 | 14491 | 14511 | 11933 | 9456  | 8760  | 4300  | 112,306 |
|            | PK            | 20.5                                   | 16.4  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5    |
| 1          | EQ5105        | COOLING TOWER                          |       |       |       |       |       |       |       |       |       |       |       |         |
|            | WATER         | 34                                     | 29    | 65    | 85    | 111   | 123   | 139   | 142   | 115   | 78    | 54    | 30    | 1,006   |
|            | PK            | 0.3                                    | 0.3   | 0.3   | 0.3   | 0.4   | 0.4   | 0.4   | 0.4   | 0.4   | 0.3   | 0.3   | 0.3   | 0.4     |
| 1          | EQ5302        | CONTROLS                               |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 29                                     | 25    | 46    | 48    | 57    | 63    | 71    | 71    | 58    | 46    | 43    | 26    | 583     |
|            | PK            | 0.1                                    | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1     |
| 2          | EQ1100S       | AIR-CLD RECIP 25-45 TONS               |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 16615                                  | 15000 | 18039 | 18458 | 20788 | 21734 | 24143 | 24546 | 21847 | 19193 | 17573 | 16747 | 234,684 |
|            | PK            | 26.2                                   | 26.4  | 28.5  | 31.5  | 35.2  | 38.0  | 40.9  | 41.4  | 37.6  | 32.0  | 28.4  | 26.4  | 41.4    |
|            | EQ5200        | CONDENSER FANS                         |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|   |        |                            |      |      |      |      |      |      |      |      |      |      |      |        |
|---|--------|----------------------------|------|------|------|------|------|------|------|------|------|------|------|--------|
|   | ELEC   | 671                        | 575  | 1054 | 1400 | 1776 | 1968 | 2363 | 2315 | 2026 | 1366 | 1034 | 696  | 17,243 |
|   | PK     | 1.5                        | 1.4  | 2.7  | 3.1  | 3.3  | 3.5  | 4.9  | 4.9  | 3.6  | 3.2  | 2.6  | 1.6  | 4.9    |
| 2 | EQ5001 | CHILLED WATER PUMP C.V.    |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 2219                       | 2004 | 2219 | 2148 | 2219 | 2148 | 2219 | 2219 | 2148 | 2219 | 2148 | 2219 | 26,129 |
|   | PK     | 3.0                        | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0    |
| 2 | EQ5303 | CONTROLS                   |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 223                        | 202  | 223  | 216  | 223  | 216  | 223  | 223  | 216  | 223  | 216  | 223  | 2,628  |
|   | PK     | 0.3                        | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3    |
| 1 | EQ2002 | GAS FIRE TUBE STEAM        |      |      |      |      |      |      |      |      |      |      |      |        |
|   | GAS    | 1307                       | 1204 | 1065 | 930  | 858  | 778  | 796  | 798  | 837  | 1027 | 1032 | 1275 | 11,908 |
|   | PK     | 6.3                        | 5.3  | 2.0  | 1.6  | 1.4  | 1.4  | 1.4  | 1.4  | 1.3  | 1.8  | 1.9  | 4.5  | 6.3    |
| 1 | EQ5020 | HEAT WATER CIRC. PUMP C.V. |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 3699                       | 3341 | 3699 | 3579 | 3699 | 3579 | 3699 | 3699 | 3579 | 3699 | 3579 | 3699 | 43,549 |
|   | PK     | 5.0                        | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0    |
| 1 | EQ5240 | BOILER FORCED DRAFT FAN    |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 486                        | 439  | 486  | 470  | 486  | 470  | 486  | 486  | 470  | 486  | 470  | 486  | 5,720  |
|   | PK     | 0.7                        | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7    |
| 1 | EQ5307 | BOILER CONTROLS            |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 372                        | 336  | 372  | 360  | 372  | 360  | 372  | 372  | 360  | 372  | 360  | 372  | 4,380  |
|   | PK     | 0.5                        | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5    |
|   | EQ5061 | CONDENSATE RETURN PUMP     |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 23                         | 21   | 23   | 22   | 23   | 22   | 23   | 23   | 22   | 23   | 22   | 23   | 269    |
|   | PK     | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0    |
| 1 | EQ5406 | MAKE-UP WATER              |      |      |      |      |      |      |      |      |      |      |      |        |
|   | WATER  | 3                          | 2    | 3    | 2    | 3    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 30     |
|   | PK     | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0    |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        246.0    (kW)  
Yearly Time of Peak   16 (hr)    8 (mo)  
  
Hour 16   Month   8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description                  | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|----------------------------------------|---------------------------|------------------------|
| Cooling Equipment    |                        |                                        |                           |                        |
| 1                    | EQ1131L                | WTR-CLD COND COMP W-EVAP COND >30 TONS | 101.7                     | 41.34                  |
| 2                    | EQ1100S                | AIR-CLD RECIP 25-45 TONS               | 49.0                      | 19.94                  |
| Sub Total            |                        |                                        | 150.7                     | 61.28                  |
| Heating Equipment    |                        |                                        |                           |                        |
| 1                    | EQ2002                 | GAS FIRE TUBE STEAM                    | 6.2                       | 2.50                   |
| Sub Total            |                        |                                        | 6.2                       | 2.50                   |
| Sub Total            |                        |                                        | 0.0                       | 0.00                   |
| Sub Total            |                        |                                        | 0.0                       | 0.00                   |
| Miscellaneous        |                        |                                        |                           |                        |
| Lights               |                        |                                        | 89.1                      | 36.22                  |
| Base Utilities       |                        |                                        | 0.0                       | 0.00                   |
| Misc Equipment       |                        |                                        | 0.0                       | 0.00                   |
| Sub Total            |                        |                                        | 89.1                      | 36.22                  |
| Grand Total          |                        |                                        | 246.0                     | 100.00                 |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| January |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|---------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour    | OADB | OAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1       | 41.3 | 36.7 | -28,758            | 0.0     | -29,994             | 0.0     | -33,138             | 0.0     | -37,149            | 0.0     | -37,355            | 0.0     |
| 2       | 40.0 | 36.0 | -31,932            | 0.0     | -36,437             | 0.0     | -40,876             | 0.0     | -46,861            | 0.0     | -39,071            | 0.0     |
| 3       | 39.5 | 35.9 | -34,609            | 0.0     | -39,968             | 0.0     | -47,541             | 0.0     | -51,060            | 0.0     | -45,037            | 0.0     |
| 4       | 39.9 | 36.4 | -36,506            | 0.0     | -41,115             | 0.0     | -46,594             | 0.0     | -51,211            | 0.0     | -44,827            | 0.0     |
| 5       | 40.8 | 37.6 | -37,178            | 0.0     | -43,555             | 0.0     | -49,251             | 0.0     | -51,082            | 0.0     | -45,336            | 0.0     |
| 6       | 42.4 | 39.4 | -21,847            | 0.0     | 0                   | 0.0     | -7,361              | 0.0     | -10,002            | 0.0     | -1,897             | 0.0     |
| 7       | 44.4 | 41.5 | -523,029           | 5.5     | -323,186            | 10.1    | -443,428            | 9.2     | -356,032           | 9.0     | -245,556           | 9.6     |
| 8       | 46.9 | 44.1 | -328,475           | 6.5     | -197,943            | 10.5    | -228,125            | 9.7     | -213,162           | 9.6     | -203,250           | 10.1    |
| 9       | 49.5 | 46.6 | -133,331           | 8.3     | -141,654            | 11.6    | -139,518            | 10.9    | -139,505           | 10.8    | -139,749           | 11.3    |
| 10      | 52.2 | 48.2 | -143,203           | 10.2    | -134,989            | 12.8    | -142,038            | 12.2    | -142,001           | 12.2    | -141,814           | 14.2    |
| 11      | 54.9 | 49.2 | -141,632           | 16.4    | -113,754            | 16.1    | -135,105            | 13.7    | -140,533           | 13.6    | -112,197           | 20.2    |
| 12      | 57.3 | 50.1 | -139,860           | 29.1    | -107,249            | 26.1    | -109,978            | 17.8    | -109,982           | 22.6    | -107,400           | 26.0    |
| 13      | 59.4 | 50.4 | -132,698           | 41.2    | -98,269             | 34.9    | -100,572            | 32.9    | -100,575           | 33.6    | -98,385            | 34.8    |
| 14      | 60.9 | 50.0 | -88,095            | 47.4    | -92,536             | 46.0    | -94,500             | 45.1    | -94,503            | 45.1    | -92,628            | 45.9    |
| 15      | 61.9 | 50.3 | -85,061            | 51.7    | -89,757             | 49.1    | 0                   | 0.0     | 0                  | 0.0     | -89,828            | 49.0    |
| 16      | 62.2 | 49.8 | -82,135            | 64.1    | -86,482             | 52.2    | -2,804              | 0.0     | -2,804             | 0.0     | -86,536            | 52.1    |
| 17      | 61.8 | 49.3 | -78,702            | 68.1    | -82,101             | 54.1    | 0                   | 0.0     | 0                  | 0.0     | -82,143            | 54.1    |
| 18      | 60.4 | 48.6 | -80,089            | 61.1    | -82,143             | 51.5    | 0                   | 0.0     | 0                  | 0.0     | -82,175            | 51.5    |
| 19      | 58.3 | 48.2 | -107,846           | 47.0    | -107,416            | 40.3    | 0                   | 0.0     | 0                  | 0.0     | -107,441           | 40.3    |
| 20      | 55.6 | 46.8 | -116,946           | 39.1    | -114,792            | 34.7    | 0                   | 0.0     | 0                  | 0.0     | -114,811           | 34.7    |
| 21      | 52.5 | 44.9 | -126,166           | 31.5    | -124,222            | 28.6    | 0                   | 0.0     | 0                  | 0.0     | -124,237           | 28.6    |
| 22      | 49.3 | 42.5 | -132,372           | 26.2    | -131,024            | 23.9    | 0                   | 0.0     | 0                  | 0.0     | -131,036           | 23.9    |
| 23      | 46.2 | 40.4 | -48,813            | 0.0     | -51,607             | 0.0     | -11,092             | 0.0     | -11,104            | 0.0     | -51,681            | 0.0     |
| 24      | 43.5 | 38.5 | -11,130            | 0.0     | -19,563             | 0.0     | -26,313             | 0.0     | -26,316            | 0.0     | -19,636            | 0.0     |

| Hour | ----- Design ----- |      |          |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|------|--------------------|------|----------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
|      | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1    | 45.2               | 40.8 | -25,919  | 0.0     | -13,355             | 0.0     | -21,387             | 0.0     | -25,859            | 0.0     | -25,462            | 0.0     |
| 2    | 43.4               | 39.0 | -28,052  | 0.0     | -25,342             | 0.0     | -30,552             | 0.0     | -34,215            | 0.0     | -29,215            | 0.0     |
| 3    | 41.9               | 37.4 | -32,950  | 0.0     | -32,585             | 0.0     | -38,368             | 0.0     | -43,905            | 0.0     | -37,885            | 0.0     |
| 4    | 40.8               | 36.7 | -37,128  | 0.0     | -38,167             | 0.0     | -44,147             | 0.0     | -45,985            | 0.0     | -40,518            | 0.0     |
| 5    | 40.1               | 36.1 | -40,004  | 0.0     | -42,398             | 0.0     | -50,462             | 0.0     | -49,991            | 0.0     | -46,919            | 0.0     |
| 6    | 39.8               | 36.0 | 0        | 0.0     | 0                   | 0.0     | 0                   | 0.0     | -9,716             | 0.0     | 0                  | 0.0     |
| 7    | 40.3               | 36.6 | -288,168 | 9.8     | -338,538            | 9.8     | -448,964            | 8.7     | -332,445           | 8.4     | -231,409           | 9.1     |
| 8    | 41.6               | 38.2 | -190,397 | 10.0    | -228,017            | 9.9     | -249,558            | 9.0     | -242,913           | 8.8     | -235,138           | 9.4     |
| 9    | 43.8               | 40.1 | -148,109 | 11.2    | -150,395            | 11.0    | -147,602            | 10.2    | -147,582           | 10.0    | -147,835           | 10.6    |
| 10   | 46.4               | 41.5 | -132,479 | 12.7    | -120,281            | 12.1    | -147,595            | 11.5    | -147,536           | 11.4    | -129,895           | 13.2    |
| 11   | 49.4               | 42.9 | -114,305 | 24.3    | -114,396            | 14.3    | -121,798            | 12.9    | -131,092           | 12.8    | -112,303           | 18.5    |
| 12   | 52.4               | 45.0 | -107,052 | 38.5    | -113,004            | 21.4    | -112,971            | 14.0    | -112,866           | 17.2    | -111,033           | 21.3    |
| 13   | 55.0               | 46.4 | -97,128  | 51.4    | -104,856            | 32.7    | -107,256            | 30.2    | -107,264           | 32.0    | -105,045           | 32.6    |
| 14   | 57.2               | 47.2 | -90,790  | 57.0    | -98,235             | 40.1    | -100,269            | 38.7    | -100,275           | 38.7    | -98,385            | 40.0    |
| 15   | 58.5               | 47.9 | -88,160  | 61.6    | -95,023             | 46.9    | 0                   | 0.0     | 0                  | 0.0     | -95,138            | 46.9    |
| 16   | 59.0               | 47.6 | -85,168  | 65.6    | -91,111             | 50.2    | -2,674              | 0.0     | -2,674             | 0.0     | -91,201            | 50.1    |
| 17   | 58.8               | 47.7 | -80,915  | 68.1    | -86,111             | 52.9    | 0                   | 0.0     | 0                  | 0.0     | -86,180            | 52.9    |
| 18   | 58.0               | 47.2 | -81,556  | 64.4    | -84,769             | 51.7    | 0                   | 0.0     | 0                  | 0.0     | -84,823            | 51.6    |
| 19   | 56.9               | 47.1 | -107,861 | 49.4    | -108,212            | 40.6    | 0                   | 0.0     | 0                  | 0.0     | -108,254           | 40.5    |
| 20   | 55.4               | 47.2 | -117,441 | 40.4    | -114,810            | 35.8    | 0                   | 0.0     | 0                  | 0.0     | -114,842           | 35.8    |
| 21   | 53.6               | 46.7 | -127,005 | 32.7    | -122,663            | 30.2    | 0                   | 0.0     | 0                  | 0.0     | -122,688           | 30.1    |
| 22   | 51.5               | 45.7 | -132,890 | 27.0    | -128,207            | 26.1    | 0                   | 0.0     | 0                  | 0.0     | -128,226           | 26.1    |
| 23   | 49.4               | 44.5 | -48,135  | 0.0     | -38,510             | 0.0     | -7,134              | 0.0     | -7,134             | 0.0     | -38,631            | 0.0     |
| 24   | 47.3               | 42.7 | -9,907   | 0.0     | -2,405              | 0.0     | -15,414             | 0.0     | -15,421            | 0.0     | -2,525             | 0.0     |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| Month | Design |      | Weekday  |         | Saturday |         | Sunday   |         | Monday   |         |
|-------|--------|------|----------|---------|----------|---------|----------|---------|----------|---------|
| Hour  | OADB   | OAWB | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 59.0   | 53.6 | -4,742   | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 2     | 56.7   | 51.7 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 3     | 54.6   | 50.0 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 4     | 52.8   | 48.6 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 5     | 51.5   | 47.5 | -4,462   | 0.0     | 0        | 0.0     | 0        | 0.0     | -7,577   | 0.0     |
| 6     | 50.7   | 47.0 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 7     | 50.4   | 46.9 | -152,610 | 12.5    | -163,656 | 18.4    | -176,873 | 12.2    | -145,248 | 30.8    |
| 8     | 51.0   | 47.8 | -150,972 | 14.1    | -163,715 | 14.3    | -159,433 | 12.2    | -158,957 | 22.4    |
| 9     | 52.5   | 48.7 | -140,125 | 22.5    | -157,088 | 19.8    | -157,050 | 18.1    | -139,334 | 25.8    |
| 10    | 55.0   | 49.4 | -131,372 | 40.1    | -116,728 | 28.1    | -148,347 | 24.5    | -116,946 | 32.8    |
| 11    | 58.0   | 50.7 | -106,677 | 55.9    | -106,200 | 36.9    | -119,682 | 35.0    | -108,822 | 41.5    |
| 12    | 61.4   | 52.5 | -84,648  | 61.8    | -97,735  | 47.2    | -100,555 | 44.1    | -100,003 | 46.6    |
| 13    | 64.9   | 54.4 | -76,075  | 66.1    | -87,253  | 52.2    | -89,639  | 51.4    | -89,148  | 51.7    |
| 14    | 67.9   | 56.1 | -67,582  | 70.9    | -79,554  | 57.5    | -81,574  | 56.8    | -81,242  | 57.0    |
| 15    | 70.4   | 57.9 | -57,896  | 75.3    | -75,299  | 61.5    | 0        | 0.0     | 0        | 0.0     |
| 16    | 71.9   | 58.5 | -56,003  | 79.2    | -72,162  | 64.6    | 0        | 0.0     | 0        | 0.0     |
| 17    | 72.5   | 58.8 | -50,256  | 81.1    | -66,749  | 67.5    | 0        | 0.0     | 0        | 0.0     |
| 18    | 72.2   | 59.0 | -53,258  | 78.3    | -64,207  | 67.2    | 0        | 0.0     | 0        | 0.0     |
| 19    | 71.4   | 59.4 | -86,526  | 63.8    | -86,392  | 56.6    | 0        | 0.0     | 0        | 0.0     |
| 20    | 70.1   | 59.9 | -96,865  | 53.5    | -91,258  | 51.0    | 0        | 0.0     | 0        | 0.0     |
| 21    | 68.3   | 60.0 | -107,184 | 45.5    | -99,197  | 45.5    | 0        | 0.0     | 0        | 0.0     |
| 22    | 66.2   | 58.8 | -113,795 | 39.4    | -104,881 | 41.3    | 0        | 0.0     | 0        | 0.0     |
| 23    | 63.9   | 57.5 | -13,141  | 0.0     | -9,417   | 0.0     | 0        | 0.0     | -9,417   | 0.0     |
| 24    | 61.4   | 55.5 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |

| Month | Design |      | Weekday  |         | Saturday |         | Sunday   |         | Monday   |         |
|-------|--------|------|----------|---------|----------|---------|----------|---------|----------|---------|
| Hour  | OADB   | OAWB | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh | Clg Ton |
| 1     | 62.7   | 58.8 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 2     | 61.1   | 57.4 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 3     | 60.1   | 56.5 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 4     | 59.7   | 56.2 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 5     | 60.1   | 56.5 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 6     | 61.1   | 57.6 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |
| 7     | 62.7   | 59.2 | -128,230 | 37.3    | -118,295 | 34.7    | -127,924 | 25.3    | -40,438  | 74.4    |
| 8     | 64.7   | 61.1 | -123,945 | 35.4    | -122,619 | 31.1    | -122,619 | 23.6    | -98,547  | 36.8    |
| 9     | 67.1   | 62.3 | -117,049 | 49.2    | -116,254 | 42.7    | -116,254 | 37.0    | -105,553 | 47.1    |
| 10    | 69.7   | 63.6 | -90,008  | 58.5    | -94,466  | 51.4    | -109,357 | 49.7    | -93,412  | 54.4    |
| 11    | 72.3   | 64.8 | -83,481  | 64.7    | -86,138  | 56.9    | -108,562 | 55.7    | -88,592  | 59.2    |
| 12    | 74.7   | 65.6 | -55,311  | 69.2    | -81,486  | 60.7    | -84,757  | 59.8    | -83,622  | 62.3    |
| 13    | 76.8   | 66.5 | -45,862  | 73.0    | -75,186  | 64.5    | -77,552  | 63.7    | -69,510  | 64.3    |
| 14    | 78.4   | 66.6 | -41,313  | 77.1    | -59,612  | 68.2    | -73,417  | 67.6    | -59,912  | 67.7    |
| 15    | 79.4   | 66.9 | -42,040  | 81.1    | -57,793  | 71.8    | 0        | 0.0     | 0        | 0.0     |
| 16    | 79.7   | 66.4 | -39,994  | 84.7    | -56,502  | 73.2    | 0        | 0.0     | 0        | 0.0     |
| 17    | 79.4   | 65.7 | -35,272  | 86.5    | -51,206  | 75.0    | 0        | 0.0     | 0        | 0.0     |
| 18    | 78.4   | 65.0 | -36,900  | 85.0    | -51,918  | 73.9    | 0        | 0.0     | 0        | 0.0     |
| 19    | 76.8   | 64.8 | -73,420  | 73.5    | -82,624  | 65.7    | 0        | 0.0     | 0        | 0.0     |
| 20    | 74.7   | 65.4 | -84,367  | 63.3    | -87,139  | 58.1    | 0        | 0.0     | 0        | 0.0     |
| 21    | 72.3   | 65.0 | -93,056  | 54.4    | -93,912  | 51.5    | 0        | 0.0     | 0        | 0.0     |
| 22    | 69.7   | 63.7 | -99,761  | 48.3    | -97,801  | 46.3    | 0        | 0.0     | 0        | 0.0     |
| 23    | 67.1   | 62.0 | -7,130   | 0.0     | -8,268   | 0.0     | 0        | 0.0     | -8,268   | 0.0     |
| 24    | 64.7   | 60.4 | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     | 0        | 0.0     |



BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| Day  | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1    | 73.3               | 68.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 2    | 71.3               | 67.4 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 3    | 69.6               | 66.1 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 4    | 68.1               | 64.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 5    | 67.0               | 64.3 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 6    | 66.4               | 63.8 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 7    | 66.1               | 63.9 | -47,068  | 70.1    | -19,707             | 72.4    | -53,562  | 63.7    | 0                   | 100.6   | 0        | 104.5   | 0                  | 104.5   | 0        | 104.5   | 0                  | 104.5   | 0        | 104.5   |
| 8    | 66.8               | 63.8 | -108,506 | 48.4    | -99,644             | 41.3    | -116,989 | 39.3    | 0                   | 74.0    | 0        | 83.1    | 0                  | 83.1    | 0        | 83.1    | 0                  | 83.1    | 0        | 83.1    |
| 9    | 68.6               | 63.8 | -102,217 | 61.3    | -96,854             | 50.6    | -112,218 | 46.4    | -40,076             | 54.3    | -15,518  | 56.9    | -40,076            | 54.3    | -15,518  | 56.9    | -40,076            | 54.3    | -15,518  | 56.9    |
| 10   | 71.3               | 64.6 | -58,107  | 67.3    | -87,028             | 57.5    | -98,893  | 54.1    | -43,247             | 60.0    | -40,823  | 62.3    | -43,247            | 60.0    | -40,823  | 62.3    | -43,247            | 60.0    | -40,823  | 62.3    |
| 11   | 74.7               | 66.3 | -46,904  | 71.9    | -77,189             | 61.0    | -85,761  | 59.4    | -74,646             | 63.9    | -36,125  | 65.7    | -74,646            | 63.9    | -36,125  | 65.7    | -74,646            | 63.9    | -36,125  | 65.7    |
| 12   | 78.4               | 68.1 | -40,189  | 76.0    | -61,804             | 65.1    | -65,533  | 64.5    | -65,522             | 67.8    | -60,145  | 69.2    | -65,522            | 67.8    | -60,145  | 69.2    | -65,522            | 67.8    | -60,145  | 69.2    |
| 13   | 81.8               | 69.9 | -31,404  | 79.8    | -51,244             | 69.5    | -54,422  | 69.0    | -54,418             | 71.2    | -51,232  | 72.4    | -54,418            | 71.2    | -51,232  | 72.4    | -54,418            | 71.2    | -51,232  | 72.4    |
| 14   | 84.5               | 70.9 | -26,828  | 83.5    | -43,707             | 74.9    | -46,415  | 74.5    | -46,415             | 75.9    | -43,706  | 76.9    | -46,415            | 75.9    | -43,706  | 76.9    | -46,415            | 75.9    | -43,706  | 76.9    |
| 15   | 86.3               | 71.8 | -27,263  | 87.6    | -43,411             | 78.6    | 0        | 0.0     | 0                   | 0.0     | -43,411  | 80.5    | 0                  | 0.0     | -43,411  | 80.5    | 0                  | 0.0     | -43,411  | 80.5    |
| 16   | 87.0               | 71.6 | -25,488  | 90.7    | -42,139             | 80.4    | 0        | 0.0     | 0                   | 0.0     | -42,139  | 81.9    | 0                  | 0.0     | -42,139  | 81.9    | 0                  | 0.0     | -42,139  | 81.9    |
| 17   | 86.7               | 72.0 | -19,186  | 92.8    | -36,394             | 82.4    | 0        | 0.0     | 0                   | 0.0     | -36,394  | 83.6    | 0                  | 0.0     | -36,394  | 83.6    | 0                  | 0.0     | -36,394  | 83.6    |
| 18   | 86.1               | 71.7 | -19,776  | 91.9    | -35,034             | 82.2    | 0        | 0.0     | 0                   | 0.0     | -35,034  | 83.3    | 0                  | 0.0     | -35,034  | 83.3    | 0                  | 0.0     | -35,034  | 83.3    |
| 19   | 85.0               | 71.9 | -54,338  | 82.2    | -66,100             | 74.8    | 0        | 0.0     | 0                   | 0.0     | -66,100  | 76.2    | 0                  | 0.0     | -66,100  | 76.2    | 0                  | 0.0     | -66,100  | 76.2    |
| 20   | 83.5               | 72.5 | -70,363  | 72.0    | -76,983             | 67.8    | 0        | 0.0     | 0                   | 0.0     | -76,983  | 70.1    | 0                  | 0.0     | -76,983  | 70.1    | 0                  | 0.0     | -76,983  | 70.1    |
| 21   | 81.8               | 72.9 | -88,545  | 62.3    | -90,042             | 61.7    | 0        | 0.0     | 0                   | 0.0     | -90,042  | 64.4    | 0                  | 0.0     | -90,042  | 64.4    | 0                  | 0.0     | -90,042  | 64.4    |
| 22   | 79.8               | 72.1 | -93,358  | 56.0    | -93,413             | 57.3    | 0        | 0.0     | 0                   | 0.0     | -93,413  | 57.9    | 0                  | 0.0     | -93,413  | 57.9    | 0                  | 0.0     | -93,413  | 57.9    |
| 23   | 77.6               | 71.2 | -6,662   | 0.0     | -3,756              | 0.0     | 0        | 0.0     | 0                   | 0.0     | -3,770   | 0.0     | 0                  | 0.0     | -3,770   | 0.0     | 0                  | 0.0     | -3,770   | 0.0     |
| 24   | 75.5               | 69.9 | -2,312   | 0.0     | -2,305              | 0.0     | 0        | 0.0     | 0                   | 0.0     | -2,305   | 0.0     | 0                  | 0.0     | -2,305   | 0.0     | 0                  | 0.0     | -2,305   | 0.0     |

| Day  | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour | OADB               | OAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1    | 78.8               | 73.3 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 2    | 76.6               | 71.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 3    | 74.6               | 70.6 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 4    | 73.0               | 69.2 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 5    | 71.7               | 68.1 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 6    | 71.0               | 67.5 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 7    | 70.7               | 67.5 | 0        | 95.0    | 0                   | 95.2    | 0        | 91.2    | 0                   | 110.3   | 0        | 113.6   | 0                  | 110.3   | 0        | 113.6   | 0                  | 110.3   | 0        | 113.6   |
| 8    | 71.2               | 67.0 | -36,902  | 58.4    | -34,362             | 50.9    | -86,698  | 45.7    | 0                   | 101.6   | 0        | 105.7   | 0                  | 101.6   | 0        | 105.7   | 0                  | 101.6   | 0        | 105.7   |
| 9    | 72.7               | 66.6 | -67,429  | 67.4    | -84,104             | 56.2    | -97,119  | 54.7    | 0                   | 68.2    | 0        | 77.0    | 0                  | 68.2    | 0        | 77.0    | 0                  | 68.2    | 0        | 77.0    |
| 10   | 75.0               | 66.9 | -46,331  | 74.1    | -68,390             | 63.6    | -77,943  | 62.1    | -7,711              | 67.5    | 0        | 70.3    | -7,711             | 67.5    | 0        | 70.3    | -7,711             | 67.5    | 0        | 70.3    |
| 11   | 77.9               | 67.5 | -37,683  | 78.9    | -59,698             | 67.8    | -64,079  | 64.7    | -28,513             | 70.4    | -15,896  | 72.8    | -28,513            | 70.4    | -15,896  | 72.8    | -28,513            | 70.4    | -15,896  | 72.8    |
| 12   | 81.2               | 68.7 | -31,924  | 82.2    | -53,174             | 71.2    | -56,905  | 69.0    | -38,558             | 73.2    | -24,535  | 75.2    | -38,558            | 73.2    | -24,535  | 75.2    | -38,558            | 73.2    | -24,535  | 75.2    |
| 13   | 84.4               | 69.9 | -23,195  | 84.6    | -42,454             | 74.5    | -45,631  | 73.3    | -45,631             | 76.1    | -23,790  | 77.7    | -45,631            | 76.1    | -23,790  | 77.7    | -45,631            | 76.1    | -23,790  | 77.7    |
| 14   | 87.3               | 71.0 | -17,751  | 88.3    | -36,376             | 78.4    | -39,084  | 77.8    | -39,078             | 79.8    | -36,378  | 81.0    | -39,078            | 79.8    | -36,378  | 81.0    | -39,078            | 79.8    | -36,378  | 81.0    |
| 15   | 89.7               | 71.7 | -18,350  | 91.8    | -35,781             | 82.7    | 0        | 0.0     | 0                   | 0.0     | -35,775  | 85.2    | 0                  | 0.0     | -35,775  | 85.2    | 0                  | 0.0     | -35,775  | 85.2    |
| 16   | 91.1               | 72.8 | -16,527  | 95.5    | -34,007             | 85.1    | 0        | 0.0     | 0                   | 0.0     | -34,007  | 87.3    | 0                  | 0.0     | -34,007  | 87.3    | 0                  | 0.0     | -34,007  | 87.3    |
| 17   | 91.7               | 72.8 | -10,375  | 97.7    | -26,666             | 87.4    | 0        | 0.0     | 0                   | 0.0     | -26,666  | 89.3    | 0                  | 0.0     | -26,666  | 89.3    | 0                  | 0.0     | -26,666  | 89.3    |
| 18   | 91.4               | 72.6 | -8,618   | 96.8    | -24,610             | 87.9    | 0        | 0.0     | 0                   | 0.0     | -24,610  | 89.6    | 0                  | 0.0     | -24,610  | 89.6    | 0                  | 0.0     | -24,610  | 89.6    |
| 19   | 90.6               | 73.2 | -41,736  | 88.3    | -55,139             | 82.0    | 0        | 0.0     | 0                   | 0.0     | -55,139  | 83.6    | 0                  | 0.0     | -55,139  | 83.6    | 0                  | 0.0     | -55,139  | 83.6    |
| 20   | 89.4               | 74.1 | -59,204  | 77.9    | -66,633             | 74.8    | 0        | 0.0     | 0                   | 0.0     | -66,633  | 77.6    | 0                  | 0.0     | -66,633  | 77.6    | 0                  | 0.0     | -66,633  | 77.6    |
| 21   | 87.7               | 75.7 | -79,127  | 68.2    | -81,481             | 69.0    | 0        | 0.0     | 0                   | 0.0     | -81,481  | 72.0    | 0                  | 0.0     | -81,481  | 72.0    | 0                  | 0.0     | -81,481  | 72.0    |
| 22   | 85.7               | 76.0 | -91,068  | 61.9    | -90,848             | 64.9    | 0        | 0.0     | 0                   | 0.0     | -90,848  | 67.6    | 0                  | 0.0     | -90,848  | 67.6    | 0                  | 0.0     | -90,848  | 67.6    |
| 23   | 83.5               | 75.3 | -4,780   | 0.0     | -4,046              | 0.0     | 0        | 0.0     | 0                   | 0.0     | -4,046   | 0.0     | 0                  | 0.0     | -4,046   | 0.0     | 0                  | 0.0     | -4,046   | 0.0     |
| 24   | 81.2               | 74.2 | -2,862   | 0.0     | -2,972              | 0.0     | 0        | 0.0     | 0                   | 0.0     | -2,972   | 0.0     | 0                  | 0.0     | -2,972   | 0.0     | 0                  | 0.0     | -2,972   | 0.0     |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| July | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour | OADB               | QAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1    | 82.5               | 74.8 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 2    | 80.3               | 73.7 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 3    | 78.2               | 72.8 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 4    | 76.5               | 71.6 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 5    | 75.3               | 70.8 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 6    | 74.5               | 70.4 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 7    | 74.2               | 70.4 | 0        | 102.7   | 0                   | 102.6   | 0        | 100.5   | 0                   | 113.8   | 0        | 113.8   | 0                  | 113.8   | 0        | 115.2   | 0                  | 115.2   | 0        | 115.2   |
| 8    | 74.7               | 70.5 | 0        | 75.3    | -2,470              | 68.2    | -24,906  | 61.9    | 0                   | 110.0   | 0        | 110.0   | 0                  | 110.0   | 0        | 113.4   | 0                  | 113.4   | 0        | 113.4   |
| 9    | 76.3               | 70.6 | -35,260  | 72.3    | -51,913             | 61.5    | -94,557  | 60.0    | 0                   | 95.0    | 0        | 95.0    | 0                  | 95.0    | 0        | 101.8   | 0                  | 101.8   | 0        | 101.8   |
| 10   | 78.6               | 70.9 | -44,967  | 79.6    | -65,240             | 68.9    | -70,376  | 67.8    | 0                   | 76.6    | 0        | 76.6    | 0                  | 76.6    | 0        | 83.3    | 0                  | 83.3    | 0        | 83.3    |
| 11   | 81.6               | 71.2 | -35,094  | 84.7    | -55,961             | 73.4    | -60,355  | 72.5    | 0                   | 77.4    | 0        | 77.4    | 0                  | 77.4    | 0        | 80.2    | 0                  | 80.2    | 0        | 80.2    |
| 12   | 84.9               | 71.9 | -27,362  | 88.4    | -47,587             | 76.6    | -51,317  | 74.5    | -21,418             | 79.5    | -3,580   | 81.9    | -3,580             | 81.9    | -16,576  | 84.0    | -16,576            | 84.0    | -16,576  | 84.0    |
| 13   | 88.2               | 72.7 | -18,549  | 90.8    | -37,859             | 79.8    | -41,036  | 78.5    | -18,371             | 81.9    | -13,628  | 87.5    | -13,628            | 87.5    | -21,133  | 91.6    | -21,133            | 91.6    | -21,133  | 91.6    |
| 14   | 91.2               | 73.2 | -12,901  | 94.2    | -30,634             | 84.1    | -33,341  | 83.4    | -33,344             | 85.8    | -26,702  | 94.3    | -26,702            | 94.3    | -19,642  | 97.2    | -19,642            | 97.2    | -19,642  | 97.2    |
| 15   | 93.6               | 73.9 | -13,397  | 97.5    | -29,613             | 88.6    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 16   | 95.1               | 73.7 | -11,554  | 100.9   | -26,703             | 91.7    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 17   | 95.7               | 73.9 | -6,132   | 103.2   | -19,645             | 94.8    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 18   | 95.4               | 73.8 | -5,999   | 102.0   | -18,199             | 95.5    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 19   | 94.6               | 73.9 | -38,437  | 92.7    | -48,648             | 89.0    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 20   | 93.3               | 74.7 | -55,336  | 82.3    | -60,255             | 82.0    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 21   | 91.6               | 76.0 | -75,866  | 73.4    | -75,397             | 74.6    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 22   | 89.6               | 76.6 | -87,844  | 65.8    | -84,769             | 70.3    | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 23   | 87.3               | 76.3 | -4,400   | 0.0     | -4,647              | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 24   | 84.9               | 75.6 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |

| August | ----- Design ----- |      |          |         | ----- Weekday ----- |         |          |         | ----- Saturday----- |         |          |         | ----- Sunday ----- |         |          |         | ----- Monday ----- |         |          |         |
|--------|--------------------|------|----------|---------|---------------------|---------|----------|---------|---------------------|---------|----------|---------|--------------------|---------|----------|---------|--------------------|---------|----------|---------|
| Hour   | OADB               | QAWB | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh | Clg Ton |
| 1      | 82.5               | 75.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 2      | 80.3               | 74.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 3      | 78.4               | 73.6 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 4      | 76.8               | 72.4 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 5      | 75.6               | 71.4 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 6      | 74.9               | 70.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |
| 7      | 74.6               | 71.0 | 0        | 105.3   | 0                   | 104.5   | 0        | 102.4   | 0                   | 113.6   | 0        | 113.6   | 0                  | 113.6   | 0        | 115.2   | 0                  | 115.2   | 0        | 115.2   |
| 8      | 75.1               | 71.3 | -2,297   | 77.0    | -15,708             | 66.3    | -41,553  | 59.8    | 0                   | 110.5   | 0        | 110.5   | 0                  | 110.5   | 0        | 113.4   | 0                  | 113.4   | 0        | 113.4   |
| 9      | 76.5               | 71.4 | -42,131  | 72.4    | -59,968             | 61.8    | -96,658  | 60.3    | 0                   | 93.1    | 0        | 93.1    | 0                  | 93.1    | 0        | 99.7    | 0                  | 99.7    | 0        | 99.7    |
| 10     | 78.8               | 71.6 | -50,588  | 80.2    | -69,770             | 69.3    | -76,760  | 68.2    | 0                   | 77.2    | 0        | 77.2    | 0                  | 77.2    | 0        | 85.2    | 0                  | 85.2    | 0        | 85.2    |
| 11     | 81.6               | 72.2 | -40,124  | 86.7    | -59,487             | 74.2    | -63,877  | 73.3    | -19,244             | 77.8    | 0        | 80.6    | -19,244            | 77.8    | 0        | 80.6    | 0                  | 80.6    | 0        | 80.6    |
| 12     | 84.7               | 73.4 | -32,128  | 91.0    | -51,031             | 78.4    | -54,761  | 76.1    | -24,692             | 81.2    | -20,914  | 83.6    | -24,692            | 81.2    | -20,914  | 83.6    | -20,914            | 83.6    | -20,914  | 83.6    |
| 13     | 87.9               | 74.2 | -22,777  | 93.9    | -41,374             | 82.1    | -44,551  | 80.8    | -30,971             | 84.3    | -19,723  | 86.4    | -30,971            | 84.3    | -19,723  | 86.4    | -19,723            | 86.4    | -19,723  | 86.4    |
| 14     | 90.7               | 75.1 | -18,352  | 97.9    | -35,133             | 87.0    | -37,841  | 86.5    | -37,839             | 89.0    | -17,745  | 90.8    | -37,839            | 89.0    | -17,745  | 90.8    | -17,745            | 90.8    | -17,745  | 90.8    |
| 15     | 92.9               | 75.6 | -18,601  | 101.7   | -34,159             | 92.0    | 0        | 0.0     | 0                   | 0.0     | -31,997  | 95.3    | 0                  | 0.0     | -31,997  | 95.3    | -31,997            | 95.3    | -31,997  | 95.3    |
| 16     | 94.3               | 75.2 | -16,645  | 104.1   | -32,167             | 93.3    | 0        | 0.0     | 0                   | 0.0     | -32,163  | 96.2    | 0                  | 0.0     | -32,163  | 96.2    | -32,163            | 96.2    | -32,163  | 96.2    |
| 17     | 94.8               | 74.9 | -11,692  | 105.8   | -24,726             | 96.5    | 0        | 0.0     | 0                   | 0.0     | -24,725  | 99.2    | 0                  | 0.0     | -24,725  | 99.2    | -24,725            | 99.2    | -24,725  | 99.2    |
| 18     | 94.6               | 74.4 | -13,231  | 103.6   | -24,437             | 95.8    | 0        | 0.0     | 0                   | 0.0     | -24,437  | 98.1    | 0                  | 0.0     | -24,437  | 98.1    | -24,437            | 98.1    | -24,437  | 98.1    |
| 19     | 93.8               | 74.6 | -49,660  | 90.9    | -56,791             | 87.7    | 0        | 0.0     | 0                   | 0.0     | -56,791  | 89.8    | 0                  | 0.0     | -56,791  | 89.8    | -56,791            | 89.8    | -56,791  | 89.8    |
| 20     | 92.6               | 75.7 | -64,102  | 81.6    | -66,921             | 80.9    | 0        | 0.0     | 0                   | 0.0     | -66,921  | 83.5    | 0                  | 0.0     | -66,921  | 83.5    | -66,921            | 83.5    | -66,921  | 83.5    |
| 21     | 91.0               | 77.2 | -81,388  | 72.8    | -80,550             | 74.9    | 0        | 0.0     | 0                   | 0.0     | -80,550  | 78.3    | 0                  | 0.0     | -80,550  | 78.3    | -80,550            | 78.3    | -80,550  | 78.3    |
| 22     | 89.1               | 77.6 | -90,785  | 66.0    | -88,171             | 70.1    | 0        | 0.0     | 0                   | 0.0     | -88,171  | 73.4    | 0                  | 0.0     | -88,171  | 73.4    | -88,171            | 73.4    | -88,171  | 73.4    |
| 23     | 87.0               | 77.3 | -4,296   | 0.0     | -4,453              | 0.0     | 0        | 0.0     | 0                   | 0.0     | -4,453   | 0.0     | 0                  | 0.0     | -4,453   | 0.0     | -4,453             | 0.0     | -4,453   | 0.0     |
| 24     | 84.7               | 76.9 | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                   | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     | 0                  | 0.0     | 0        | 0.0     |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| September |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|-----------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour      | OADB | OAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1         | 76.3 | 71.3 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 2         | 74.7 | 70.5 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 3         | 73.2 | 69.4 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 4         | 72.0 | 68.6 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 5         | 71.1 | 68.0 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 6         | 70.6 | 67.7 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 7         | 70.4 | 67.9 | 0                  | 99.7    | 0                   | 92.3    | -27,833             | 80.8    | 0                  | 108.9   | 0                  | 112.0   |
| 8         | 70.9 | 68.6 | -52,230            | 54.9    | -73,120             | 47.2    | -108,506            | 45.3    | 0                  | 92.9    | 0                  | 99.0    |
| 9         | 72.4 | 68.5 | -91,407            | 66.3    | -95,291             | 56.5    | -108,506            | 54.6    | -35,059            | 63.5    | -10,468            | 70.6    |
| 10        | 74.7 | 69.3 | -63,884            | 75.0    | -86,585             | 64.7    | -91,301             | 61.2    | -44,120            | 67.6    | -41,714            | 70.0    |
| 11        | 77.4 | 70.7 | -53,738            | 81.6    | -82,624             | 70.0    | -85,622             | 67.1    | -65,370            | 72.1    | -37,549            | 74.2    |
| 12        | 80.4 | 71.5 | -47,454            | 85.8    | -65,919             | 72.9    | -73,891             | 71.8    | -68,464            | 75.5    | -54,094            | 77.2    |
| 13        | 83.2 | 73.2 | -38,282            | 89.7    | -54,851             | 78.0    | -58,025             | 77.5    | -58,022            | 80.1    | -54,843            | 81.6    |
| 14        | 85.4 | 73.8 | -33,500            | 94.8    | -47,830             | 84.4    | -50,539             | 84.0    | -50,537            | 85.8    | -47,826            | 87.3    |
| 15        | 86.9 | 74.0 | -34,111            | 98.8    | -48,010             | 87.2    | 0                   | 0.0     | 0                  | 0.0     | -48,009            | 89.8    |
| 16        | 87.4 | 73.6 | -32,568            | 101.7   | -47,241             | 88.3    | 0                   | 0.0     | 0                  | 0.0     | -47,241            | 90.5    |
| 17        | 87.2 | 73.5 | -28,157            | 103.9   | -40,611             | 89.9    | 0                   | 0.0     | 0                  | 0.0     | -40,611            | 91.8    |
| 18        | 86.7 | 73.0 | -30,761            | 97.6    | -41,257             | 87.5    | 0                   | 0.0     | 0                  | 0.0     | -41,257            | 89.2    |
| 19        | 85.8 | 73.7 | -68,612            | 82.3    | -75,286             | 77.0    | 0                   | 0.0     | 0                  | 0.0     | -75,286            | 78.9    |
| 20        | 84.6 | 74.6 | -80,546            | 72.9    | -84,230             | 71.0    | 0                   | 0.0     | 0                  | 0.0     | -84,230            | 74.0    |
| 21        | 83.2 | 74.7 | -90,253            | 65.1    | -90,578             | 65.2    | 0                   | 0.0     | 0                  | 0.0     | -90,578            | 68.3    |
| 22        | 81.5 | 74.9 | -93,779            | 60.4    | -93,618             | 61.7    | 0                   | 0.0     | 0                  | 0.0     | -93,618            | 62.6    |
| 23        | 79.8 | 73.5 | -4,889             | 0.0     | -3,365              | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -3,365             | 0.0     |
| 24        | 78.0 | 72.7 | -2,479             | 0.0     | -2,426              | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -2,426             | 0.0     |

| October |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|---------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour    | OADB | OAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1       | 59.6 | 54.2 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 2       | 56.9 | 53.0 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 3       | 54.9 | 51.3 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 4       | 53.6 | 50.6 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 5       | 53.1 | 50.4 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 6       | 53.6 | 50.8 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 7       | 54.9 | 52.2 | -137,517           | 26.4    | -151,146            | 23.6    | -151,181            | 15.7    | -2,760             | 0.0     | 0                  | 0.0     |
| 8       | 56.9 | 54.3 | -139,064           | 24.5    | -146,488            | 18.2    | -146,588            | 16.5    | -96,747            | 48.4    | -67,880            | 56.9    |
| 9       | 59.6 | 55.8 | -125,030           | 41.8    | -136,146            | 27.6    | -136,146            | 23.5    | -148,917           | 28.7    | -131,533           | 30.7    |
| 10      | 62.8 | 55.9 | -97,129            | 55.0    | -113,457            | 40.4    | -127,659            | 35.9    | -134,211           | 39.9    | -114,133           | 41.8    |
| 11      | 66.1 | 56.9 | -87,143            | 62.8    | -94,350             | 51.7    | -118,906            | 49.9    | -105,448           | 46.2    | -101,644           | 48.0    |
| 12      | 69.5 | 58.5 | -81,687            | 69.7    | -85,624             | 57.5    | -89,277             | 56.5    | -96,746            | 51.1    | -93,457            | 54.8    |
| 13      | 72.7 | 60.0 | -74,879            | 76.2    | -85,624             | 57.5    | -89,277             | 56.5    | -87,713            | 56.9    | -84,921            | 59.7    |
| 14      | 75.4 | 61.2 | -74,879            | 76.2    | -78,434             | 63.5    | -80,759             | 62.7    | -80,197            | 62.9    | -77,877            | 64.4    |
| 15      | 77.4 | 62.2 | -54,765            | 83.2    | -73,989             | 70.1    | -75,961             | 69.3    | -80,197            | 62.9    | -77,877            | 64.4    |
| 16      | 78.7 | 62.7 | -53,275            | 88.2    | -72,194             | 72.6    | 0                   | 0.0     | -75,571            | 69.5    | -73,601            | 70.1    |
| 17      | 79.2 | 62.8 | -51,420            | 91.2    | -69,003             | 75.5    | 0                   | 0.0     | 0                  | 0.0     | -71,893            | 72.6    |
| 18      | 78.7 | 62.9 | -47,486            | 90.3    | -63,853             | 77.5    | 0                   | 0.0     | 0                  | 0.0     | -68,770            | 75.4    |
| 19      | 77.4 | 63.4 | -53,003            | 80.0    | -62,250             | 73.2    | 0                   | 0.0     | 0                  | 0.0     | -63,675            | 77.3    |
| 20      | 75.4 | 63.9 | -83,487            | 66.1    | -85,421             | 63.6    | 0                   | 0.0     | 0                  | 0.0     | -60,383            | 73.1    |
| 21      | 72.7 | 63.2 | -91,419            | 56.7    | -89,706             | 57.6    | 0                   | 0.0     | 0                  | 0.0     | -85,339            | 63.5    |
| 22      | 69.5 | 61.4 | -101,580           | 48.9    | -95,192             | 51.9    | 0                   | 0.0     | 0                  | 0.0     | -89,644            | 57.5    |
| 23      | 66.1 | 59.5 | -108,328           | 43.3    | -98,994             | 46.8    | 0                   | 0.0     | 0                  | 0.0     | -95,144            | 51.8    |
| 24      | 62.8 | 56.6 | -11,300            | 0.0     | -8,428              | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -98,957            | 46.7    |
|         |      |      | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -8,428             | 0.0     |
|         |      |      |                    |         |                     |         |                     |         |                    |         | 0                  | 0.0     |

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 2  
EXISTING CONDITIONS WITH STOP-START

| November |      |      | ----- Design ----- |         | ----- Weekday ----- |         | ----- Saturday----- |         | ----- Sunday ----- |         | ----- Monday ----- |         |
|----------|------|------|--------------------|---------|---------------------|---------|---------------------|---------|--------------------|---------|--------------------|---------|
| Hour     | OADB | OAWB | Htg Btuh           | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh            | Clg Ton | Htg Btuh           | Clg Ton | Htg Btuh           | Clg Ton |
| 1        | 58.2 | 54.3 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 2        | 56.0 | 52.3 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 3        | 54.2 | 50.7 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -5,246             | 0.0     |
| 4        | 52.8 | 49.5 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | -2,169             | 0.0     | 0                  | 0.0     |
| 5        | 51.9 | 49.0 | 0                  | 0.0     | 0                   | 0.0     | -5,225              | 0.0     | -2,104             | 0.0     | 0                  | 0.0     |
| 6        | 51.6 | 48.8 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |
| 7        | 52.0 | 49.4 | -152,764           | 19.9    | -159,166            | 18.4    | -153,498            | 13.1    | -159,672           | 23.9    | -143,198           | 26.0    |
| 8        | 53.2 | 50.6 | -148,589           | 16.6    | -156,493            | 15.7    | -151,191            | 13.2    | -159,377           | 20.3    | -156,466           | 24.6    |
| 9        | 55.2 | 52.0 | -138,268           | 23.3    | -147,817            | 21.4    | -146,734            | 17.4    | -147,817           | 21.5    | -131,369           | 30.4    |
| 10       | 57.6 | 53.3 | -126,268           | 44.0    | -130,429            | 24.5    | -144,246            | 22.2    | -128,228           | 33.4    | -111,023           | 38.2    |
| 11       | 60.4 | 53.9 | -95,627            | 55.8    | -104,265            | 38.1    | -134,024            | 33.0    | -107,091           | 41.2    | -103,825           | 42.2    |
| 12       | 63.3 | 55.2 | -86,535            | 61.5    | -96,241             | 46.5    | -99,735             | 44.5    | -98,664            | 45.7    | -95,895            | 46.6    |
| 13       | 66.1 | 56.5 | -78,051            | 67.6    | -86,746             | 51.6    | -89,159             | 50.7    | -88,825            | 50.9    | -86,479            | 51.6    |
| 14       | 68.5 | 57.8 | -73,822            | 73.9    | -79,578             | 56.4    | -81,617             | 55.7    | -81,361            | 55.8    | -79,372            | 56.4    |
| 15       | 70.4 | 58.7 | -71,661            | 78.9    | -76,093             | 60.3    | 0                   | 0.0     | 0                  | 0.0     | -75,933            | 60.3    |
| 16       | 71.6 | 59.4 | -68,171            | 81.4    | -73,023             | 63.8    | 0                   | 0.0     | 0                  | 0.0     | -72,900            | 63.7    |
| 17       | 72.1 | 59.5 | -63,476            | 80.4    | -68,290             | 65.1    | 0                   | 0.0     | 0                  | 0.0     | -68,194            | 65.0    |
| 18       | 71.8 | 60.2 | -64,518            | 68.7    | -67,012             | 60.8    | 0                   | 0.0     | 0                  | 0.0     | -66,938            | 60.7    |
| 19       | 70.9 | 61.4 | -92,282            | 56.5    | -90,115             | 52.3    | 0                   | 0.0     | 0                  | 0.0     | -90,058            | 52.2    |
| 20       | 69.5 | 61.8 | -100,290           | 49.1    | -94,285             | 48.2    | 0                   | 0.0     | 0                  | 0.0     | -94,240            | 48.1    |
| 21       | 67.6 | 61.6 | -109,213           | 42.6    | -101,663            | 43.9    | 0                   | 0.0     | 0                  | 0.0     | -101,629           | 43.8    |
| 22       | 65.5 | 60.0 | -114,918           | 37.6    | -106,849            | 39.8    | 0                   | 0.0     | 0                  | 0.0     | -106,822           | 39.6    |
| 23       | 63.1 | 58.5 | -12,237            | 0.0     | -9,333              | 0.0     | 0                   | 0.0     | 0                  | 0.0     | -9,333             | 0.0     |
| 24       | 60.6 | 55.9 | 0                  | 0.0     | 0                   | 0.0     | 0                   | 0.0     | 0                  | 0.0     | 0                  | 0.0     |

| December |      | ----- Design ----- |          | ----- Weekday ----- |          | ----- Saturday----- |          | ----- Sunday ----- |          | ----- Monday ----- |          |         |
|----------|------|--------------------|----------|---------------------|----------|---------------------|----------|--------------------|----------|--------------------|----------|---------|
| Hour     | OADB | OAWB               | Htg Btuh | Clg Ton             | Htg Btuh | Clg Ton             | Htg Btuh | Clg Ton            | Htg Btuh | Clg Ton            | Htg Btuh | Clg Ton |
| 1        | 48.2 | 44.6               | -13,228  | 0.0                 | -2,045   | 0.0                 | -10,161  | 0.0                | -14,837  | 0.0                | -14,926  | 0.0     |
| 2        | 46.1 | 42.8               | -24,262  | 0.0                 | -16,708  | 0.0                 | -22,041  | 0.0                | -24,772  | 0.0                | -19,772  | 0.0     |
| 3        | 44.2 | 41.1               | -29,868  | 0.0                 | -25,219  | 0.0                 | -31,168  | 0.0                | -33,370  | 0.0                | -27,706  | 0.0     |
| 4        | 42.6 | 39.7               | -34,735  | 0.0                 | -32,766  | 0.0                 | -38,898  | 0.0                | -40,669  | 0.0                | -34,735  | 0.0     |
| 5        | 41.4 | 38.7               | -40,389  | 0.0                 | -38,555  | 0.0                 | -44,613  | 0.0                | -47,204  | 0.0                | -42,520  | 0.0     |
| 6        | 40.7 | 37.8               | 0        | 0.0                 | 0        | 0.0                 | 0        | 0.0                | -2,431   | 0.0                | 0        | 0.0     |
| 7        | 40.4 | 37.7               | -233,063 | 10.8                | -284,019 | 10.2                | -357,083 | 9.0                | -237,716 | 8.8                | -218,437 | 9.6     |
| 8        | 41.1 | 38.2               | -187,908 | 11.0                | -236,114 | 10.2                | -260,176 | 9.3                | -259,429 | 9.1                | -218,621 | 9.7     |
| 9        | 43.1 | 40.1               | -148,492 | 12.3                | -151,152 | 11.4                | -148,292 | 10.5               | -148,277 | 10.4               | -148,532 | 14.4    |
| 10       | 46.1 | 42.3               | -133,133 | 14.7                | -122,193 | 12.5                | -147,024 | 11.9               | -146,983 | 11.7               | -128,032 | 16.7    |
| 11       | 49.8 | 44.5               | -113,897 | 24.7                | -112,745 | 16.4                | -123,065 | 13.3               | -127,365 | 13.6               | -110,616 | 18.8    |
| 12       | 53.7 | 46.6               | -103,590 | 39.6                | -113,048 | 21.5                | -112,400 | 14.5               | -112,345 | 20.7               | -111,039 | 21.2    |
| 13       | 57.4 | 49.0               | -93,376  | 54.0                | -102,421 | 27.9                | -104,828 | 26.6               | -104,834 | 26.5               | -102,614 | 27.6    |
| 14       | 60.4 | 50.9               | -86,812  | 60.2                | -94,629  | 40.0                | -96,668  | 38.4               | -96,672  | 38.4               | -94,781  | 40.2    |
| 15       | 62.4 | 52.0               | -83,999  | 64.7                | -90,306  | 48.8                | 0        | 0.0                | 0        | 0.0                | -90,423  | 48.6    |
| 16       | 63.0 | 52.1               | -81,201  | 68.2                | -86,313  | 52.0                | -2,677   | 0.0                | -2,677   | 0.0                | -86,404  | 51.8    |
| 17       | 62.8 | 51.6               | -77,908  | 67.8                | -81,353  | 53.7                | 0        | 0.0                | 0        | 0.0                | -81,423  | 53.5    |
| 18       | 62.1 | 51.6               | -80,338  | 57.2                | -80,837  | 49.0                | 0        | 0.0                | 0        | 0.0                | -80,891  | 48.8    |
| 19       | 60.9 | 51.8               | -108,426 | 44.9                | -105,275 | 40.0                | 0        | 0.0                | 0        | 0.0                | -105,317 | 39.8    |
| 20       | 59.3 | 52.1               | -116,889 | 37.6                | -110,682 | 36.3                | 0        | 0.0                | 0        | 0.0                | -110,715 | 36.0    |
| 21       | 57.4 | 51.8               | -125,713 | 31.2                | -118,247 | 31.8                | 0        | 0.0                | 0        | 0.0                | -118,273 | 31.6    |
| 22       | 55.2 | 50.7               | -131,436 | 26.1                | -123,444 | 28.0                | -6,133   | 0.0                | -6,133   | 0.0                | -123,464 | 27.8    |
| 23       | 52.9 | 48.9               | -46,187  | 0.0                 | -2,348   | 0.0                 | 0        | 0.0                | 0        | 0.0                | -2,348   | 0.0     |
| 24       | 50.5 | 46.7               | -8,361   | 0.0                 | -3,285   | 0.0                 | 0        | 0.0                | 0        | 0.0                | -3,285   | 0.0     |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 GL) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 58,679                   | 194                       | 769                       | 35                 | 6                                |
| Feb   | 50,416                   | 192                       | 692                       | 30                 | 5                                |
| March | 69,034                   | 208                       | 542                       | 64                 | 2                                |
| April | 71,759                   | 218                       | 397                       | 82                 | 2                                |
| May   | 81,052                   | 229                       | 306                       | 105                | 1                                |
| June  | 82,624                   | 235                       | 226                       | 115                | 1                                |
| July  | 84,565                   | 242                       | 169                       | 125                | 1                                |
| Aug   | 89,972                   | 246                       | 217                       | 132                | 1                                |
| Sept  | 79,775                   | 240                       | 290                       | 108                | 1                                |
| Oct   | 73,049                   | 221                       | 486                       | 76                 | 2                                |
| Nov   | 64,568                   | 210                       | 509                       | 53                 | 2                                |
| Dec   | 56,222                   | 197                       | 699                       | 31                 | 4                                |
| Total | 861,716                  | 246                       | 5,302                     | 956                | 6                                |

Building Energy Consumption = 97,397 (Btu/Sq Ft/Year)  
Source Energy Consumption = 263,246 (Btu/Sq Ft/Year)

Floor Area = 35,640 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

EQUIPMENT ENERGY CONSUMPTION

| Ref<br>Num | Equip<br>Code | Monthly Consumption                    |       |       |       |       |       |       |       |       |       |       |       | Total   |
|------------|---------------|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|            |               | Jan                                    | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0          | LIGHTS        |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 31114                                  | 28120 | 32183 | 29938 | 31648 | 31007 | 30579 | 32183 | 29938 | 31648 | 29938 | 30579 | 368,874 |
|            | PK            | 89.1                                   | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1  | 89.1    |
| 1          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | GAS           | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | OIL           | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P STEAM       | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|            | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P HOTW20      | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6          | MISC LD       |                                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P CHILL       | 0                                      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                                    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1          | EQ1131L       | WTR-CLD COND COMP W-EVAP COND >30 TONS |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 7657                                   | 6629  | 13908 | 17844 | 22738 | 24572 | 26442 | 28097 | 23323 | 16356 | 11930 | 6832  | 206,328 |
|            | PK            | 49.6                                   | 49.5  | 58.3  | 64.6  | 76.5  | 82.6  | 85.5  | 85.9  | 81.5  | 66.3  | 59.0  | 49.3  | 85.9    |
| 1          | EQ5105        | COOLING TOWER                          |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 4430                                   | 2010  | 7104  | 8187  | 8678  | 8514  | 8351  | 8842  | 8187  | 8167  | 7737  | 4081  | 84,287  |
|            | PK            | 20.5                                   | 16.4  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5  | 20.5    |
| 1          | EQ5105        | COOLING TOWER                          |       |       |       |       |       |       |       |       |       |       |       |         |
|            | WATER         | 33                                     | 28    | 62    | 80    | 104   | 114   | 124   | 131   | 106   | 75    | 52    | 29    | 939     |
|            | PK            | 0.3                                    | 0.3   | 0.3   | 0.3   | 0.4   | 0.4   | 0.4   | 0.4   | 0.4   | 0.3   | 0.3   | 0.3   | 0.4     |
| 1          | EQ5302        | CONTROLS                               |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 28                                     | 23    | 41    | 40    | 42    | 42    | 41    | 43    | 40    | 40    | 38    | 27    | 445     |
|            | PK            | 0.1                                    | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1     |
| 2          | EQ1100S       | AIR-CLD RECIP 25-45 TONS               |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 9750                                   | 8693  | 11021 | 11050 | 12897 | 13625 | 14429 | 15581 | 13447 | 11877 | 10472 | 9604  | 142,446 |
|            | PK            | 26.2                                   | 26.4  | 28.5  | 31.5  | 35.2  | 38.0  | 41.1  | 41.8  | 38.2  | 32.5  | 28.9  | 26.7  | 41.8    |
|            | EQ5200        | CONDENSER FANS                         |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|   |        |                            |      |      |      |      |      |      |      |      |      |      |      |        |
|---|--------|----------------------------|------|------|------|------|------|------|------|------|------|------|------|--------|
|   | ELEC   | 439                        | 357  | 701  | 950  | 1157 | 1271 | 1458 | 1512 | 1299 | 960  | 679  | 429  | 11,212 |
|   | PK     | 1.5                        | 1.4  | 2.7  | 3.1  | 3.3  | 3.5  | 4.9  | 4.9  | 3.7  | 3.2  | 2.7  | 1.6  | 4.9    |
| 2 | EQ5001 | CHILLED WATER PUMP C.V.    |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 1241                       | 1122 | 1289 | 1193 | 1265 | 1241 | 1217 | 1289 | 1193 | 1265 | 1193 | 1217 | 14,723 |
|   | PK     | 3.0                        | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0    |
| 2 | EQ5303 | CONTROLS                   |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 125                        | 113  | 130  | 120  | 127  | 125  | 122  | 130  | 120  | 127  | 120  | 122  | 1,481  |
|   | PK     | 0.3                        | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3    |
| 1 | EQ2002 | GAS FIRE TUBE STEAM        |      |      |      |      |      |      |      |      |      |      |      |        |
|   | GAS    | 769                        | 692  | 542  | 397  | 306  | 226  | 169  | 217  | 290  | 486  | 509  | 699  | 5,302  |
|   | PK     | 6.3                        | 5.4  | 2.1  | 1.5  | 1.4  | 1.2  | 1.1  | 1.2  | 1.3  | 1.8  | 2.0  | 4.3  | 6.3    |
| 1 | EQ5020 | HEAT WATER CIRC. PUMP C.V. |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 3147                       | 2704 | 2148 | 1969 | 2018 | 1800 | 1556 | 1854 | 1800 | 2108 | 1989 | 2689 | 25,781 |
|   | PK     | 5.0                        | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0  | 5.0    |
| 1 | EQ5240 | BOILER FORCED DRAFT FAN    |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 413                        | 355  | 282  | 259  | 265  | 236  | 204  | 244  | 236  | 277  | 261  | 353  | 3,386  |
|   | PK     | 0.7                        | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7    |
| 1 | EQ5307 | BOILER CONTROLS            |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 317                        | 272  | 216  | 198  | 203  | 181  | 157  | 186  | 181  | 212  | 200  | 271  | 2,593  |
|   | PK     | 0.5                        | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5  | 0.5    |
|   | EQ5061 | CONDENSATE RETURN PUMP     |      |      |      |      |      |      |      |      |      |      |      |        |
|   | ELEC   | 19                         | 17   | 13   | 12   | 12   | 11   | 10   | 11   | 11   | 13   | 12   | 17   | 159    |
|   | PK     | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0    |
| 1 | EQ5406 | MAKE-UP WATER              |      |      |      |      |      |      |      |      |      |      |      |        |
|   | WATER  | 2                          | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 18     |
|   | PK     | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0    |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        246.4    (kW)  
Yearly Time of Peak 16 (hr)    8 (mo)

Hour 16    Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|------------------------|
|----------------------|------------------------|-----------------------|---------------------------|------------------------|

Cooling Equipment

|   |         |                                        |       |       |
|---|---------|----------------------------------------|-------|-------|
| 1 | EQ1131L | WTR-CLD COND COMP W-EVAP COND >30 TONS | 101.7 | 41.29 |
| 2 | EQ1100S | AIR-CLD RECIP 25-45 TONS               | 49.4  | 20.05 |

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 151.1 | 61.33 |
|-----------|--|--|-------|-------|

Heating Equipment

|   |        |                     |     |      |
|---|--------|---------------------|-----|------|
| 1 | EQ2002 | GAS FIRE TUBE STEAM | 6.2 | 2.50 |
|---|--------|---------------------|-----|------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 6.2 | 2.50 |
|-----------|--|--|-----|------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Miscellaneous

|        |  |  |      |       |
|--------|--|--|------|-------|
| Lights |  |  | 89.1 | 36.17 |
|--------|--|--|------|-------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Base Utilities |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Misc Equipment |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|           |  |  |      |       |
|-----------|--|--|------|-------|
| Sub Total |  |  | 89.1 | 36.17 |
|-----------|--|--|------|-------|

|             |  |  |       |        |
|-------------|--|--|-------|--------|
| Grand Total |  |  | 246.4 | 100.00 |
|-------------|--|--|-------|--------|



[illegible]

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0407 - ECO IV. C. 1) - ADD STOP/START FUNCTION TO HVAC EQUIPMENT  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |         |
|----------------------------------------|---------|---------|
| A. CONSTRUCTION COST                   | \$2,003 |         |
| B. SIOH                                | \$110   |         |
| C. DESIGN COST                         | \$120   |         |
| D. TOTAL COST (1A+1B+1C)               | \$2,233 |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0     |         |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0     |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         | \$2,233 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 618.66             | \$6,527              | 11.77              | \$76,821              |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 681.08             | \$2,254              | 15.34              | \$34,582              |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 11.12              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$0                  | 11.12              | \$0                   |
| N. TOTAL          |                 | 1299.74            | \$8,781              |                    | \$111,403             |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |         |
|---------------------------------------|---------|
| A. ANNUAL RECURRING (+/-)             | (\$45)  |
| 1. DISCOUNT FACTOR (TABLE A)          | 11.1    |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) | (\$500) |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) (\$500)

4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ : 0.3 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$110,904

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 49.66

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 34.9%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 407

ECO NO: VII. C, D & IX A, B, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

KWH Savings: 12,315 KWH/yr  
Demand Savings: 53.2 KW/yr  
Gas Savings: N/A MCF/yr  
Cost Savings: \$ 1,012 /yr  
Implementation Cost: \$ 4,557.00  
Simple Payback: 4.5 Years  
Savings to Investment:  
Ratio (SIR): 1.97

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current lighting levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE            | ACTION                                                                          |
|-----|-------------------------|---------------------------------------------------------------------------------|
| 15  | Decorative chandelier   | None.                                                                           |
| 16  | Decorative wall sconce  | None.                                                                           |
| 26  | Incandescent downlights | Retrofit with compact fluor. lamps.                                             |
| 90  | 2-Lamp, 4' Fluor.       | Remove 5 fixtures and retrofit remaining with T8 lamps and electronic ballasts. |
| 3   | Incand. Exit Light      | Replace with LED exit fixture.                                                  |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (15.64 \text{ KW} - 11.21 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (15.64 \text{ KW} - 11.21 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$354.40/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD0407A                | 48190                | 11388                   | 119914                        | 8823                         | 5054                         | 2.786                          | 10.187                             | 4087                     | 29014                         | 86812                          | 2135                         | 6388                          |
| *BLD0407B               | 53244                | 0                       | 131302                        | 9661                         | 0                            | 0.000                          | 0.000                              | 0                        | 26104                         | 105198                         | 1921                         | 7741                          |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD0407A   | POST RETROFIT CONDITIONS |
| BLD0407B   | EXISTING CONDITIONS      |

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Whole Building Summary Report

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0407\BLD0407A.WBR  
 Date: 10/17/1993

Lighting Annual : 48190 kWh  
 Lighting Capacity : 11.207 kW  
 Annual Cooling Effect : 67663 kWh  
 Annual Heating Effect : 13901 kWh  
 Total Surveyed Floor Area: 8180 SqFt  
 Percent Survey Completed : 818000 %  
 Lighting Power Density : 1.370 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| PVLCC \$ | 4087    | 36476  | 29014  | 52721   | -2385   | 119914 |
| AVLCC \$ | 301     | 2684   | 2135   | 3879    | -176    | 8823   |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0407\BLD0407A.LLR  
 Date: 10/17/1993

| Room                   |       |       |       |       |                |                |       |
|------------------------|-------|-------|-------|-------|----------------|----------------|-------|
| Foot Candles           | MAX   | MIN   | AVG   | SDEV  | MAX Room       | MIN Room       |       |
| -----                  | ----- | ----- | ----- | ----- | -----          | -----          | ----- |
| Calculated             | 81.0  | 6.2   | 45.9  | 34.74 | 4-food prepare | 2-dining       |       |
| Measured               | 75.3  | 4.6   | 36.4  | 25.73 | 6-kitchen      | 2-dining       |       |
| Required               | 75.0  | 5.0   | 40.4  | 31.40 | 4-food prepare | 1-bar          |       |
|                        |       |       |       |       |                |                |       |
| Foot Candle Comparison | MAX   | MIN   | AVG   | SDEV  | MAX Room       | MIN Room       |       |
| -----                  | ----- | ----- | ----- | ----- | -----          | -----          | ----- |
| Calc - Req.            | 20.2  | -1.3  | 5.5   | 7.55  | 5-skullery     | 2-dining       |       |
| Meas - Req.            | 9.9   | -21.3 | -4.1  | 11.15 | 1-bar          | 4-food prepare |       |



Lighting System Survey Summary  
One Page for Each Defined System

ject: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0407\BLD0407A.LSR  
Date: 10/17/1993

System Number: 1 Descrip: decorative chandelier

Rooms Served: 2  
Floor Area: 4400 SqFt  
Possible kW: 4.800  
Working kW: 4.800  
Capacity kW: 4.800  
Lighting: 20640 Annual kWh  
Heating: 5954 Annual kWh  
Cooling: 28999 Annual kWh  
Op Hours/Year: 4300 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 2.8 Months  
Power Density: 1.091 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 15       | 120   | 0.0      |
| Working       | 15       | 120   | 0.0      |
| Capacity      | 15       | 120   | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 15623  | 20600  | 22598   | -1022   | 58016 |
| AVLCC \$ | 1150   | 1516   | 1663    | -75     | 4269  |

System Number: 2 Descrip: decorative wall sconce

Rooms Served: 2  
Floor Area: 4400 SqFt  
Possible kW: 0.640  
Working kW: 0.640  
Capacity kW: 0.640  
Lighting: 2752 Annual kWh  
Heating: 794 Annual kWh  
Cooling: 3867 Annual kWh  
Op Hours/Year: 4300 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 2.8 Months  
Power Density: 0.145 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 16       | 16    | 0.0      |
| Working       | 16       | 16    | 0.0      |
| Capacity      | 16       | 16    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2083   | 2747   | 3013    | -136    | 7735  |
| AVLCC \$ | 153    | 202    | 222     | -10     | 569   |

System Number: 3      Descrip: incand down light

Rooms Served: 2  
 Floor Area: 4594 SqFt  
 Possible kW: 0.429  
 Working kW: 0.429  
 Capacity kW: 0.429  
 Lighting: 1845 Annual kWh  
 Heating: 532 Annual kWh  
 Cooling: 2592 Annual kWh  
 Op Hours/Year: 4300 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 46.0 Months  
 Power Density: 0.093 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 26       | 26    | 26.0     |
| Working       | 26       | 26    | 26.0     |
| Capacity      | 26       | 26    | 26.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1396   | 2531   | 2020    | -91     | 6211  |
| AVLCC \$ | 103    | 186    | 149     | -7      | 457   |

System Number: 4      Descrip: 2x4 lay-in

Rooms Served: 1  
 Floor Area: 616 SqFt  
 Possible kW: 0.314  
 Working kW: 0.314  
 Capacity kW: 0.314  
 Lighting: 1350 Annual kWh  
 Heating: 389 Annual kWh  
 Cooling: 1853 Annual kWh  
 Op Hours/Year: 4300 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.0 Months  
 Power Density: 0.510 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 5        | 10    | 5.0      |
| Working       | 5        | 10    | 5.0      |
| Capacity      | 5        | 10    | 5.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1022   | 185    | 1437    | -67     | 2782  |
| AVLCC \$ | 75     | 14     | 106     | -5      | 205   |

System Number: 5      Descrip: fluor wrap

Rooms Served: 3  
Floor Area: 3164 SqFt  
Possible kW: 5.024  
Working kW: 5.024  
Capacity kW: 5.024  
Lighting: 21603 Annual kWh  
Heating: 6232 Annual kWh  
Cooling: 30352 Annual kWh  
Op Hours/Year: 4300 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 92.0 Months  
Power Density: 1.588 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 80       | 160   | 80.0     |
| Working       | 80       | 160   | 80.0     |
| Capacity      | 80       | 160   | 80.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 16352  | 2953   | 23653   | -1069   | 45169 |
| AVLCC \$ | 1203   | 217    | 1740    | -79     | 3324  |

Project: FT SAM HOUSTON EEAP  
 File: H:\J08\911099\12\FELECT\FLEX\OUT\0407\BLD0407A.RRR  
 Date: 10/17/1993

| Room Name  | Floor | # | Total Area | SYSTEM1       | Work Watts | Pot. Watts | Watt sqft | SYSTEM2    | Work Watts | Pot. Watts | Watt sqft | SYSTEM3    | Work Watts | Pot. Watts | Watt sqft | Watt Meas. | Calc. | Req. |
|------------|-------|---|------------|---------------|------------|------------|-----------|------------|------------|------------|-----------|------------|------------|------------|-----------|------------|-------|------|
| 1-bar      | 1     | 1 | 2200       | 42 incand dow | 264        | 264        | 0.12      | decorative | 960        | 960        | 0.44      | decorative | 240        | 240        | 0.11      | 1464       | 1464  | 5.0  |
| 2-dining   | 1     | 1 | 2200       | 40 decorative | 3840       | 3840       | 1.75      | decorative | 400        | 400        | 0.18      |            | 4240       | 4240       | 1.93      | 4.6        | 6.2   | 7.5  |
| 3-serv lin | 1     | 1 | 616        | 10 2x4 lay-in | 314        | 314        | 0.51      |            |            |            |           |            | 314        | 314        | 0.51      | 32.1       | 33.5  | 30.0 |
| 4-food pre | 1     | 1 | 420        | 2 fluor wrap  | 816        | 816        | 1.94      |            |            |            |           |            | 816        | 816        | 1.94      | 53.7       | 81.0  | 75.0 |
| 5-skullery | 1     | 1 | 350        | 2 fluor wrap  | 628        | 628        | 1.79      |            |            |            |           |            | 628        | 628        | 1.79      | 37.5       | 70.2  | 50.0 |
| 6-kitchen  | 1     | 1 | 2394       | 10 fluor wrap | 3580       | 3580       | 1.50      | incand dow | 165        | 165        | 0.07      |            | 3745       | 3745       | 1.56      | 75.3       | 77.4  | 75.0 |

Total Rooms : 6  
 Total Area Sqft : 8180  
 Total People : 106  
 Total Working kW : 11.207  
 Total Potential kW : 11.207  
 Power Density W/sqft : 1.370

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0407\BLD0407B.WBR

Date: 10/16/1993

Lighting Annual : 53244 kWh  
 Lighting Capacity : 15.640 kW  
 Annual Cooling Effect : 74923 kWh  
 Annual Heating Effect : 15359 kWh  
 Total Surveyed Floor Area: 8180 SqFt  
 Percent Survey Completed : 818000 %  
 Lighting Power Density : 1.912 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| PVLCC \$ | 0       | 43953  | 26104  | 63880   | -2636   | 131302 |
| AVLCC \$ | 0       | 3234   | 1921   | 4700    | -194    | 9661   |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\0407\BLD0407B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: decorative chandelier

Rooms Served: 2  
Floor Area: 4400 SqFt  
Possible kW: 4.800  
Working kW: 4.640  
Capacity kW: 4.800  
Lighting: 16320 Annual kWh  
Heating: 4708 Annual kWh  
Cooling: 22949 Annual kWh  
Op Hours/Year: 3400 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 3.5 Months  
Power Density: 1.055 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 15       | 120   | 0.0      |
| Working       | 15       | 116   | 0.0      |
| Capacity      | 15       | 120   | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 4     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 13479  | 16288  | 19585   | -808    | 48544 |
| AVLCC \$ | 992    | 1198   | 1441    | -59     | 3572  |

System Number: 2      Descrip: decorative wall sconce

Rooms Served: 2  
Floor Area: 4400 SqFt  
Possible kW: 0.640  
Working kW: 0.520  
Capacity kW: 0.640  
Lighting: 2176 Annual kWh  
Heating: 628 Annual kWh  
Cooling: 3060 Annual kWh  
Op Hours/Year: 3400 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 3.5 Months  
Power Density: 0.118 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 16       | 16    | 0.0      |
| Working       | 15       | 13    | 0.0      |
| Capacity      | 16       | 16    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 1        | 2     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1797   | 2172   | 2611    | -108    | 6473  |
| AVLCC \$ | 132    | 160    | 192     | -8      | 476   |

System Number: 3      Descrip: incand down light

Rooms Served: 2  
 Floor Area: 4594 SqFt  
 Possible kW: 1.560  
 Working kW: 1.080  
 Capacity kW: 1.560  
 Lighting: 5304 Annual kWh  
 Heating: 1530 Annual kWh  
 Cooling: 7459 Annual kWh  
 Op Hours/Year: 3400 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 3.5 Months  
 Power Density: 0.235 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 26       | 26    | 0.0      |
| Working       | 22       | 18    | 0.0      |
| Capacity      | 26       | 26    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 4        | 4     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4381   | 3433   | 6365    | -263    | 13916 |
| AVLCC \$ | 322    | 253    | 468     | -19     | 1024  |

System Number: 5      Descrip: 2x4 lay-in

Rooms Served: 1  
 Floor Area: 616 SqFt  
 Possible kW: 0.960  
 Working kW: 0.768  
 Capacity kW: 0.960  
 Lighting: 3332 Annual kWh  
 Heating: 961 Annual kWh  
 Cooling: 4736 Annual kWh  
 Op Hours/Year: 3471 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 93.8 Months  
 Power Density: 1.247 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 20    | 10.0     |
| Working       | 8        | 16    | 8.0      |
| Capacity      | 10       | 20    | 10.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 2        | 0     | 2.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2730   | 495    | 3983    | -165    | 7042  |
| AVLCC \$ | 201    | 36     | 293     | -12     | 518   |

System Number: 6      Descrip: fluor wrap

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Rooms Served: 3  
Floor Area: 3164 SqFt  
Possible kW: 7.680  
Working kW: 7.488  
Capacity kW: 7.680  
Lighting: 26112 Annual kWh  
Heating: 7532 Annual kWh  
Cooling: 36719 Annual kWh  
Op Hours/Year: 3400 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 115.9 Months  
Power Density: 2.367 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 80       | 160   | 80.0     |
| Working       | 80       | 156   | 78.0     |
| Capacity      | 80       | 160   | 80.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 4     | 2.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 21566  | 3717   | 31336   | -1293   | 55327 |
| AVLCC \$ | 1587   | 274    | 2306    | -95     | 4071  |



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 0407 - ECO VII. C., D. & IX A., B., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |         |
|----------------------------------------|---------|---------|
| A. CONSTRUCTION COST                   | \$4,087 |         |
| B. SIOH                                | \$225   |         |
| C. DESIGN COST                         | \$245   |         |
| D. TOTAL COST (1A+1B+1C)               | \$4,557 |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0     |         |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0     |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         | \$4,557 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 17.25              | \$182                | 11.77              | \$2,142               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             |                 |                    | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 24.78              | \$261                | 11.12              | \$2,907               |
| M. DEMAND SAVINGS |                 |                    | \$354                | 11.12              | \$3,941               |
| N. TOTAL          |                 | 42.03              | \$798                |                    | \$8,990               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |         |
|---------------------------------------|-------|---------|
| A. ANNUAL RECURRING (+/-)             | \$214 |         |
| 1. DISCOUNT FACTOR (TABLE A)          |       | 11.1    |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       | \$2,375 |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

|    | ITEM  | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----|-------|-----------------------|-------------------|--------------------|----------------------------------|
| a. | N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. | N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. | N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. | N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. | N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. | N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. | N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. | N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. | N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. | N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. | N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. | N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. | N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. | N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. | N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. | TOTAL | \$0                   |                   |                    | \$0                              |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$2,375

4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ : 4.5 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$11,365

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 2.49

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.5%

## ENERGY CONSERVATION ANALYSIS

### BUILDING 1350 - ACADEMY DINING

Building 1350 is a three story building consisting of approximately 180,000 square feet. This facility contains a full service kitchen and a large dining area which consists of 8,430 square feet.

The operating hours are from 4:30 am to 9:00 pm, 5 days per week.

The lighting system is primarily fluorescent.

The mechanical system consists of multizone air handling units served by a water cooled centrifugal chiller. Heating is provided to the units by two gas fire boilers. The chiller and boilers are located in a remote central mechanical room.

Hot water for the kitchen is provided by two gas fired boilers located in a nearby mechanical room. Dishwashing is accomplished by utilizing an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 1350:

1. IV. D. 1) - Replace chiller with higher EF/CFC free chiller
2. VII. D - Reduce indoor/outdoor lighting to AEI levels
3. IX. C - Replace standard lamps with energy saving lamps
4. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING 1350

ECO NO: IV.D.1)

ECO NAME: Replace chiller with higher efficiency, CFC free chiller.

#### SUMMARY DATA (DEPENDENT):

|                                        |                      |        |
|----------------------------------------|----------------------|--------|
| KWH Savings:                           | <u>126,750</u>       | KWH/yr |
| Demand Savings:                        | <u>528</u>           | KW/yr  |
| Gas Savings:                           | <u>0</u>             | MCF/yr |
| Cost Savings:                          | <u>\$ 8,084</u>      | /yr    |
| Implementation Cost:                   | <u>\$ 231,987.00</u> |        |
| Simple Payback:                        | <u>11.8</u>          | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>1.05</u>          |        |

#### ECO DESCRIPTION:

Currently, a 438 ton centrifugal chiller is utilized for Building 1350. This chiller was installed in 1986 and operates at an efficiency of .715 KW/ton. Also, this chiller contains refrigerant R-11. This ECO analyzes replacement of the existing chiller with a CFC free chiller with an operating efficiency of .534 KW/ton. This ECO accounts for the interdependencies related to the operating controls and the proposed lighting retrofit.

#### COST SAVINGS CALCULATIONS:

(Refer to following Trace Output)

*KWH Savings* =  $(2,940,848 \text{ KWH/yr} - 2,814,098 \text{ KWH}) \times \$0.036/\text{KWH} = \$4,563/\text{yr}$   
*Demand Savings* =  $(569 - 525 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (569 \text{ KW} - 525 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW}$   
= \$3,520/yr  
*Total Savings* = \$8,084/yr

**IMPLEMENTATION COSTS:**

(Refer to following Cost Estimate)

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

| LINE # |                                           |
|--------|-------------------------------------------|
| 1      | JOB - 1                                   |
| 2      | 01/FORT SAM HOUSTON EEAP                  |
| 3      | 01/SAN ANTONIO                            |
| 4      | 01/FWD-COE                                |
| 5      | 01/SCOTT CLARK                            |
| 6      | 01/HVAC IMPROVEMENTS                      |
| 7      | 08/SANANTON                               |
| 8      | 09/JAN/DEC                                |
| 9      | 10/CLTD-CLF                               |
| 10     | 11/JAN/DEC                                |
| 11     | LOAD - 1                                  |
| 12     | 19/1/ENERGY CONSERVATION SIMULATION       |
| 13     | 20/1/1/FIRST FLOOR/15/230//4//14          |
| 14     | 20/2/2/FIRST FLOOR/15/230//4//14          |
| 15     | 20/3/3/FIRST FLOOR/15/230//4//14          |
| 16     | 20/4/4/FIRST FLOOR/15/230//4//14          |
| 17     | 20/5/5/FIRST FLOOR/215/215//4//14         |
| 18     | 20/6/6/SECOND FLOOR/15/230//4//14         |
| 19     | 20/7/7/SECOND FLOOR/15/230//4//14         |
| 20     | 20/8/8/SECOND FLOOR/15/230//4//14         |
| 21     | 20/9/9/SECOND FLOOR/15/230//4//14         |
| 22     | 20/10/10/SECOND FLOOR/215/215//4//14      |
| 23     | 20/11/11/THIRD FLOOR/15/230//4//14        |
| 24     | 20/12/12/THIRD FLOOR/15/230//4//14        |
| 25     | 20/13/13/THIRD FLOOR/15/230//4//14        |
| 26     | 20/14/14/THIRD FLOOR/15/230//4//14        |
| 27     | 20/15/15/THIRD FLOOR/215/215//4//14       |
| 28     | 21/M/78/50/78//70/70                      |
| 29     | 22/11/1/YES///.07                         |
| 30     | 22/12/1/YES///.07                         |
| 31     | 22/13/1/YES///.07                         |
|        | 22/14/1/YES///.07                         |
|        | 22/15/1/YES///.07                         |
| 34     | 24/1/1/245/14/.15/68                      |
| 35     | 24/2/1/245/14/.15/68/90                   |
| 36     | 24/3/1/245/14/.15/68/180                  |
| 37     | 24/4/1/245/14/.15/68/270                  |
| 38     | 24/6/1/245/14/.15/68                      |
| 39     | 24/7/1/245/14/.15/68/90                   |
| 40     | 24/8/1/245/14/.15/68/180                  |
| 41     | 24/9/1/245/14/.15/68/270                  |
| 42     | 24/11/1/245/14/.15/68                     |
| 43     | 24/12/1/245/14/.15/68/90                  |
| 44     | 24/13/1/245/14/.15/68/180                 |
| 45     | 24/14/1/245/14/.15/68/270                 |
| 46     | 25/M/1///15/1.07/.5                       |
| 47     | 26/M/1350PLP/1350LT                       |
| 48     | 27/M/125/SF-PERS/255/255/2.5/WATT-SF///30 |
| 49     | 28/M/1//1.5/WATT-SF/1350LT                |
| 50     | 29/M/15/CFM-P/15/CFM-P                    |
| 51     | 30/M/.75/CFM-SF                           |
| 52     | SYSTEM - 1                                |
| 53     | 39/1/EXISTING COND, 24 HR OPERATION       |
| 54     | 40/1/VTCV                                 |
| 55     | 41/1/1/15                                 |
| 56     | 42/1/2.5/2.5                              |
| 57     | 43/1/54/62                                |
| 58     | 44/1/NONE                                 |

LINE # -----

59 45/1/AVAIL

60 EQUIPMENT - 1

61 60/1/1/PKPLANT/1/1

62 61/1/1

63 62/1/EQ1001S//438/TONS/.715/KW-TON

64 63/1/50/HP/25/HP

65 64/1//NO/NO/NONE

66 65/1/1//1/1

67 66/1/1

68 67/1/EQ2001/1/15/HP

69 69/1/EQ4003/EQ4003

70 70/1/150/150

71 SYSTEM - 2

72 39/2/EXISTING COND, STOP-START ADDED

73 40/1/VTCV

74 41/1/1/15

75 42/1/2.5/2.5

76 43/1/54/62

77 44/1/NONE

78 45/1/1350EX

79 46/1///START/STOP

80 EQUIPMENT - 2

81 60/1/1/PKPLANT/1/1

82 61/1/1

83 62/1/EQ1001S//438/TONS/.715/KW-TON

84 63/1/50/HP/25/HP

85 64/1//NO/NO/NONE

86 65/1/1//1/1

87 66/1/1

88 67/1/EQ2001/1/15/HP

69/1/EQ4003/EQ4003

70/1/150/150

91 SYSTEM - 3

92 39/3/STOP-START WITH NEW CHILLER

93 40/1/VTCV

94 41/1/1/15

95 42/1/2.5/2.5

96 43/1/54/62

97 44/1/NONE

98 45/1/1350EX

99 46/1///START/STOP

100 EQUIPMENT - 3

101 60/1/1/PKPLANT/1/1

102 61/1/1

103 62/1/EQ1001S//438/TONS/.534/KW-TON

104 63/1/50/HP/25/HP

105 64/1//NO/NO/NONE

106 65/1/1//1/1

107 66/1/1

108 67/1/EQ2001/1/15/HP

109 69/1/EQ4003/EQ4003

110 70/1/150/150

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TRACE 600 ANALYSIS \*\*  
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\*\* by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/Lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 12:31:17 4/17/94  
Dataset Name: 1350E .TM



AIRFLOW - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 21,609                      | 146,258                     | 146,258                     | 146,258                    | 21,609                      | 0                                    | 0                                   |
| Totals           |                | 21,609                      | 146,258                     | 146,258                     | 146,258                    | 21,609                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

|        |        | Cooling   |           |           |         | Heating    |           |          |          |          |           |            |
|--------|--------|-----------|-----------|-----------|---------|------------|-----------|----------|----------|----------|-----------|------------|
|        |        | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys.  | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |
| System | System | Capacity  | Capacity  | Capacity  | Totals  | Capacity   | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |
| Number | Type   | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)     | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |
| 1      | VTCV   | 371.9     | 0.0       | 0.0       | 371.9   | -1,571,391 | 0         | 0        | 0        | 0        | 0         | -1,571,391 |
| Totals |        | 371.9     | 0.0       | 0.0       | 371.9   | -1,571,391 | 0         | 0        | 0        | 0        | 0         | -1,571,391 |

The building peaked at hour 14 month 8 with a capacity of 370.3 tons

ENGINEERING CHECKS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 14.77                     | 0.81          | 393.2       | 484.2         | 24.79          | 0.81          | -8.73          | 180,075             |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |           |          |           |        | ***** CLG SPACE PEAK ***** |        |            | ***** HEATING COIL PEAK ***** |        |  |
|------------------------------------------|-----------|----------|-----------|--------|----------------------------|--------|------------|-------------------------------|--------|--|
| Peak at Time ==> Mo/Hr: 8/14             |           |          |           |        | Mo/Hr: 7/16                |        |            | Mo/Hr: 13/ 1                  |        |  |
| Outside Air ==> OADB/WB/HR: 96/ 79/126.0 |           |          |           |        | OADB: 96                   |        |            | OADB: 30                      |        |  |
| Space                                    | Ret. Air  | Ret. Air | Net       | Perct  | Space                      | Perct  | Space Peak | Coil Peak                     | Perct  |  |
| Sens.+Lat.                               | Sensible  | Latent   | Total     | Of Tot | Sensible                   | Of Tot | Space Sens | Tot Sens                      | Of Tot |  |
| (Btuh)                                   | (Btuh)    | (Btuh)   | (Btuh)    | (%)    | (Btuh)                     | (%)    | (Btuh)     | (Btuh)                        | (%)    |  |
| Envelope Loads                           |           |          |           |        |                            |        |            |                               |        |  |
| Skylite Solr                             | 0         | 0        | 0         | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Skylite Cond                             | 0         | 0        | 0         | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Roof Cond                                | 0         | 219,558  | 219,558   | 4.92   | 0                          | 0.00   | 0          | -163,538                      | 10.41  |  |
| Glass Solar                              | 162,068   | 0        | 162,068   | 3.63   | 221,235                    | 8.70   | 0          | 0                             | 0.00   |  |
| Glass Cond                               | 93,257    | 0        | 93,257    | 2.09   | 82,137                     | 3.23   | -290,011   | -290,011                      | 18.46  |  |
| Wall Cond                                | 56,439    | 25,002   | 81,441    | 1.82   | 60,010                     | 2.36   | -139,356   | -208,013                      | 13.24  |  |
| Partition                                | 0         | 0        | 0         | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Exposed Floor                            | 0         | 0        | 0         | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Infiltration                             | 0         | 0        | 0         | 0.00   | 0                          | 0.00   | -1         | -1                            | 0.00   |  |
| Sub Total==>                             | 311,764   | 244,559  | 556,324   | 12.46  | 363,382                    | 14.29  | -429,368   | -661,563                      | 42.10  |  |
| Internal Loads                           |           |          |           |        |                            |        |            |                               |        |  |
| Lights                                   | 445,392   | 190,882  | 636,274   | 14.26  | 459,178                    | 18.06  | 0          | 0                             | 0.00   |  |
| People                                   | 690,834   |          | 690,834   | 15.48  | 333,615                    | 13.12  | 0          | 0                             | 0.00   |  |
| Misc                                     | 832,176   | 0        | 832,176   | 18.65  | 849,625                    | 33.42  | 0          | 0                             | 0.00   |  |
| Sub Total==>                             | 1,968,402 | 190,882  | 2,159,284 | 48.38  | 1,642,417                  | 64.60  | 0          | 0                             | 0.00   |  |
| Ceiling Load                             | 115,638   | -115,638 | 0         | 0.00   | 141,308                    | 5.56   | -61,543    | 0                             | 0.00   |  |
| Outside Air                              | 0         | 0        | 1,139,484 | 25.53  | 0                          | 0.00   | 0          | -935,041                      | 59.50  |  |
| Sup. Fan Heat                            |           |          | 260,013   | 5.83   |                            | 0.00   |            | 0                             | 0.00   |  |
| Ret. Fan Heat                            |           | 0        | 0         | 0.00   |                            | 0.00   |            | 0                             | 0.00   |  |
| Duct Heat Pkup                           |           | 0        | 0         | 0.00   |                            | 0.00   |            | 0                             | 0.00   |  |
| OV/UNDR Sizing                           | 395,512   |          | 395,512   | 8.86   | 395,512                    | 15.56  | 0          | 0                             | 0.00   |  |
| Wst Heat                                 |           | -47,376  | -47,376   | -1.06  |                            | 0.00   |            | 25,213                        | -1.60  |  |
| Main Bypass                              |           | 0        | 0         | 0.00   |                            | 0.00   |            | 0                             | 0.00   |  |
| Grand Total==>                           | 2,791,317 | 272,427  | 4,463,242 | 100.00 | 2,542,620                  | 100.00 | -490,911   | -1,571,391                    | 100.00 |  |

| -----COOLING COIL SELECTION----- |           |            |                   |         |       |                  |       |       |             | -----AREAS----- |       |         |
|----------------------------------|-----------|------------|-------------------|---------|-------|------------------|-------|-------|-------------|-----------------|-------|---------|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |         |       | Leaving DB/WB/HR |       |       | Gross Total | Glass (sf)      | (%)   |         |
| (Tons)                           | (Mbh)     | (Mbh)      | (cfm)             | Deg F   | Deg F | Grains           | Deg F | Deg F | Grains      |                 |       |         |
| Main Clg                         | 371.9     | 4,463.2    | 3,362.7           | 146,258 | 82.3  | 68.0             | 83.2  | 60.3  | 58.7        | 73.6            | Floor | 180,075 |
| Aux Clg                          | 0.0       | 0.0        | 0.0               | 0       | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | Part  | 0       |
| Opt Vent                         | 0.0       | 0.0        | 0.0               | 0       | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | ExFlr | 0       |
| Totals                           | 371.9     | 4,463.2    |                   |         |       |                  |       |       |             |                 | Roof  | 60,025  |
|                                  |           |            |                   |         |       |                  |       |       |             |                 | Wall  | 41,160  |
|                                  |           |            |                   |         |       |                  |       |       |             |                 |       | 6,174   |
|                                  |           |            |                   |         |       |                  |       |       |             |                 |       | 15      |

| -----HEATING COIL SELECTION----- |            |         |       |      | -----AIRFLOWS (cfm)----- |         |          | -----ENGINEERING CHECKS----- |        | -----TEMPERATURES (F)----- |      |      |
|----------------------------------|------------|---------|-------|------|--------------------------|---------|----------|------------------------------|--------|----------------------------|------|------|
| Capacity                         | Coil Airfl | Ent     | Lvg   | Type | Cooling                  | Heating | Clg % OA | 14.8                         | Type   | Clg                        | Htg  |      |
| (Mbh)                            | (cfm)      | Deg F   | Deg F |      |                          |         |          |                              |        |                            |      |      |
| Main Htg                         | -1,571.4   | 146,258 | 63.2  | 73.1 | Vent                     | 21,609  | 21,609   | Clg Cfm/Sqft                 | 0.81   | SADB                       | 61.9 | 73.1 |
| Aux Htg                          | 0.0        | 0       | 0.0   | 0.0  | Infil                    | 0       | 0        | Clg Cfm/Ton                  | 393.23 | Plenum                     | 80.0 | 68.9 |
| Preheat                          | -0.0       | 146,258 | 63.2  | 60.3 | Supply                   | 146,258 | 146,258  | Clg Sqft/Ton                 | 484.15 | Return                     | 80.0 | 68.9 |
| Reheat                           | 0.0        | 0       | 0.0   | 0.0  | Mincfm                   | 0       | 0        | Clg Btuh/Sqft                | 24.79  | Ret/OA                     | 82.3 | 63.2 |
| Humidif                          | 0.0        | 0       | 0.0   | 0.0  | Return                   | 146,258 | 146,258  | No. People                   | 1,441  | Runarnd                    | 78.0 | 70.0 |
| Opt Vent                         | 0.0        | 0       | 0.0   | 0.0  | Exhaust                  | 21,609  | 21,609   | Htg % OA                     | 14.8   | Fn MtrTD                   | 0.4  | 0.4  |
| Total                            | -1,571.4   |         |       |      | Rm Exh                   | 0       | 0        | Htg Cfm/SqFt                 | 0.81   | Fn BldTD                   | 0.3  | 0.3  |
|                                  |            |         |       |      | Auxil                    | 0       | 0        | Htg Btuh/SqFt                | -8.73  | Fn Frict                   | 0.9  | 0.9  |

MAIN SYSTEM COOLING - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

PEAK COOLING LOADS  
(Main System)

| Room<br>Number | Description  | Peak<br>Time<br>Mo/Hr | Space                |                         |                             |                               | Peak<br>Time<br>Mo/Hr | Coil                 |                         |                             |                                 | Coil<br>Air<br>Flow<br>(Cfm) | Coil<br>Sens.<br>Load<br>(Btuh) | Coil<br>Lat.<br>Load<br>(Btuh) |
|----------------|--------------|-----------------------|----------------------|-------------------------|-----------------------------|-------------------------------|-----------------------|----------------------|-------------------------|-----------------------------|---------------------------------|------------------------------|---------------------------------|--------------------------------|
|                |              |                       | OA<br>Cond.<br>DB/°F | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Air<br>Flow<br>(Cfm) |                       | OA<br>Cond.<br>DB/°F | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Lat.<br>Load<br>(Btuh) |                              |                                 |                                |
| 1              | FIRST FLOOR  | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 62,845                          | 21,670                         |
| Zone 1         | Total/Ave.   |                       | 96 75                | 78                      | 61.2                        | 2,872                         |                       | 96 79                | 78                      | 62.4                        |                                 | 2,872                        | 62,845                          | 21,670                         |
| Zone 1         | Block        | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 62,845                          | 21,670                         |
| 2              | FIRST FLOOR  | 7/11                  | 89 77                | 78                      | 61.8                        | 3,741                         | 8/12                  | 91 79                | 78                      | 62.3                        | 7,038                           | 3,741                        | 78,972                          | 23,641                         |
| Zone 2         | Total/Ave.   |                       | 89 77                | 78                      | 61.8                        | 3,741                         |                       | 91 79                | 78                      | 62.3                        |                                 | 3,741                        | 78,972                          | 23,641                         |
| Zone 2         | Block        | 7/11                  | 89 77                | 78                      | 61.8                        | 3,741                         | 8/12                  | 91 79                | 78                      | 62.3                        | 7,038                           | 3,741                        | 78,972                          | 23,641                         |
| 3              | FIRST FLOOR  | 9/15                  | 89 75                | 78                      | 61.8                        | 3,602                         | 8/14                  | 96 79                | 78                      | 63.5                        | 7,038                           | 3,602                        | 72,711                          | 21,670                         |
| Zone 3         | Total/Ave.   |                       | 89 75                | 78                      | 61.8                        | 3,602                         |                       | 96 79                | 78                      | 63.5                        |                                 | 3,602                        | 72,711                          | 21,670                         |
| Zone 3         | Block        | 9/15                  | 89 75                | 78                      | 61.8                        | 3,602                         | 8/14                  | 96 79                | 78                      | 63.5                        | 7,038                           | 3,602                        | 72,711                          | 21,670                         |
| 4              | FIRST FLOOR  | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 78,037                          | 19,745                         |
| Zone 4         | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 3,861                         |                       | 96 78                | 78                      | 63.6                        |                                 | 3,861                        | 78,037                          | 19,745                         |
| Zone 4         | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 78,037                          | 19,745                         |
| 5              | FIRST FLOOR  | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.5                        | 94,299                          | 34,669                       | 757,278                         | 280,776                        |
| Zone 5         | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 34,669                        |                       | 96 79                | 78                      | 62.5                        |                                 | 34,669                       | 757,278                         | 280,776                        |
| Zone 5         | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.5                        | 94,299                          | 34,669                       | 757,278                         | 280,776                        |
| 6              | SECOND FLOOR | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 62,845                          | 21,670                         |
| Zone 6         | Total/Ave.   |                       | 96 75                | 78                      | 61.2                        | 2,872                         |                       | 96 79                | 78                      | 62.4                        |                                 | 2,872                        | 62,845                          | 21,670                         |
| Zone 6         | Block        | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 62,845                          | 21,670                         |
| 7              | SECOND FLOOR | 7/11                  | 89 77                | 78                      | 61.8                        | 3,741                         | 8/12                  | 91 79                | 78                      | 62.3                        | 7,038                           | 3,741                        | 78,972                          | 23,641                         |
| Zone 7         | Total/Ave.   |                       | 89 77                | 78                      | 61.8                        | 3,741                         |                       | 91 79                | 78                      | 62.3                        |                                 | 3,741                        | 78,972                          | 23,641                         |
| Zone 7         | Block        | 7/11                  | 89 77                | 78                      | 61.8                        | 3,741                         | 8/12                  | 91 79                | 78                      | 62.3                        | 7,038                           | 3,741                        | 78,972                          | 23,641                         |
| 8              | SECOND FLOOR | 9/15                  | 89 75                | 78                      | 61.8                        | 3,602                         | 8/14                  | 96 79                | 78                      | 63.5                        | 7,038                           | 3,602                        | 72,711                          | 21,670                         |
| Zone 8         | Total/Ave.   |                       | 89 75                | 78                      | 61.8                        | 3,602                         |                       | 96 79                | 78                      | 63.5                        |                                 | 3,602                        | 72,711                          | 21,670                         |
| Zone 8         | Block        | 9/15                  | 89 75                | 78                      | 61.8                        | 3,602                         | 8/14                  | 96 79                | 78                      | 63.5                        | 7,038                           | 3,602                        | 72,711                          | 21,670                         |
| 9              | SECOND FLOOR | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 78,037                          | 19,745                         |
| Zone 9         | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 3,861                         |                       | 96 78                | 78                      | 63.6                        |                                 | 3,861                        | 78,037                          | 19,745                         |
| Zone 9         | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 78,037                          | 19,745                         |
| 10             | SECOND FLOOR | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.5                        | 94,299                          | 34,669                       | 757,278                         | 280,776                        |
| Zone 10        | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 34,669                        |                       | 96 79                | 78                      | 62.5                        |                                 | 34,669                       | 757,278                         | 280,776                        |
| Zone 10        | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.5                        | 94,299                          | 34,669                       | 757,278                         | 280,776                        |
| 11             | THIRD FLOOR  | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 75,396                          | 21,670                         |
| Zone 11        | Total/Ave.   |                       | 96 75                | 78                      | 61.2                        | 2,872                         |                       | 96 79                | 78                      | 62.4                        |                                 | 2,872                        | 75,396                          | 21,670                         |
| Zone 11        | Block        | 7/16                  | 96 75                | 78                      | 61.2                        | 2,872                         | 8/14                  | 96 79                | 78                      | 62.4                        | 7,038                           | 2,872                        | 75,396                          | 21,670                         |
| 12             | THIRD FLOOR  | 7/12                  | 92 78                | 78                      | 61.9                        | 3,757                         | 8/14                  | 96 79                | 78                      | 63.0                        | 7,038                           | 3,757                        | 90,899                          | 21,670                         |
| Zone 12        | Total/Ave.   |                       | 92 78                | 78                      | 61.9                        | 3,757                         |                       | 96 79                | 78                      | 63.0                        |                                 | 3,757                        | 90,899                          | 21,670                         |
| Zone 12        | Block        | 7/12                  | 92 78                | 78                      | 61.9                        | 3,757                         | 8/14                  | 96 79                | 78                      | 63.0                        | 7,038                           | 3,757                        | 90,899                          | 21,670                         |
| 13             | THIRD FLOOR  | 9/15                  | 89 75                | 78                      | 61.8                        | 3,607                         | 8/14                  | 96 79                | 78                      | 63.6                        | 7,038                           | 3,607                        | 85,271                          | 21,670                         |
| Zone 13        | Total/Ave.   |                       | 89 75                | 78                      | 61.8                        | 3,607                         |                       | 96 79                | 78                      | 63.6                        |                                 | 3,607                        | 85,271                          | 21,670                         |
| Zone 13        | Block        | 9/15                  | 89 75                | 78                      | 61.8                        | 3,607                         | 8/14                  | 96 79                | 78                      | 63.6                        | 7,038                           | 3,607                        | 85,271                          | 21,670                         |
| 14             | THIRD FLOOR  | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 92,808                          | 19,745                         |
| Zone 14        | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 3,861                         |                       | 96 78                | 78                      | 63.6                        |                                 | 3,861                        | 92,808                          | 19,745                         |
| Zone 14        | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 3,861                         | 8/15                  | 96 78                | 78                      | 63.6                        | 7,038                           | 3,861                        | 92,808                          | 19,745                         |
| 15             | THIRD FLOOR  | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.6                        | 94,299                          | 34,669                       | 918,648                         | 280,776                        |
| Zone 15        | Total/Ave.   |                       | 96 75                | 78                      | 62.0                        | 34,669                        |                       | 96 79                | 78                      | 62.6                        |                                 | 34,669                       | 918,648                         | 280,776                        |
| Zone 15        | Block        | 7/16                  | 96 75                | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                | 78                      | 62.6                        | 94,299                          | 34,669                       | 918,648                         | 280,776                        |
| System         | 1 Total/Ave. |                       | 96 75                | 78                      | 61.9                        | 146,258                       |                       | 96 79                | 78                      | 62.7                        | 367,353                         | 146,258                      | 3,362,708                       | 1,100,534                      |
| System         | 1 Block      | 7/16                  | 96 75                | 78                      | 62.2                        | 146,258                       | 8/14                  | 96 79                | 78                      | 62.8                        | 367,353                         | 146,258                      | 3,340,811                       | 1,102,505                      |

BUILDING AREAS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- B U I L D I N G   A R E A S -----

| Room<br>Number | Description   | Number of<br>Duplicate<br>Flr | Rm | Floor<br>Area/Dupl<br>Room<br>(sqft) | Total<br>Floor<br>Area<br>(sqft) | Partition<br>Area<br>(sqft) | Exposed<br>Floor<br>Area<br>(sqft) | Skylight<br>Area<br>(sqft) | Skl<br>/Rf<br>(%) | Net Roof<br>Area<br>(sqft) | Window<br>Area<br>(sqft) | Win<br>/Wl<br>(%) | Net Wall<br>Area<br>(sqft) |
|----------------|---------------|-------------------------------|----|--------------------------------------|----------------------------------|-----------------------------|------------------------------------|----------------------------|-------------------|----------------------------|--------------------------|-------------------|----------------------------|
| 1              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 1 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 2              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 2 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 3              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 3 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 4              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 4 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 5              | FIRST FLOOR   | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 5 Total/Ave.  |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 6              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 6 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 7              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 7 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 8              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 8 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 9              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 9 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 10             | SECOND FLOOR  | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 10 Total/Ave. |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 11             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 11 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 12             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 12 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 13             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 13 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 14             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 14 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 15             | THIRD FLOOR   | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| Zone           | 15 Total/Ave. |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| System         | 1 Total/Ave.  |                               |    |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |
| Building       |               |                               |    |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 Gl) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 253,518                  | 559                       | 1,089                     | 112                | 7                                |
| Feb   | 224,427                  | 533                       | 1,145                     | 99                 | 7                                |
| March | 276,853                  | 578                       | 339                       | 170                | 3                                |
| April | 288,175                  | 610                       | 83                        | 233                | 1                                |
| May   | 328,223                  | 631                       | 0                         | 308                | 0                                |
| June  | 326,140                  | 643                       | 0                         | 341                | 0                                |
| July  | 344,687                  | 657                       | 0                         | 392                | 0                                |
| Aug   | 346,506                  | 670                       | 0                         | 399                | 0                                |
| Sept  | 326,371                  | 654                       | 0                         | 339                | 0                                |
| Oct   | 290,436                  | 609                       | 291                       | 217                | 3                                |
| Nov   | 271,789                  | 590                       | 345                       | 167                | 3                                |
| Dec   | 257,642                  | 566                       | 982                       | 117                | 6                                |
| Total | 3,534,766                | 670                       | 4,274                     | 2,893              | 7                                |

Building Energy Consumption = 69,369 (Btu/Sq Ft/Year)  
Source Energy Consumption = 203,504 (Btu/Sq Ft/Year)

Floor Area = 180,075 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

| ----- EQUIPMENT ENERGY CONSUMPTION ----- |                           |                     |       |       |       |       |       |       |       |       |       |       |         |
|------------------------------------------|---------------------------|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Ref                                      | Equip                     | Monthly Consumption |       |       |       |       |       |       |       |       |       |       |         |
| Num                                      | Code                      | Jan                 | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec     |
| 0                                        | LIGHTS                    |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 75529               | 68220 | 75529 | 73092 | 75529 | 73092 | 75529 | 75529 | 73092 | 75529 | 73092 | 75529   |
|                                          | PK                        | 221.5               | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5 | 221.5   |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 889,291 |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 221.5   |
| 1                                        | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
| 2                                        | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | GAS                       | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
| 3                                        | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | OIL                       | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
| 4                                        | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P STEAM                   | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
|                                          | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P HOTW20                  | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
| 6                                        | MISC LD                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P CHILL                   | 0                   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK                        | 0.0                 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0       |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 0.0     |
| 1                                        | EQ1001S                   |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 23120               | 20734 | 32168 | 42650 | 58988 | 65591 | 75452 | 77272 | 65821 | 39096 | 31357 | 24098   |
|                                          | PK                        | 77.0                | 78.7  | 95.9  | 127.8 | 148.7 | 161.5 | 175.5 | 188.5 | 172.6 | 127.3 | 108.6 | 83.7    |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 556,349 |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 188.5   |
| 1                                        | EQ5100                    |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 7549                | 294   | 15097 | 19828 | 25881 | 25046 | 25881 | 25881 | 25046 | 19411 | 17741 | 8726    |
|                                          | PK                        | 34.8                | 7.9   | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8    |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 216,383 |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 34.8    |
| 1                                        | EQ5100                    |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | WATER                     | 112                 | 99    | 170   | 233   | 308   | 341   | 392   | 399   | 339   | 217   | 167   | 117     |
|                                          | PK                        | 0.4                 | 0.5   | 0.6   | 0.8   | 0.9   | 0.9   | 1.0   | 1.1   | 1.0   | 0.8   | 0.7   | 0.5     |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 2,893   |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 1.1     |
| 1                                        | EQ5001                    |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 20035               | 19488 | 26199 | 28337 | 36987 | 35794 | 36987 | 36987 | 35794 | 27740 | 25354 | 21576   |
|                                          | PK                        | 49.7                | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7    |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 351,275 |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 49.7    |
| 1                                        | EQ5010                    |                     |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC                      | 10017               | 9744  | 13099 | 14168 | 18493 | 17897 | 18493 | 18493 | 17897 | 13870 | 12677 | 10788   |
|                                          | PK                        | 24.9                | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9    |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 175,638 |
|                                          |                           |                     |       |       |       |       |       |       |       |       |       |       | 24.9    |
| EQ5300                                   | CONTROL PANEL & INTERLOCK |                     |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|          |                            |        |        |        |        |        |        |        |        |        |        |        |           |
|----------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
| ELEC     | 403                        | 392    | 527    | 570    | 744    | 720    | 744    | 744    | 720    | 558    | 510    | 434    | 7,066     |
| PK       | 1.0                        | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0       |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |        |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 111600                     | 100800 | 111600 | 108000 | 111600 | 108000 | 111600 | 111600 | 108000 | 111600 | 108000 | 111600 | 1,314,000 |
| PK       | 150.0                      | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0     |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |        |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 0                          | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
| PK       | 0.0                        | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 1 EQ2001 | GAS FIRE TUBE HOT WATER    |        |        |        |        |        |        |        |        |        |        |        |           |
| GAS      | 1089                       | 1145   | 339    | 83     | 0      | 0      | 0      | 0      | 0      | 291    | 345    | 982    | 4,274     |
| PK       | 6.5                        | 6.8    | 3.2    | 1.1    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 2.5    | 3.0    | 5.7    | 6.8       |
| 1 EQ5020 | HEAT WATER CIRC. PUMP C.V. |        |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 4623                       | 4176   | 2312   | 1342   | 0      | 0      | 0      | 0      | 0      | 2312   | 2685   | 4295   | 21,745    |
| PK       | 14.9                       | 14.9   | 14.9   | 14.9   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 14.9   | 14.9   | 14.9   | 14.9      |
| 1 EQ5240 | BOILER FORCED DRAFT FAN    |        |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 487                        | 440    | 244    | 141    | 0      | 0      | 0      | 0      | 0      | 244    | 283    | 453    | 2,291     |
| PK       | 1.6                        | 1.6    | 1.6    | 1.6    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 1.6    | 1.6    | 1.6    | 1.6       |
| 1 EQ5307 | BOILER CONTROLS            |        |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 155                        | 140    | 78     | 45     | 0      | 0      | 0      | 0      | 0      | 78     | 90     | 144    | 729       |
| PK       | 0.5                        | 0.5    | 0.5    | 0.5    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.5    | 0.5    | 0.5    | 0.5       |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

----- UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 670.3 (kW)  
Yearly Time of Peak 15 (hr) 8 (mo)

Hour 15 Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Percnt<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|

Cooling Equipment

|   |         |                     |       |       |
|---|---------|---------------------|-------|-------|
| 1 | EQ1001S | 2-STG CTV <555 TONS | 298.8 | 44.58 |
|---|---------|---------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 298.8 | 44.58 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |       |       |
|---|--|------------------------------------|-------|-------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 150.0 | 22.38 |
|---|--|------------------------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 150.0 | 22.38 |
|-----------|--|--|-------|-------|

|       |  |  |     |      |
|-------|--|--|-----|------|
| Total |  |  | 0.0 | 0.00 |
|-------|--|--|-----|------|

Miscellaneous

|                |  |  |       |       |
|----------------|--|--|-------|-------|
| Lights         |  |  | 221.5 | 33.04 |
| Base Utilities |  |  | 0.0   | 0.00  |
| Misc Equipment |  |  | 0.0   | 0.00  |
| Sub Total      |  |  | 221.5 | 33.04 |

|             |  |  |       |        |
|-------------|--|--|-------|--------|
| Grand Total |  |  | 670.3 | 100.00 |
|-------------|--|--|-------|--------|



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TRACE 600 ANALYSIS

by \*\*

FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 7:37:16 4/18/94  
Dataset Name: 1350E .TM

AIRFLOW - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 21,609                      | 143,714                     | 143,714                     | 143,714                    | 21,609                      | 0                                    | 0                                   |
| Totals           |                | 21,609                      | 143,714                     | 143,714                     | 143,714                    | 21,609                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

|        |        | Cooling   |           |           |         | Heating    |           |          |          |          |           |            |
|--------|--------|-----------|-----------|-----------|---------|------------|-----------|----------|----------|----------|-----------|------------|
|        |        | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys.  | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |
| System | System | Capacity  | Capacity  | Capacity  | Totals  | Capacity   | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |
| Number | Type   | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)     | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |
| 1      | VTCV   | 365.1     | 0.0       | 0.0       | 365.1   | -1,570,993 | 0         | 0        | 0        | 0        | 0         | -1,570,993 |
| Totals |        | 365.1     | 0.0       | 0.0       | 365.1   | -1,570,993 | 0         | 0        | 0        | 0        | 0         | -1,570,993 |

The building peaked at hour 14 month 8 with a capacity of 363.5 tons

ENGINEERING CHECKS - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 15.04                     | 0.80          | 393.6       | 493.2         | 24.33          | 0.80          | -8.72          | 180,075             |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |           |          |           |           | ***** CLG SPACE PEAK ***** |           |            | ***** HEATING COIL PEAK ***** |            |        |
|------------------------------------------|-----------|----------|-----------|-----------|----------------------------|-----------|------------|-------------------------------|------------|--------|
| Peak at Time ==> Mo/Hr: 8/14             |           |          |           |           | Mo/Hr: 7/16                |           |            | Mo/Hr: 13/ 1                  |            |        |
| Outside Air ==> OADB/WB/HR: 96/ 79/126.0 |           |          |           |           | OADB: 96                   |           |            | OADB: 30                      |            |        |
| Space                                    | Ret. Air  | Ret. Air | Net       | Perct     | Space                      | Perct     | Space Peak | Coil Peak                     | Perct      |        |
| Sens.+Lat.                               | Sensible  | Latent   | Total     | Of Tot    | Sensible                   | Of Tot    | Space Sens | Tot Sens                      | Of Tot     |        |
| (Btuh)                                   | (Btuh)    | (Btuh)   | (Btuh)    | (%)       | (Btuh)                     | (%)       | (Btuh)     | (Btuh)                        | (%)        |        |
| Envelope Loads                           |           |          |           |           |                            |           |            |                               |            |        |
| Skylite Solr                             | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | 0          | 0                             | 0.00       |        |
| Skylite Cond                             | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | 0          | 0                             | 0.00       |        |
| Roof Cond                                | 0         | 220,832  | 220,832   | 5.04      | 0                          | 0.00      | 0          | -163,481                      | 10.41      |        |
| Glass Solar                              | 162,068   | 0        | 162,068   | 3.70      | 221,235                    | 8.84      | 0          | 0                             | 0.00       |        |
| Glass Cond                               | 93,257    | 0        | 93,257    | 2.13      | 82,137                     | 3.28      | -290,011   | -290,011                      | 18.46      |        |
| Wall Cond                                | 56,439    | 25,537   | 81,976    | 1.87      | 60,010                     | 2.40      | -139,356   | -207,989                      | 13.24      |        |
| Partition                                | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | 0          | 0                             | 0.00       |        |
| Exposed Floor                            | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | 0          | 0                             | 0.00       |        |
| Infiltration                             | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | -1         | -1                            | 0.00       |        |
| Sub Total==>                             | 311,764   | 246,368  | 558,133   | 12.74     | 363,382                    | 14.52     | -429,368   | -661,482                      | 42.11      |        |
| Internal Loads                           |           |          |           |           |                            |           |            |                               |            |        |
| Lights                                   | 278,822   | 119,495  | 398,318   | 9.09      | 287,453                    | 11.48     | 0          | 0                             | 0.00       |        |
| People                                   | 690,834   |          | 690,834   | 15.77     | 333,615                    | 13.33     | 0          | 0                             | 0.00       |        |
| Misc                                     | 832,176   | 0        | 832,176   | 18.99     | 849,625                    | 33.95     | 0          | 0                             | 0.00       |        |
| Sub Total==>                             | 1,801,833 | 119,495  | 1,921,328 | 43.85     | 1,470,692                  | 58.76     | 0          | 0                             | 0.00       |        |
| Ceiling Load                             | 98,335    | -98,335  | 0         | 0.00      | 121,227                    | 4.84      | -62,317    | 0                             | 0.00       |        |
| Outside Air                              | 0         | 0        | 0         | 0.00      | 0                          | 0.00      | 0          | -935,041                      | 59.52      |        |
| Sup. Fan Heat                            |           |          | 255,492   | 5.83      |                            | 0.00      |            | 0                             | 0.00       |        |
| Ret. Fan Heat                            |           | 0        | 0         | 0.00      |                            | 0.00      |            | 0                             | 0.00       |        |
| Duct Heat Pkup                           |           | 0        | 0         | 0.00      |                            | 0.00      |            | 0                             | 0.00       |        |
| OV/UNDR Sizing                           | 547,630   |          | 547,630   | 12.50     | 547,630                    | 21.88     | 0          | 0                             | 0.00       |        |
| Heat                                     |           | -40,287  | -40,287   | -0.92     |                            | 0.00      |            | 25,531                        | -1.63      |        |
| Minimal Bypass                           |           | 0        | 0         | 0.00      |                            | 0.00      |            | 0                             | 0.00       |        |
| Grand Total==>                           | 2,759,562 | 227,242  | 0         | 4,381,532 | 100.00                     | 2,502,932 | 100.00     | -491,686                      | -1,570,992 | 100.00 |

| -----COOLING COIL SELECTION----- |           |            |                   |         |        |                  |       |        |             | -----AREAS----- |         |          |
|----------------------------------|-----------|------------|-------------------|---------|--------|------------------|-------|--------|-------------|-----------------|---------|----------|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |         |        | Leaving DB/WB/HR |       |        | Gross Total | Glass (sf)      | (%)     |          |
| (Tons)                           | (Mbh)     | (cfm)      | Deg F             | Deg F   | Grains | Deg F            | Deg F | Grains | Floor       |                 |         |          |
| Main Clg                         | 365.1     | 4,381.5    | 3,281.2           | 143,714 | 82.1   | 68.0             | 83.4  | 60.3   | 58.6        | 73.5            | 180,075 |          |
| Aux Clg                          | 0.0       | 0.0        | 0.0               | 0       | 0.0    | 0.0              | 0.0   | 0.0    | 0.0         | 0.0             | 0       |          |
| Opt Vent                         | 0.0       | 0.0        | 0.0               | 0       | 0.0    | 0.0              | 0.0   | 0.0    | 0.0         | 0.0             | 0       |          |
| Totals                           | 365.1     | 4,381.5    |                   |         |        |                  |       |        |             |                 | 60,025  | 0 0      |
|                                  |           |            |                   |         |        |                  |       |        |             |                 | 41,160  | 6,174 15 |

| -----HEATING COIL SELECTION----- |            |         |       |      | -----AIRFLOWS (cfm)----- |         |          | -----ENGINEERING CHECKS----- |        |          | -----TEMPERATURES (F)----- |      |  |
|----------------------------------|------------|---------|-------|------|--------------------------|---------|----------|------------------------------|--------|----------|----------------------------|------|--|
| Capacity                         | Coil Airfl | Ent     | Lvg   | Type | Cooling                  | Heating | Clg % OA | 15.0                         | Type   | Clg      | Htg                        |      |  |
| (Mbh)                            | (cfm)      | Deg F   | Deg F |      |                          |         |          |                              |        |          |                            |      |  |
| Main Htg                         | -1,571.0   | 143,714 | 63.1  | 73.2 | Vent                     | 21,609  | 21,609   | Clg Cfm/Sqft                 | 0.80   | SADB     | 61.9                       | 73.2 |  |
| Aux Htg                          | 0.0        | 0       | 0.0   | 0.0  | Infil                    | 0       | 0        | Clg Cfm/Ton                  | 393.60 | Plenum   | 79.7                       | 68.9 |  |
| Preheat                          | -0.0       | 143,714 | 63.1  | 60.3 | Supply                   | 143,714 | 143,714  | Clg Sqft/Ton                 | 493.18 | Return   | 79.7                       | 68.9 |  |
| Reheat                           | 0.0        | 0       | 0.0   | 0.0  | Mincfm                   | 0       | 0        | Clg Btuh/Sqft                | 24.33  | Ret/OA   | 82.1                       | 63.1 |  |
| Humidif                          | 0.0        | 0       | 0.0   | 0.0  | Return                   | 143,714 | 143,714  | No. People                   | 1,441  | Runarnd  | 78.0                       | 70.0 |  |
| Opt Vent                         | 0.0        | 0       | 0.0   | 0.0  | Exhaust                  | 21,609  | 21,609   | Htg % OA                     | 15.0   | Fn MtrTD | 0.4                        | 0.4  |  |
| Total                            | -1,571.0   |         |       |      | Rm Exh                   | 0       | 0        | Htg Cfm/Sqft                 | 0.80   | Fn BldTD | 0.3                        | 0.3  |  |
|                                  |            |         |       |      | Auxil                    | 0       | 0        | Htg Btuh/Sqft                | -8.72  | Fn Frict | 0.9                        | 0.9  |  |

MAIN SYSTEM COOLING - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

PEAK COOLING LOADS  
(Main System)

| Room<br>Number | Description   | Peak<br>Time<br>Mo/Hr | Space                       |                         |                             |                               | Peak<br>Time<br>Mo/Hr | Coil                        |                         |                             |                                 | Coil<br>Air<br>Flow<br>(Cfm) | Coil<br>Sens.<br>Load<br>(Btuh) | Coil<br>Lat.<br>Load<br>(Btuh) |
|----------------|---------------|-----------------------|-----------------------------|-------------------------|-----------------------------|-------------------------------|-----------------------|-----------------------------|-------------------------|-----------------------------|---------------------------------|------------------------------|---------------------------------|--------------------------------|
|                |               |                       | OA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Bib<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Air<br>Flow<br>(Cfm) |                       | OA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Bib<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Lat.<br>Load<br>(Btuh) |                              |                                 |                                |
| 1              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 1 Total/Ave.  |                       | 96 75                       | 78                      | 61.0                        | 2,654                         |                       | 96 79                       | 78                      | 62.3                        |                                 | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 1 Block       | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 58,467                          | 21,670                         |
| 2              | FIRST FLOOR   | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 8/12                  | 91 79                       | 78                      | 62.2                        | 7,038                           | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 2 Total/Ave.  |                       | 89 77                       | 78                      | 61.7                        | 3,529                         |                       | 91 79                       | 78                      | 62.2                        |                                 | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 2 Block       | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 8/12                  | 91 79                       | 78                      | 62.2                        | 7,038                           | 3,529                        | 74,713                          | 23,641                         |
| 3              | FIRST FLOOR   | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 3 Total/Ave.  |                       | 89 75                       | 78                      | 61.7                        | 3,379                         |                       | 96 79                       | 78                      | 63.5                        |                                 | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 3 Block       | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,379                        | 68,324                          | 21,670                         |
| 4              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 4 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 3,668                         |                       | 96 78                       | 78                      | 63.6                        |                                 | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 4 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 73,649                          | 19,662                         |
| 5              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.4                        | 94,299                          | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 5 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 34,669                        |                       | 96 79                       | 78                      | 62.4                        |                                 | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 5 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.4                        | 94,299                          | 34,669                       | 746,836                         | 280,776                        |
| 6              | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 6 Total/Ave.  |                       | 96 75                       | 78                      | 61.0                        | 2,654                         |                       | 96 79                       | 78                      | 62.3                        |                                 | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 6 Block       | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 58,467                          | 21,670                         |
| 7              | SECOND FLOOR  | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 8/12                  | 91 79                       | 78                      | 62.2                        | 7,038                           | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 7 Total/Ave.  |                       | 89 77                       | 78                      | 61.7                        | 3,529                         |                       | 91 79                       | 78                      | 62.2                        |                                 | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 7 Block       | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 8/12                  | 91 79                       | 78                      | 62.2                        | 7,038                           | 3,529                        | 74,713                          | 23,641                         |
| 8              | SECOND FLOOR  | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 8 Total/Ave.  |                       | 89 75                       | 78                      | 61.7                        | 3,379                         |                       | 96 79                       | 78                      | 63.5                        |                                 | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 8 Block       | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,379                        | 68,324                          | 21,670                         |
| 9              | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 9 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 3,668                         |                       | 96 78                       | 78                      | 63.6                        |                                 | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 9 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 73,649                          | 19,662                         |
| 10             | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.4                        | 94,299                          | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 10 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 34,669                        |                       | 96 79                       | 78                      | 62.4                        |                                 | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 10 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.4                        | 94,299                          | 34,669                       | 746,836                         | 280,776                        |
| 11             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 71,091                          | 21,670                         |
| Zone           | 11 Total/Ave. |                       | 96 75                       | 78                      | 61.0                        | 2,654                         |                       | 96 79                       | 78                      | 62.3                        |                                 | 2,654                        | 71,091                          | 21,670                         |
| Zone           | 11 Block      | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 8/14                  | 96 79                       | 78                      | 62.3                        | 7,038                           | 2,654                        | 71,091                          | 21,670                         |
| 12             | THIRD FLOOR   | 7/12                  | 92 78                       | 78                      | 61.8                        | 3,541                         | 8/14                  | 96 79                       | 78                      | 62.9                        | 7,038                           | 3,541                        | 86,598                          | 21,670                         |
| Zone           | 12 Total/Ave. |                       | 92 78                       | 78                      | 61.8                        | 3,541                         |                       | 96 79                       | 78                      | 62.9                        |                                 | 3,541                        | 86,598                          | 21,670                         |
| Zone           | 12 Block      | 7/12                  | 92 78                       | 78                      | 61.8                        | 3,541                         | 8/14                  | 96 79                       | 78                      | 62.9                        | 7,038                           | 3,541                        | 86,598                          | 21,670                         |
| 13             | THIRD FLOOR   | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,384                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,384                        | 80,958                          | 21,670                         |
| Zone           | 13 Total/Ave. |                       | 89 75                       | 78                      | 61.7                        | 3,384                         |                       | 96 79                       | 78                      | 63.5                        |                                 | 3,384                        | 80,958                          | 21,670                         |
| Zone           | 13 Block      | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,384                         | 8/14                  | 96 79                       | 78                      | 63.5                        | 7,038                           | 3,384                        | 80,958                          | 21,670                         |
| 14             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 88,493                          | 19,662                         |
| Zone           | 14 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 3,668                         |                       | 96 78                       | 78                      | 63.6                        |                                 | 3,668                        | 88,493                          | 19,662                         |
| Zone           | 14 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 8/15                  | 96 78                       | 78                      | 63.6                        | 7,038                           | 3,668                        | 88,493                          | 19,662                         |
| 15             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.5                        | 94,299                          | 34,669                       | 910,130                         | 280,776                        |
| Zone           | 15 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 34,669                        |                       | 96 79                       | 78                      | 62.5                        |                                 | 34,669                       | 910,130                         | 280,776                        |
| Zone           | 15 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 8/14                  | 96 79                       | 78                      | 62.5                        | 94,299                          | 34,669                       | 910,130                         | 280,776                        |
| System         | 1 Total/Ave.  |                       | 96 75                       | 78                      | 61.9                        | 143,714                       |                       | 96 79                       | 78                      | 62.6                        |                                 | 143,714                      | 3,281,247                       | 1,100,285                      |
| System         | 1 Block       | 7/16                  | 96 75                       | 78                      | 62.2                        | 143,714                       | 8/14                  | 96 79                       | 78                      | 62.8                        | 367,353                         | 143,714                      | 3,259,253                       | 1,102,256                      |

BUILDING AREAS - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

BUILDING AREAS

| Room<br>Number | Description   | Number of<br>Duplicate<br>Flr Rm | Floor<br>Area/Dupl<br>Room<br>(sqft) | Total<br>Floor<br>Area<br>(sqft) | Partition<br>Area<br>(sqft) | Exposed<br>Floor<br>Area<br>(sqft) | Skylight<br>Area<br>(sqft) | Skl<br>/Rf<br>(%) | Net Roof<br>Area<br>(sqft) | Window<br>Area<br>(sqft) | Win<br>/Wl<br>(%) | Net Wall<br>Area<br>(sqft) |
|----------------|---------------|----------------------------------|--------------------------------------|----------------------------------|-----------------------------|------------------------------------|----------------------------|-------------------|----------------------------|--------------------------|-------------------|----------------------------|
| 1              | FIRST FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 1 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 2              | FIRST FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 2 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 3              | FIRST FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 3 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 4              | FIRST FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 4 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 5              | FIRST FLOOR   | 1                                | 1                                    | 46,225                           | 46,225                      | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 5 Total/Ave.  |                                  |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 6              | SECOND FLOOR  | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 6 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 7              | SECOND FLOOR  | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 7 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 8              | SECOND FLOOR  | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 8 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 9              | SECOND FLOOR  | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 9 Total/Ave.  |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 10             | SECOND FLOOR  | 1                                | 1                                    | 46,225                           | 46,225                      | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 10 Total/Ave. |                                  |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 11             | THIRD FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 11 Total/Ave. |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 12             | THIRD FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 12 Total/Ave. |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 13             | THIRD FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 13 Total/Ave. |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 14             | THIRD FLOOR   | 1                                | 1                                    | 3,450                            | 3,450                       | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 14 Total/Ave. |                                  |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 15             | THIRD FLOOR   | 1                                | 1                                    | 46,225                           | 46,225                      | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| Zone           | 15 Total/Ave. |                                  |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| System         | 1 Total/Ave.  |                                  |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |
| Building       |               |                                  |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 Gl) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 218,966                  | 468                       | 1,197                     | 94                 | 7                                |
| Feb   | 191,019                  | 440                       | 1,060                     | 78                 | 7                                |
| March | 233,147                  | 487                       | 299                       | 138                | 4                                |
| April | 242,624                  | 516                       | 15                        | 202                | 1                                |
| May   | 266,552                  | 536                       | 0                         | 270                | 0                                |
| June  | 264,386                  | 548                       | 0                         | 303                | 0                                |
| July  | 280,383                  | 560                       | 0                         | 356                | 0                                |
| Aug   | 281,806                  | 569                       | 0                         | 361                | 0                                |
| Sept  | 265,112                  | 553                       | 0                         | 301                | 0                                |
| Oct   | 244,561                  | 513                       | 183                       | 182                | 3                                |
| Nov   | 229,353                  | 495                       | 307                       | 138                | 3                                |
| Dec   | 222,938                  | 475                       | 830                       | 93                 | 6                                |
| Total | 2,940,848                | 569                       | 3,890                     | 2,515              | 7                                |

Building Energy Consumption = 57,899 (Btu/Sq Ft/Year)  
 Source Energy Consumption = 169,506 (Btu/Sq Ft/Year)

Floor Area = 180,075 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

| ----- EQUIPMENT ENERGY CONSUMPTION ----- |          |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|------------------------------------------|----------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Ref                                      | Equip    | Monthly Consumption       |       |       |       |       |       |       |       |       |       |       |       |         |
| Num                                      | Code     | Jan                       | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   | Total   |
| 0                                        | LIGHTS   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 47282                     | 42707 | 47282 | 45757 | 47282 | 45757 | 47282 | 47282 | 45757 | 47282 | 45757 | 47282 | 556,711 |
|                                          | PK       | 138.7                     | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7   |
| 1                                        | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2                                        | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | GAS      | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3                                        | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | OIL      | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4                                        | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P STEAM  | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P WOTH2O | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6                                        | MISC LD  |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P CHILL  | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1                                        | EQ1001S  | 2-STG CTV <555 TONS       |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 20570                     | 17497 | 27688 | 37697 | 49790 | 54347 | 63342 | 64765 | 55073 | 33575 | 27337 | 20537 | 472,219 |
|                                          | PK       | 69.0                      | 72.0  | 87.6  | 117.3 | 137.3 | 159.1 | 187.6 | 199.9 | 183.8 | 113.6 | 95.8  | 76.3  | 199.9   |
| 1                                        | EQ5100   | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 7549                      | 48    | 12941 | 16698 | 18333 | 17741 | 18333 | 18333 | 17741 | 16941 | 15306 | 8627  | 168,589 |
|                                          | PK       | 34.8                      | 3.9   | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8    |
| 1                                        | EQ5100   | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | WATER    | 94                        | 78    | 138   | 202   | 270   | 303   | 356   | 361   | 301   | 182   | 138   | 93    | 2,515   |
|                                          | PK       | 0.4                       | 0.4   | 0.5   | 0.7   | 0.8   | 1.0   | 1.1   | 1.2   | 1.1   | 0.7   | 0.6   | 0.4   | 1.2     |
| 1                                        | EQ5001   | CHILLED WATER PUMP C.V.   |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 20035                     | 18096 | 22719 | 23862 | 26199 | 25354 | 26199 | 26199 | 25354 | 24210 | 21874 | 21576 | 281,676 |
|                                          | PK       | 49.7                      | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7    |
| 1                                        | EQ5010   | CONDENSER WATER PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 10017                     | 9048  | 11360 | 11931 | 13099 | 12677 | 13099 | 13099 | 12677 | 12105 | 10937 | 10788 | 140,838 |
|                                          | PK       | 24.9                      | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9    |
|                                          | EQ5300   | CONTROL PANEL & INTERLOCK |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|          |                            |       |        |        |        |        |        |        |        |        |        |        |           |
|----------|----------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
| ELEC     | 403                        | 364   | 457    | 480    | 527    | 510    | 527    | 527    | 510    | 487    | 440    | 434    | 5,666     |
| PK       | 1.0                        | 1.0   | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0       |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 107777                     | 97349 | 107949 | 105689 | 111322 | 108000 | 111600 | 111600 | 108000 | 108465 | 104950 | 108038 | 1,290,740 |
| PK       | 150.0                      | 150.0 | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0     |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 0                          | 0     | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
| PK       | 0.0                        | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 1 EQ2001 | GAS FIRE TUBE HOT WATER    |       |        |        |        |        |        |        |        |        |        |        |           |
| GAS      | 1197                       | 1060  | 299    | 15     | 0      | 0      | 0      | 0      | 0      | 183    | 307    | 830    | 3,890     |
| PK       | 7.1                        | 6.6   | 3.7    | 0.5    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 2.8    | 3.1    | 5.8    | 7.1       |
| 1 EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 4683                       | 5190  | 2416   | 447    | 0      | 0      | 0      | 0      | 0      | 1312   | 2416   | 4966   | 21,431    |
| PK       | 14.9                       | 14.9  | 14.9   | 14.9   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 14.9   | 14.9   | 14.9   | 14.9      |
| 1 EQ5240 | BOILER FORCED DRAFT FAN    |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 493                        | 547   | 255    | 47     | 0      | 0      | 0      | 0      | 0      | 138    | 255    | 523    | 2,258     |
| PK       | 1.6                        | 1.6   | 1.6    | 1.6    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 1.6    | 1.6    | 1.6    | 1.6       |
| 1 EQ5307 | BOILER CONTROLS            |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 157                        | 174   | 81     | 15     | 0      | 0      | 0      | 0      | 0      | 44     | 81     | 167    | 718       |
| PK       | 0.5                        | 0.5   | 0.5    | 0.5    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.5    | 0.5    | 0.5    | 0.5       |



UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        569.3    (kW)  
Yearly Time of Peak 15 (hr)    8 (mo)

Hour 15    Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|------------------------|
|----------------------|------------------------|-----------------------|---------------------------|------------------------|

Cooling Equipment

|   |         |                     |       |       |
|---|---------|---------------------|-------|-------|
| 1 | EQ1001S | 2-STG CTV <555 TONS | 280.6 | 49.29 |
|---|---------|---------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 280.6 | 49.29 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |       |       |
|---|--|------------------------------------|-------|-------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 150.0 | 26.35 |
|---|--|------------------------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 150.0 | 26.35 |
|-----------|--|--|-------|-------|

|       |  |  |     |      |
|-------|--|--|-----|------|
| Total |  |  | 0.0 | 0.00 |
|-------|--|--|-----|------|

Miscellaneous

|        |  |  |       |       |
|--------|--|--|-------|-------|
| Lights |  |  | 138.7 | 24.36 |
|--------|--|--|-------|-------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Base Utilities |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Misc Equipment |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 138.7 | 24.36 |
|-----------|--|--|-------|-------|

|             |  |  |       |        |
|-------------|--|--|-------|--------|
| Grand Total |  |  | 569.3 | 100.00 |
|-------------|--|--|-------|--------|

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TRACE 600 ANALYSIS \*\*  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 13:22: 6 4/17/94  
Dataset Name: 1350E .TH

AIRFLOW - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 21,609                      | 143,714                     | 143,714                     | 143,714                    | 21,609                      | 0                                    | 0                                   |
| Totals           |                | 21,609                      | 143,714                     | 143,714                     | 143,714                    | 21,609                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

|        |        | ----- Cooling ----- |           |           |         | ----- Heating ----- |           |          |          |          |           |            |
|--------|--------|---------------------|-----------|-----------|---------|---------------------|-----------|----------|----------|----------|-----------|------------|
|        |        | Main Sys.           | Aux. Sys. | Opt. Vent | Cooling | Main Sys.           | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |
| System | System | Capacity            | Capacity  | Capacity  | Totals  | Capacity            | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |
| Number | Type   | (Tons)              | (Tons)    | (Tons)    | (Tons)  | (Btuh)              | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |
| 1      | VTCV   | 365.1               | 0.0       | 0.0       | 365.1   | -1,570,993          | 0         | 0        | 0        | 0        | 0         | -1,570,993 |
| Totals |        | 365.1               | 0.0       | 0.0       | 365.1   | -1,570,993          | 0         | 0        | 0        | 0        | 0         | -1,570,993 |

The building peaked at hour 14 month 8 with a capacity of 363.5 tons

ENGINEERING CHECKS - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 15.04                     | 0.80          | 393.6       | 493.2         | 24.33          | 0.80          | -8.72          | 180,075             |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK ***** |           |          |           |        |   | CLG SPACE PEAK ***** |        |   | ***** HEATING COIL PEAK ***** |            |        |
|-------------------------------|-----------|----------|-----------|--------|---|----------------------|--------|---|-------------------------------|------------|--------|
| Peak at Time ==>              |           |          |           |        |   | Mo/Hr: 7/16          |        |   | Mo/Hr: 13/ 1                  |            |        |
| Outside Air ==>               |           |          |           |        |   | OADB: 96             |        |   | OADB: 30                      |            |        |
| Space                         | Ret. Air  | Ret. Air | Net       | Percnt |   | Space                | Percnt |   | Space Peak                    | Coil Peak  | Percnt |
| Sens.+Lat.                    | Sensible  | Latent   | Total     | Of Tot |   | Sensible             | Of Tot |   | Space Sens                    | Tot Sens   | Of Tot |
| (Btuh)                        | (Btuh)    | (Btuh)   | (Btuh)    | (%)    |   | (Btuh)               | (%)    |   | (Btuh)                        | (Btuh)     | (%)    |
| Envelope Loads                |           |          |           |        |   |                      |        |   |                               |            |        |
| Skylite Solr                  | 0         | 0        | 0         | 0.00   | * | 0                    | 0.00   | * | 0                             | 0          | 0.00   |
| Skylite Cond                  | 0         | 0        | 0         | 0.00   | * | 0                    | 0.00   | * | 0                             | 0          | 0.00   |
| Roof Cond                     | 0         | 220,832  | 220,832   | 5.04   | * | 0                    | 0.00   | * | 0                             | -163,481   | 10.41  |
| Glass Solar                   | 162,068   | 0        | 162,068   | 3.70   | * | 221,235              | 8.84   | * | 0                             | 0          | 0.00   |
| Glass Cond                    | 93,257    | 0        | 93,257    | 2.13   | * | 82,137               | 3.28   | * | -290,011                      | -290,011   | 18.46  |
| Wall Cond                     | 56,439    | 25,537   | 81,976    | 1.87   | * | 60,010               | 2.40   | * | -139,356                      | -207,989   | 13.24  |
| Partition                     | 0         | 0        | 0         | 0.00   | * | 0                    | 0.00   | * | 0                             | 0          | 0.00   |
| Exposed Floor                 | 0         | 0        | 0         | 0.00   | * | 0                    | 0.00   | * | 0                             | 0          | 0.00   |
| Infiltration                  | 0         | 0        | 0         | 0.00   | * | 0                    | 0.00   | * | -1                            | -1         | 0.00   |
| Sub Total==>                  | 311,764   | 246,368  | 558,133   | 12.74  | * | 363,382              | 14.52  | * | -429,368                      | -661,482   | 42.11  |
| Internal Loads                |           |          |           |        |   |                      |        |   |                               |            |        |
| Lights                        | 278,822   | 119,495  | 398,318   | 9.09   | * | 287,453              | 11.48  | * | 0                             | 0          | 0.00   |
| People                        | 690,834   |          | 690,834   | 15.77  | * | 333,615              | 13.33  | * | 0                             | 0          | 0.00   |
| Misc                          | 832,176   | 0        | 832,176   | 18.99  | * | 849,625              | 33.95  | * | 0                             | 0          | 0.00   |
| Sub Total==>                  | 1,801,833 | 119,495  | 1,921,328 | 43.85  | * | 1,470,692            | 58.76  | * | 0                             | 0          | 0.00   |
| Ceiling Load                  | 98,335    | -98,335  | 0         | 0.00   | * | 121,227              | 4.84   | * | -62,317                       | 0          | 0.00   |
| Outside Air                   | 0         | 0        | 1,139,235 | 26.00  | * | 0                    | 0.00   | * | 0                             | -935,041   | 59.52  |
| Sup. Fan Heat                 |           |          | 255,492   | 5.83   | * |                      | 0.00   | * |                               | 0          | 0.00   |
| Ret. Fan Heat                 |           | 0        | 0         | 0.00   | * |                      | 0.00   | * |                               | 0          | 0.00   |
| Duct Heat Pkup                |           | 0        | 0         | 0.00   | * |                      | 0.00   | * |                               | 0          | 0.00   |
| OV/UNDR Sizing                | 547,630   |          | 547,630   | 12.50  | * | 547,630              | 21.88  | * | 0                             | 0          | 0.00   |
| Exhaust Heat                  |           | -40,287  | -40,287   | -0.92  | * |                      | 0.00   | * |                               | 25,531     | -1.63  |
| Terminal Bypass               |           | 0        | 0         | 0.00   | * |                      | 0.00   | * |                               | 0          | 0.00   |
| Grand Total==>                | 2,759,562 | 227,242  | 4,381,532 | 100.00 | * | 2,502,932            | 100.00 | * | -491,686                      | -1,570,992 | 100.00 |

| -----COOLING COIL SELECTION----- |                |         |           |            |                   |       |        |                  |       |        | -----AREAS----- |  |            |     |
|----------------------------------|----------------|---------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|-----------------|--|------------|-----|
|                                  | Total Capacity |         | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     |  | Glass (sf) | (%) |
|                                  | (Tons)         | (Mbh)   | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |  |            |     |
| Main Clg                         | 365.1          | 4,381.5 | 3,281.2   | 143,714    | 82.1              | 68.0  | 83.4   | 60.3             | 58.6  | 73.5   | 180,075         |  |            |     |
| Aux Clg                          | 0.0            | 0.0     | 0.0       | 0          | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0               |  |            |     |
| Opt Vent                         | 0.0            | 0.0     | 0.0       | 0          | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0               |  |            |     |
| Totals                           | 365.1          | 4,381.5 |           |            |                   |       |        |                  |       |        |                 |  |            |     |
|                                  |                |         |           |            |                   |       |        |                  |       |        | 60,025          |  | 0          | 0   |
|                                  |                |         |           |            |                   |       |        |                  |       |        | 41,160          |  | 6,174      | 15  |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------|--------|-----------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA               | 15.0   | Type                  | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     | 21,609  | 21,609  | Clg Cfm/Sqft           | 0.80   | SADB                  | 61.9 | 73.2 |
| Main Htg                         | -1,571.0 | 143,714    | 63.1  | 73.2  | Infil                    | 0       | 0       | Clg Cfm/Ton            | 393.60 | Plenum                | 79.7 | 68.9 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 143,714 | 143,714 | Clg Sqft/Ton           | 493.18 | Return                | 79.7 | 68.9 |
| Preheat                          | -0.0     | 143,714    | 63.1  | 60.3  | Mincfm                   | 0       | 0       | Clg Btuh/Sqft          | 24.33  | Ret/OA                | 82.1 | 63.1 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 143,714 | 143,714 | No. People             | 1,441  | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 21,609  | 21,609  | Htg % OA               | 15.0   | Fn MtrTD              | 0.4  | 0.4  |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 0       | 0       | Htg Cfm/Sqft           | 0.80   | Fn BldTD              | 0.3  | 0.3  |
| Total                            | -1,571.0 |            |       |       | Auxil                    | 0       | 0       | Htg Btuh/Sqft          | -8.72  | Fn Frict              | 0.9  | 0.9  |

MAIN SYSTEM COOLING - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

PEAK COOLING LOADS  
(Main System)

| Room<br>Number | Description   | Space                 |                             |                         |                             |                               |                                  |                                 | Coil                  |                             |                         |                             |                              |                                 |                                |
|----------------|---------------|-----------------------|-----------------------------|-------------------------|-----------------------------|-------------------------------|----------------------------------|---------------------------------|-----------------------|-----------------------------|-------------------------|-----------------------------|------------------------------|---------------------------------|--------------------------------|
|                |               | Peak<br>Time<br>Mo/Hr | QA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Space<br>Air<br>Flow<br>(Cfm) | Space<br>Sens.<br>Load<br>(Btuh) | Space<br>Lat.<br>Load<br>(Btuh) | Peak<br>Time<br>Mo/Hr | QA<br>Cond.<br>DB/WB<br>(F) | Rm<br>Dry<br>Blb<br>(F) | Supp.<br>Dry<br>Bulb<br>(F) | Coil<br>Air<br>Flow<br>(Cfm) | Coil<br>Sens.<br>Load<br>(Btuh) | Coil<br>Lat.<br>Load<br>(Btuh) |
| 1              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 1 Total/Ave.  |                       | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           |                       | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 1 Block       | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| 2              | FIRST FLOOR   | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           | 8/12                  | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 2 Total/Ave.  |                       | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           |                       | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 2 Block       | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           | 8/12                  | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| 3              | FIRST FLOOR   | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 3 Total/Ave.  |                       | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           |                       | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 3 Block       | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| 4              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 4 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           |                       | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 4 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| 5              | FIRST FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 5 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          |                       | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 5 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| 6              | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 6 Total/Ave.  |                       | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           |                       | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| Zone           | 6 Block       | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 58,467                          | 21,670                         |
| 7              | SECOND FLOOR  | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           | 8/12                  | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 7 Total/Ave.  |                       | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           |                       | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| Zone           | 7 Block       | 7/11                  | 89 77                       | 78                      | 61.7                        | 3,529                         | 62,320                           | 7,038                           | 8/12                  | 91 79                       | 78                      | 62.2                        | 3,529                        | 74,713                          | 23,641                         |
| 8              | SECOND FLOOR  | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 8 Total/Ave.  |                       | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           |                       | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| Zone           | 8 Block       | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,379                         | 59,683                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,379                        | 68,324                          | 21,670                         |
| 9              | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 9 Total/Ave.  |                       | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           |                       | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| Zone           | 9 Block       | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 73,649                          | 19,662                         |
| 10             | SECOND FLOOR  | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 10 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          |                       | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| Zone           | 10 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.4                        | 34,669                       | 746,836                         | 280,776                        |
| 11             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 71,091                          | 21,670                         |
| Zone           | 11 Total/Ave. |                       | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           |                       | 96 79                       | 78                      | 62.3                        | 2,654                        | 71,091                          | 21,670                         |
| Zone           | 11 Block      | 7/16                  | 96 75                       | 78                      | 61.0                        | 2,654                         | 48,802                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.3                        | 2,654                        | 71,091                          | 21,670                         |
| 12             | THIRD FLOOR   | 7/12                  | 92 78                       | 78                      | 61.8                        | 3,541                         | 62,110                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.9                        | 3,541                        | 86,598                          | 21,670                         |
| Zone           | 12 Total/Ave. |                       | 92 78                       | 78                      | 61.8                        | 3,541                         | 62,110                           | 7,038                           |                       | 96 79                       | 78                      | 62.9                        | 3,541                        | 86,598                          | 21,670                         |
| Zone           | 12 Block      | 7/12                  | 92 78                       | 78                      | 61.8                        | 3,541                         | 62,110                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 62.9                        | 3,541                        | 86,598                          | 21,670                         |
| 13             | THIRD FLOOR   | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,384                         | 59,753                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,384                        | 80,958                          | 21,670                         |
| Zone           | 13 Total/Ave. |                       | 89 75                       | 78                      | 61.7                        | 3,384                         | 59,753                           | 7,038                           |                       | 96 79                       | 78                      | 63.5                        | 3,384                        | 80,958                          | 21,670                         |
| Zone           | 13 Block      | 9/15                  | 89 75                       | 78                      | 61.7                        | 3,384                         | 59,753                           | 7,038                           | 8/14                  | 96 79                       | 78                      | 63.5                        | 3,384                        | 80,958                          | 21,670                         |
| 14             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 88,493                          | 19,662                         |
| Zone           | 14 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           |                       | 96 78                       | 78                      | 63.6                        | 3,668                        | 88,493                          | 19,662                         |
| Zone           | 14 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 3,668                         | 63,494                           | 7,038                           | 8/15                  | 96 78                       | 78                      | 63.6                        | 3,668                        | 88,493                          | 19,662                         |
| 15             | THIRD FLOOR   | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.5                        | 34,669                       | 910,130                         | 280,776                        |
| Zone           | 15 Total/Ave. |                       | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          |                       | 96 79                       | 78                      | 62.5                        | 34,669                       | 910,130                         | 280,776                        |
| Zone           | 15 Block      | 7/16                  | 96 75                       | 78                      | 62.0                        | 34,669                        | 600,059                          | 94,299                          | 8/14                  | 96 79                       | 78                      | 62.5                        | 34,669                       | 910,130                         | 280,776                        |
| System         | 1 Total/Ave.  |                       | 96 75                       | 78                      | 61.9                        | 143,714                       | 2,502,932                        | 367,353                         |                       | 96 79                       | 78                      | 62.6                        | 143,714                      | 3,281,247                       | 1,100,285                      |
| System         | 1 Block       | 7/16                  | 96 75                       | 78                      | 62.2                        | 143,714                       | 2,460,781                        | 367,353                         | 8/14                  | 96 79                       | 78                      | 62.8                        | 143,714                      | 3,259,253                       | 1,102,256                      |

BUILDING AREAS - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

BUILDING AREAS

| Room<br>Number | Description   | Number of<br>Duplicate<br>Flr | Rm | Floor<br>Area/Dupl<br>Room<br>(sqft) | Total<br>Floor<br>Area<br>(sqft) | Partition<br>Area<br>(sqft) | Exposed<br>Floor<br>Area<br>(sqft) | Skylight<br>Area<br>(sqft) | Skl<br>/Rf<br>(%) | Net Roof<br>Area<br>(sqft) | Window<br>Area<br>(sqft) | Win<br>/Wl<br>(%) | Net Wall<br>Area<br>(sqft) |
|----------------|---------------|-------------------------------|----|--------------------------------------|----------------------------------|-----------------------------|------------------------------------|----------------------------|-------------------|----------------------------|--------------------------|-------------------|----------------------------|
| 1              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 1 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 2              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 2 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 3              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 3 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 4              | FIRST FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 4 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 5              | FIRST FLOOR   | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 5 Total/Ave.  |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 6              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 6 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 7              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 7 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 8              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 8 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 9              | SECOND FLOOR  | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| Zone           | 9 Total/Ave.  |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 0                          | 515                      | 15                | 2,915                      |
| 10             | SECOND FLOOR  | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| Zone           | 10 Total/Ave. |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 0                          | 0                        | 0                 | 0                          |
| 11             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 11 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 12             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 12 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 13             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 13 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 14             | THIRD FLOOR   | 1                             | 1  | 3,450                                | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| Zone           | 14 Total/Ave. |                               |    |                                      | 3,450                            | 0                           | 0                                  | 0                          | 0                 | 3,450                      | 515                      | 15                | 2,915                      |
| 15             | THIRD FLOOR   | 1                             | 1  | 46,225                               | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| Zone           | 15 Total/Ave. |                               |    |                                      | 46,225                           | 0                           | 0                                  | 0                          | 0                 | 46,225                     | 0                        | 0                 | 0                          |
| System         | 1 Total/Ave.  |                               |    |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |
| Building       |               |                               |    |                                      | 180,075                          | 0                           | 0                                  | 0                          | 0                 | 60,025                     | 6,174                    | 15                | 34,986                     |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 G1) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 213,436                  | 449                       | 1,197                     | 89                 | 7                                |
| Feb   | 186,586                  | 422                       | 1,060                     | 74                 | 7                                |
| March | 225,585                  | 463                       | 299                       | 132                | 4                                |
| April | 232,368                  | 485                       | 15                        | 194                | 1                                |
| May   | 253,165                  | 500                       | 0                         | 259                | 0                                |
| June  | 249,870                  | 509                       | 0                         | 291                | 0                                |
| July  | 263,564                  | 518                       | 0                         | 341                | 0                                |
| Aug   | 264,627                  | 525                       | 0                         | 346                | 0                                |
| Sept  | 250,412                  | 512                       | 0                         | 288                | 0                                |
| Oct   | 235,338                  | 482                       | 183                       | 175                | 3                                |
| Nov   | 221,779                  | 469                       | 307                       | 132                | 3                                |
| Dec   | 217,370                  | 455                       | 830                       | 88                 | 6                                |
| Total | 2,814,098                | 525                       | 3,890                     | 2,407              | 7                                |

Building Energy Consumption = 55,496 (Btu/Sq Ft/Year)  
Source Energy Consumption = 162,299 (Btu/Sq Ft/Year)

Floor Area = 180,075 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3

EQUIPMENT ENERGY CONSUMPTION

| Ref<br>Num | Equip<br>Code | Monthly Consumption       |       |       |       |       |       |       |       |       |       |       |       | Total   |
|------------|---------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|            |               | Jan                       | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0          | LIGHTS        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 47282                     | 42707 | 47282 | 45757 | 47282 | 45757 | 47282 | 47282 | 45757 | 47282 | 45757 | 47282 | 556,711 |
|            | PK            | 138.7                     | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7 | 138.7   |
| 1          | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2          | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | GAS           | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3          | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | OIL           | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4          | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P STEAM       | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|            | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P HOTH2O      | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6          | MISC LD       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P CHILL       | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1          | EQ1001S       |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | 2-STG CTV <555 TONS       |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 15363                     | 13068 | 20680 | 28155 | 37187 | 40590 | 47308 | 48371 | 41132 | 25077 | 20418 | 15338 | 352,684 |
|            | PK            | 51.6                      | 53.8  | 65.4  | 87.6  | 102.5 | 118.8 | 140.1 | 149.3 | 137.3 | 84.9  | 71.5  | 57.0  | 149.3   |
| 1          | EQ5100        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 7226                      | 44    | 12387 | 15983 | 17548 | 16982 | 17548 | 17548 | 16982 | 16216 | 14651 | 8258  | 161,375 |
|            | PK            | 33.3                      | 3.8   | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3  | 33.3    |
| 1          | EQ5100        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|            | WATER         | 89                        | 74    | 132   | 194   | 259   | 291   | 341   | 346   | 288   | 175   | 132   | 88    | 2,407   |
|            | PK            | 0.4                       | 0.4   | 0.5   | 0.7   | 0.8   | 0.9   | 1.1   | 1.1   | 1.1   | 0.7   | 0.6   | 0.4   | 1.1     |
| 1          | EQ5001        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | CHILLED WATER PUMP C.V.   |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 20035                     | 18096 | 22719 | 23862 | 26199 | 25354 | 26199 | 26199 | 25354 | 24210 | 21874 | 21576 | 281,676 |
|            | PK            | 49.7                      | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7  | 49.7    |
| 1          | EQ5010        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | CONDENSER WATER PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 10017                     | 9048  | 11360 | 11931 | 13099 | 12677 | 13099 | 13099 | 12677 | 12105 | 10937 | 10788 | 140,838 |
|            | PK            | 24.9                      | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9    |
|            | EQ5300        |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            |               | CONTROL PANEL & INTERLOCK |       |       |       |       |       |       |       |       |       |       |       |         |



EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3

|          |                            |       |        |        |        |        |        |        |        |        |        |        |           |
|----------|----------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
| ELEC     | 403                        | 364   | 457    | 480    | 527    | 510    | 527    | 527    | 510    | 487    | 440    | 434    | 5,666     |
| PK       | 1.0                        | 1.0   | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0       |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 107777                     | 97349 | 107949 | 105689 | 111322 | 108000 | 111600 | 111600 | 108000 | 108465 | 104950 | 108038 | 1,290,740 |
| PK       | 150.0                      | 150.0 | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0  | 150.0     |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 0                          | 0     | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
| PK       | 0.0                        | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 1 EQ2001 | GAS FIRE TUBE HOT WATER    |       |        |        |        |        |        |        |        |        |        |        |           |
| GAS      | 1197                       | 1060  | 299    | 15     | 0      | 0      | 0      | 0      | 0      | 183    | 307    | 830    | 3,890     |
| PK       | 7.1                        | 6.6   | 3.7    | 0.5    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 2.8    | 3.1    | 5.8    | 7.1       |
| 1 EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 4683                       | 5190  | 2416   | 447    | 0      | 0      | 0      | 0      | 0      | 1312   | 2416   | 4966   | 21,431    |
| PK       | 14.9                       | 14.9  | 14.9   | 14.9   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 14.9   | 14.9   | 14.9   | 14.9      |
| 1 EQ5240 | BOILER FORCED DRAFT FAN    |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 493                        | 547   | 255    | 47     | 0      | 0      | 0      | 0      | 0      | 138    | 255    | 523    | 2,258     |
| PK       | 1.6                        | 1.6   | 1.6    | 1.6    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 1.6    | 1.6    | 1.6    | 1.6       |
| 1 EQ5307 | BOILER CONTROLS            |       |        |        |        |        |        |        |        |        |        |        |           |
| ELEC     | 157                        | 174   | 81     | 15     | 0      | 0      | 0      | 0      | 0      | 44     | 81     | 167    | 718       |
| PK       | 0.5                        | 0.5   | 0.5    | 0.5    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.5    | 0.5    | 0.5    | 0.5       |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

----- UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 524.7 (kW)  
Yearly Time of Peak 15 (hr) 8 (mo)

Hour 15 Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description              | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|------------------------------------|---------------------------|------------------------|
| Cooling Equipment    |                        |                                    |                           |                        |
| 1                    | EQ1001S                | 2-STG CTV <555 TONS                | 236.0                     | 44.98                  |
| Sub Total            |                        |                                    | 236.0                     | 44.98                  |
| Sub Total            |                        |                                    | 0.0                       | 0.00                   |
| Air Moving Equipment |                        |                                    |                           |                        |
| 1                    |                        | SUMMATION OF FAN ELECTRICAL DEMAND | 150.0                     | 28.59                  |
| Sub Total            |                        |                                    | 150.0                     | 28.59                  |
| Total                |                        |                                    | 0.0                       | 0.00                   |
| Miscellaneous        |                        |                                    |                           |                        |
|                      | Lights                 |                                    | 138.7                     | 26.43                  |
|                      | Base Utilities         |                                    | 0.0                       | 0.00                   |
|                      | Misc Equipment         |                                    | 0.0                       | 0.00                   |
| Sub Total            |                        |                                    | 138.7                     | 26.43                  |
| Grand Total          |                        |                                    | 524.7                     | 100.00                 |

## CARTER & BURGESS COST ESTIMATING ANALYSIS

**PROJECT NAME: FORT SAM HOUSTON EEAP**

PROJECT NO: 91109912F

**PROJECT LOCATION: SAN ANTONIO, TEXAS**

ESTIMATOR: S.P. CLARK

|                   |              |
|-------------------|--------------|
| <b>SUBMITTAL:</b> | <b>35.0%</b> |
|-------------------|--------------|

DATE: 26-Oct-93

ECO NO/ BUILDING: IV. D. 1) / BLDG 1350

CHECKED BY: DJY

[illegible]



# Carter & Burgess

Consultants in Engineering, Architecture,  
Planning and the Environment

## TELEPHONE REPORT

**PROJECT:** Ft. Sam Houston EEAP

**PROJECT NO:** 91109912F

**FROM:** Glen

**WITH:** Carrier

**DATE:** 10/11/93

**TO:** Scott Clark

**WITH:** Carter & Burgess

**TIME:** 4:30 pm

**PHONE NO.:** 735-6038

The following is our understanding of the subject matter covered in this conversation. If this differs from your understanding, please notify us within (5) working days.

The efficiency data for the carrier chiller, model number 19DK7894CP, in Bldg 1350 is as follows:

A. Date installed 1986, 460V/3 $\phi$ /421 FLA/302 KW 438 tons at 70 GPM chilled water and 56°F ENT/42°F LVG, 2-pass condenser with 1314 GPM at 85°F ENT/94.6°F LVG.

- .690 KW/ton (new)
- derate at 0.5%/year or .715 KW/ton

**REPORTED BY:** Scott P. Clark

SPC/rer  
91109912.T2

c: Correspondence

TRANE

BLDG 1350

Ft Worth Office  
Dallas District  
The Trane Company

6320 Airport Freeway  
Ft Worth TX 76117  
TEL 817 838 1300  
FAX 817 831 8135

Jerry Gray  
District Manager  
Commercial Sales

FAX TRANSMITTAL COVER SHEET

TO: Scott Clark

FAX NUMBER: 735-6064

FROM: Scott Wenaas

FAX NUMBER: 817-831-8135

DATE: Oct 21 '93

NO. OF PAGES: 5  
(INCLUDING COVER SHEET)

NOTE:

Fort Sam Houston

Chiller Selections

#1 438 tons @ .534 kW/ton

#2 438 tons @ .580 kW/ton

IF YOU DO NOT RECEIVE ALL PAGES OR HAVE ANY QUESTIONS REGARDING THIS FAX  
PLEASE CALL ME AT 817-838-1305

PROJECT : FORT SAM HOUSTON  
 LOCATION : SAN ANTONIO, TEXAS  
 BLDG. OWNER :  
 PROGRAM USER : SCOTT WENAAS  
 COMMENTS : SCOTT CLARK - CARTER & BURGESS  
 MACHINE : CVHE

TECU 28

TECU 28

## \*\*\*\*\* INPUT CONDITIONS \*\*\*\*\*

|                    |       |                    |       |
|--------------------|-------|--------------------|-------|
| DESIGN DUTY        | 438   |                    |       |
| EXITING EVAP TEMP  | 42    | ENTERING COND TEMP | 85    |
| EVAP FLOW RATE     |       | COND FLOW RATE     | 1314  |
| ENTERING EVAP TEMP | 56    | EXITING COND TEMP  |       |
| EVAPORATOR PASSES  | 2     | CONDENSER PASSES   | 2     |
| FLUID TYPE         | WATER | FLUID TYPE         | WATER |
| FLUID %            | 0     | FLUID %            | 0     |
| VOLTAGE            | 460   |                    |       |
| FREQUENCY          | 60    |                    |       |
| REFRIGERANT        | 123   |                    |       |

*Inlet Vane Deg 87*

## \*\*\*\*\* OUTPUT DATA \*\*\*\*\*

NOTE - PERFORMANCE CERTIFIED IN ACCORDANCE WITH ARI STANDARD 550-92

NOTE - SOUND PRESSURE MEASURED IN ACCORDANCE WITH ARI STANDARD 575-87.

| %LOAD                  |      | 100%    | 75%   | 50%   | 25%   |
|------------------------|------|---------|-------|-------|-------|
| DESIGN DUTY            | TONS | 438     | 329   | 219   | 110   |
| POWER CONSUMED         | KW   | 254     | 186   | 129   | 78    |
| KW PER DESIGN DUTY     |      | 0.580   | 0.566 | 0.589 | 0.712 |
| EXIT EVAP TEMP         | F    | 42.00   | 42.00 | 42.00 | 42.00 |
| EVAP FLOW RATE         | GPM  | 750.9   |       |       |       |
| ENTERING EVAP TEMP     | F    | 56.00   |       |       |       |
| EVAP PD (NON-MAR)      | FEET | 13.12   |       |       |       |
| EVAP PD (MARINE)       | FEET | 13.48   |       |       |       |
| EVAP FOULING FACTOR    |      | 0.00025 |       |       |       |
| FLUID TYPE AND %       |      | WATER 0 |       |       |       |
| ENTERING COND TEMP     | F    | 85.00   | 78.75 | 72.50 | 66.25 |
| COND FLOW RATE         | GPM  | 1314.0  |       |       |       |
| EXIT COND TEMP         | F    | 94.37   |       |       |       |
| COND PD (NON-MAR)      | FEET | 34.06   |       |       |       |
| COND PD (MARINE)       | FEET | 35.20   |       |       |       |
| COND FOULING FACTOR    |      | 0.00025 |       |       |       |
| FLUID TYPE AND %       |      | WATER 0 |       |       |       |
| MAX LRA AT MOTOR KW    | AMPS | 2363    |       |       |       |
| RLA AT MOTOR KW        | AMPS | 409     |       |       |       |
| RLA AT SELECTION KW    | AMPS | 362     |       |       |       |
| MAXIMUM SOUND PRESSURE | dba  | 79      |       |       |       |
| REFRIGERANT CHARGE     | LBS  | 1000    |       |       |       |
| SHIP WT. (W/NMAR WB.)  | LBS  | 17074   |       |       |       |
| OPER WT. (W/NMAR WB.)  | LBS  | 19688   |       |       |       |

*Budget Price**\$109,500*

|           |          |           |          |           |          |          |
|-----------|----------|-----------|----------|-----------|----------|----------|
| 1-CVHE    | nton-500 | volt-460  | hrtz-60  | type-SNGL | cpkw-287 | cpim-228 |
| evtm-TECU | evth-28  | evsz-050L | evbs-500 | evwp-2    | orsz-560 | refg-123 |
| cdtm-TECU | cdth-28  | cdsz-050L | cdbS-500 | cdwp-2    | cdty-STD |          |

|           |          |           |          |           |          |          |
|-----------|----------|-----------|----------|-----------|----------|----------|
| modl-CVHE | nton-500 | volt-460  | hrtz-60  | type-SNGL | cpkw-287 | cpim-228 |
| evtm-TECU | evth-28  | evsz-050L | evbs-500 | evwp-2    | orsz-560 | refg-123 |
| cdtm-TECU | cdth-28  | cdsz-050L | cdbb-500 | cdwp-2    | cdty-STD |          |

| PERCENT | TONS | EX | EVAP | ENT | EVAP | ENT | COND | EX | COND | KW  | KW/TON |
|---------|------|----|------|-----|------|-----|------|----|------|-----|--------|
| 100     | 438  |    | 42.0 |     | 56.0 |     | 85.0 |    | 94.4 | 254 | 0.580  |
| 90      | 394  |    | 42.0 |     | 54.6 |     | 82.5 |    | 90.9 | 221 | 0.561  |
| 80      | 350  |    | 42.0 |     | 53.2 |     | 80.0 |    | 87.4 | 197 | 0.562  |
| 70      | 307  |    | 42.0 |     | 51.8 |     | 77.5 |    | 84.0 | 174 | 0.568  |
| 60      | 263  |    | 42.0 |     | 50.4 |     | 75.0 |    | 80.6 | 151 | 0.575  |
| 50      | 219  |    | 42.0 |     | 49.0 |     | 72.5 |    | 77.2 | 129 | 0.589  |
| 40      | 175  |    | 42.0 |     | 47.6 |     | 70.0 |    | 73.8 | 109 | 0.622  |
| 30      | 131  |    | 42.0 |     | 46.2 |     | 67.5 |    | 70.4 | 89  | 0.677  |
| 20      | 88   |    | 42.0 |     | 44.8 |     | 65.0 |    | 67.0 | 68  | 0.776  |
| 15      | 66   |    | 42.0 |     | 44.1 |     | 63.8 |    | 65.3 | 58  | 0.883  |

APLV VALUE = 0.589

PERFORMANCE TESTS AT PART LOAD MAY ONLY BE QUOTED FROM THE SELECTION PROGRAM.  
25% LOAD IS THE MINIMUM ARI 550 TEST POINT.

Esc-quit

.580 kw/ton  
machine

# TRANE CENTRAVAC SELECTION PROGRAM

Rev Level 55014

Version 13.09  
Thu Oct 21, 1993

PROJECT : FORT SAM HOUSTON  
LOCATION : SAN ANTONIO, TEXAS  
BUDG. OWNER :  
PROGRAM USER : SCOTT WENAAS  
COMMENTS : SCOTT CLARK - CARTER & BURGESS  
MACHINE : CVHE

TECU 28

TECU 28

## \*\*\*\*\* INPUT CONDITIONS \*\*\*\*\*

|                    |       |                    |       |
|--------------------|-------|--------------------|-------|
| DESIGN DUTY        | 438   |                    |       |
| EXITING EVAP TEMP  | 42    | ENTERING COND TEMP | 85    |
| EVAP FLOW RATE     |       | COND FLOW RATE     | 1314  |
| ENTERING EVAP TEMP | 56    | EXITING COND TEMP  |       |
| EVAPORATOR PASSES  | 2     | CONDENSER PASSES   | 2     |
| FLUID TYPE         | WATER | FLUID TYPE         | WATER |
| FLUID %            | 0     | FLUID %            | 0     |
| VOLTAGE            | 460   |                    |       |
| FREQUENCY          | 60    |                    |       |
| REFRIGERANT        | 123   |                    |       |

Inlet Vane Deg 55

## \*\*\*\*\* OUTPUT DATA \*\*\*\*\*

NOTE - PERFORMANCE CERTIFIED IN ACCORDANCE WITH ARI STANDARD 550-92

NOTE - SOUND PRESSURE MEASURED IN ACCORDANCE WITH ARI STANDARD 575-87.

| %LOAD                  |      | 100%    | 75%   | 50%   | 25%   |
|------------------------|------|---------|-------|-------|-------|
| DESIGN DUTY            | TONS | 438     | 329   | 219   | 110   |
| POWER CONSUMED         | KW   | 234     | 175   | 123   | 74    |
| PER DESIGN DUTY        |      | 0.534   | 0.533 | 0.562 | 0.676 |
| EV                     |      | 0.555   |       |       |       |
| EXIT EVAP TEMP         | F    | 42.00   | 42.00 | 42.00 | 42.00 |
| EVAP FLOW RATE         | GPM  | 750.9   |       |       |       |
| ENTERING EVAP TEMP     | F    | 56.00   |       |       |       |
| EVAP PD (NON-MAR)      | FEET | 6.63    |       |       |       |
| EVAP PD (MARINE)       | FEET | 6.74    |       |       |       |
| EVAP FOULING FACTOR    |      | 0.00025 |       |       |       |
| FLUID TYPE AND %       |      | WATER 0 |       |       |       |
| ENTERING COND TEMP     | F    | 85.00   | 78.75 | 72.50 | 66.25 |
| COND FLOW RATE         | GPM  | 1314.0  |       |       |       |
| EXIT COND TEMP         | F    | 94.28   |       |       |       |
| COND PD (NON-MAR)      | FEET | 15.25   |       |       |       |
| COND PD (MARINE)       | FEET | 15.71   |       |       |       |
| COND FOULING FACTOR    |      | 0.00025 |       |       |       |
| FLUID TYPE AND %       |      | WATER 0 |       |       |       |
| MAX LRA AT MOTOR KW    | AMPS | 3336    |       |       |       |
| RLA AT MOTOR KW        | AMPS | 449     |       |       |       |
| RLA AT SELECTION KW    | AMPS | 325     |       |       |       |
| MAXIMUM SOUND PRESSURE | dba  | 82      |       |       |       |
| REFRIGERANT CHARGE     | LBS  | 1450    |       |       |       |
| SHIP WT. (W/NMAR WB.)  | LBS  | 24204   |       |       |       |
| R WT. (W/NMAR WB.)     | LBS  | 28175   |       |       |       |

Budget Price

\$139,000-

|           |          |           |          |           |          |          |
|-----------|----------|-----------|----------|-----------|----------|----------|
| modl-CVHE | nton-560 | volt-460  | hrtz-60  | type-SNGL | cpkw-323 | cpim-230 |
| evtm-TECU | evth-28  | evsz-080L | evbs-710 | evwp-2    | orsz-500 | refg-123 |
| cdtm-TECU | cdth-28  | cdsz-080L | cdbs-800 | cdwp-2    | cdty-STD |          |



modl-CVHE nton-560 volt-460 hrtz-60 type-SNGL cpkw-323 cpim-230  
 evtm-TECU evth-28 evsz-080L evbs-710 evwp-2 orsz-500 refig-123  
 cdtm-TECU cdth-28 cdsz-080L cdbbs-800 cdwp-2 cdtty-STD

| PERCENT | TONS | EX | EVAP | ENT | EVAP | ENT | COND | EX | COND | KW  | KW/TON |
|---------|------|----|------|-----|------|-----|------|----|------|-----|--------|
| 100     | 438  |    | 42.0 |     | 56.0 |     | 85.0 |    | 94.3 | 234 | 0.534  |
| 90      | 394  |    | 42.0 |     | 54.6 |     | 82.5 |    | 90.8 | 209 | 0.530  |
| 80      | 350  |    | 42.0 |     | 53.2 |     | 80.0 |    | 87.4 | 185 | 0.528  |
| 70      | 307  |    | 42.0 |     | 51.8 |     | 77.5 |    | 84.0 | 163 | 0.532  |
| 60      | 263  |    | 42.0 |     | 50.4 |     | 75.0 |    | 80.6 | 143 | 0.544  |
| 50      | 219  |    | 42.0 |     | 49.0 |     | 72.5 |    | 77.2 | 123 | 0.562  |
| 40      | 175  |    | 42.0 |     | 47.6 |     | 70.0 |    | 73.8 | 104 | 0.594  |
| 30      | 131  |    | 42.0 |     | 46.2 |     | 67.5 |    | 70.4 | 84  | 0.639  |
| 20      | 88   |    | 42.0 |     | 44.8 |     | 65.0 |    | 67.0 | 65  | 0.742  |
| 15      | 66   |    | 42.0 |     | 44.1 |     | 63.8 |    | 65.3 | 55  | 0.837  |

APLV VALUE = 0.555

PERFORMANCE TESTS AT PART LOAD MAY ONLY BE QUOTED FROM THE SELECTION PROGRAM.  
 25% LOAD IS THE MINIMUM ARI 550 TEST POINT.  
 Esc-quit

.534 kw/ton  
machine

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1350 - ECO IV. D. 1) - REPLACE CHILLER W/ HIGHER EFF/CFC FREE CHILLEF  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |           |     |           |
|----------------------------------------|-----------|-----|-----------|
| A. CONSTRUCTION COST                   | \$208,060 |     |           |
| B. SIOH                                | \$11,443  |     |           |
| C. DESIGN COST                         | \$12,484  |     |           |
| D. TOTAL COST (1A+1B+1C)               | \$231,987 |     |           |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |           | \$0 |           |
| F. PUBLIC UTILITY COMPANY REBATE       |           | \$0 |           |
| G. TOTAL INVESTMENT (1D-1E-1F)         |           |     | \$231,987 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 432.6              | \$4,564              | 14.65              | \$66,862              |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 20.60              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$3,520              | 13.59              | \$47,837              |
| N. TOTAL          |                 | 432.6              | \$8,084              |                    | \$114,698             |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |     |  |     |
|---------------------------------------|-----|--|-----|
| A. ANNUAL RECURRING (+/-)             | \$0 |  |     |
| 1. DISCOUNT FACTOR (TABLE A)          |     |  |     |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |     |  | \$0 |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

|    | ITEM    | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----|---------|-----------------------|-------------------|--------------------|---------------------------------|
| a. | N/A     | \$0                   | 1                 | 0.96               | \$0                             |
| b. | N/A     | \$0                   | 2                 | 0.92               | \$0                             |
| c. | N/A     | \$0                   | 3                 | 0.89               | \$0                             |
| d. | N/A     | \$0                   | 4                 | 0.85               | \$0                             |
| e. | N/A     | \$0                   | 5                 | 0.82               | \$0                             |
| f. | N/A     | \$0                   | 6                 | 0.79               | \$0                             |
| g. | N/A     | \$0                   | 7                 | 0.76               | \$0                             |
| h. | N/A     | \$0                   | 8                 | 0.73               | \$0                             |
| i. | N/A     | \$0                   | 9                 | 0.7                | \$0                             |
| j. | N/A     | \$0                   | 10                | 0.68               | \$0                             |
| k. | N/A     | \$0                   | 11                | 0.65               | \$0                             |
| l. | N/A     | \$0                   | 12                | 0.62               | \$0                             |
| m. | N/A     | \$0                   | 13                | 0.6                | \$0                             |
| n. | N/A     | \$0                   | 14                | 0.58               | \$0                             |
| o. | Chiller | \$231,987             | 15                | 0.56               | \$129,913                       |
| p. | TOTAL   | \$231,987             |                   |                    | \$129,913                       |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$129,913

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 11.8 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$244,611

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 1.05

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 4.3%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1350

ECO NO: VII D. & IX C. D.

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>23.724</u>   | KWH/yr |
| Demand Savings:                        | <u>66.98</u>    | KW/yr  |
| Gas Savings:                           | <u>n/a</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 2.783</u> | /yr    |
| Implementation Cost:                   | <u>\$ 9.130</u> |        |
| Simple Payback:                        | <u>3.3</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>3.45</u>     |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting system to improve efficiency while maintaining or increasing lighting levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                      |
|-----|-------------------|---------------------------------------------|
| 191 | 1-Lamp, 4' Fluor. | Retrofit with T8 lamps and elect. ballasts. |
| 4   | 2-Lamp, 4' Fluor. | Retrofit with T8 lamps and elect. ballasts. |
| 24  | 4-Lamp, 4' Fluor. | Retrofit with T8 lamps and elect. ballasts. |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned} \text{Demand Savings} &= 66.98 \text{ KW} \times \left(\frac{4}{12}\right) \times \$7.50/\text{KW} + 66.98 \text{ KW} \times \left(\frac{8}{12}\right) \times \$6.25/\text{KW} \\ &= \$446.53/\text{yr} \end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Total LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Total LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD1350A                | 39444                | 55090                   | 113681                        | 8365                         | 23724                        | 6.728                          | 1.322                              | 8188                     | 6834                          | 98659                          | 503                          | 7259                          |
| *BLD1350B               | 63168                | 0                       | 168771                        | 12418                        | 0                            | 0.000                          | 0.000                              | 0                        | 10760                         | 158011                         | 792                          | 11627                         |

Project Description: FT SAM HOUSTON EEAP

| File Name | Case Description         |
|-----------|--------------------------|
| BLD1350A  | POST RETROFIT CONDITIONS |
| BLD1350B  | EXISTING CONDITIONS      |

=====

Whole Building Summary Report

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350A.WBR  
 Date: 10/16/1993

Lighting Annual : 39444 kWh  
 Lighting Capacity : 9.281 kW  
 Annual Cooling Effect : 55072 kWh  
 Annual Heating Effect : 5635 kWh  
 Total Surveyed Floor Area: 12052 SqFt  
 Percent Survey Completed : 1205200 %  
 Lighting Power Density : 0.770 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| PVLCC \$ | 8188    | 41162  | 6834   | 58464   | -967    | 113681 |
| AVLCC \$ | 602     | 3029   | 503    | 4302    | -71     | 8365   |

=====

| Lighting Level Comparison Report |

=====

Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350A.LLR

Date: 10/16/1993

| Room         |      |      |      |       |           |           |
|--------------|------|------|------|-------|-----------|-----------|
| Foot Candles | MAX  | MIN  | AVG  | SDEV  | MAX Room  | MIN Room  |
| Calculated   | 30.9 | 4.9  | 15.0 | 8.15  | 4-serving | 7-kitchen |
| Measured     | 30.7 | 0.0  | 17.4 | 9.67  | 4-serving | 9-office  |
| Required     | 75.0 | 10.0 | 40.9 | 19.70 | 4-serving | 2-stor    |

| Foot Candle Comparison | MAX  | MIN   | AVG   | SDEV  | MAX Room | MIN Room  |
|------------------------|------|-------|-------|-------|----------|-----------|
| Calc - Req.            | 8.1  | -45.1 | -25.9 | 20.76 | 1-dining | 7-kitchen |
| Meas - Req.            | 14.6 | -44.3 | -23.5 | 20.08 | 2-stor   | 4-serving |



=====

Lighting System Survey Summary

One Page for Each Defined System

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350A.LSR  
 Date: 10/16/1993

System Number: 1      Descrip: 1 lamp 1x4 lay-in

=====

Rooms Served: 8  
 Floor Area: 9412 SqFt  
 Possible kW: 2.060  
 Working kW: 2.060  
 Capacity kW: 2.060  
 Lighting: 8755 Annual kWh  
 Heating: 1251 Annual kWh  
 Cooling: 12112 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 0.219 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 63       | 63    | 63.0     |
| Working       | 63       | 63    | 63.0     |
| Capacity      | 63       | 63    | 63.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 9137   | 1822   | 12829   | -215    | 25844 |
| AVLCC \$ | 672    | 134    | 944     | -16     | 1902  |

System Number: 2      Descrip: 2x4 lay-in w/acrylic

=====

Rooms Served: 2  
 Floor Area: 6496 SqFt  
 Possible kW: 0.251  
 Working kW: 0.251  
 Capacity kW: 0.251  
 Lighting: 1068 Annual kWh  
 Heating: 153 Annual kWh  
 Cooling: 1477 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 0.039 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 8     | 4.0      |
| Working       | 4        | 8     | 4.0      |
| Capacity      | 4        | 8     | 4.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1114   | 146    | 1564    | -26     | 2962  |
| AVLCC \$ | 82     | 11     | 115     | -2      | 218   |

System Number: 3      Descrip: cove

Rooms Served: 2  
 Floor Area: 6496 SqFt  
 Possible kW: 4.186  
 Working kW: 4.186  
 Capacity kW: 4.186  
 Lighting: 17789 Annual kWh  
 Heating: 2541 Annual kWh  
 Cooling: 25115 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 0.644 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 128      | 128   | 128.0    |
| Working       | 128      | 128   | 128.0    |
| Capacity      | 128      | 128   | 128.0    |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 18564  | 3587   | 26732   | -436    | 52929 |
| AVLCC \$ | 1366   | 264    | 1967    | -32     | 3895  |

System Number: 4      Descrip: 4 lamp 2x4 lay-in w/ acrylic

Rooms Served: 4  
 Floor Area: 2640 SqFt  
 Possible kW: 2.784  
 Working kW: 2.784  
 Capacity kW: 2.784  
 Lighting: 11832 Annual kWh  
 Heating: 1690 Annual kWh  
 Cooling: 16368 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 1.055 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 24       | 96    | 24.0     |
| Working       | 24       | 96    | 24.0     |
| Capacity      | 24       | 96    | 24.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 12347  | 1279   | 17338   | -290    | 31946 |
| AVLCC \$ | 909    | 94     | 1276    | -21     | 2351  |

# Room-By-Room Summary Report

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350A.RRR  
 Date: 10/16/1993

| Room Name  | Floor | # | Total Area | SYSTEM1 #Pr Name | Work Watts | Pot. Watts | Watt sqft | SYSTEM2 Name | Work Watts | Pot. Watts | Watt sqft | lay-in | Work Watts | Pot. Watts | Watt sqft | Calc. FootC | Req. FootC |      |
|------------|-------|---|------------|------------------|------------|------------|-----------|--------------|------------|------------|-----------|--------|------------|------------|-----------|-------------|------------|------|
| 1-dining   | 1     | 2 | 6496       | 192 1 lamp 1x4   | 1177       | 1177       | 0.18      | cove         | 4186       | 4186       | 0.64 2x4  | 251    | 251        | 0.04       | 5614      | 0.86        | 17.4       | 22.1 |
| 2-stor     | 1     | 1 | 96         | 2 4 lamp 2x4     | 116        | 116        | 1.21      |              |            |            |           |        | 116        | 116        | 1.21      | 24.6        | 17.7       |      |
| 3-scullery | 1     | 1 | 728        | 2 4 lamp 2x4     | 580        | 580        | 0.80      |              |            |            |           |        | 580        | 580        | 0.80      | 26.0        | 18.6       |      |
| 4-serving  | 1     | 1 | 1564       | 6 4 lamp 2x4     | 1856       | 1856       | 1.19      |              |            |            |           |        | 1856       | 1856       | 1.19      | 30.7        | 30.9       |      |
| 5-kitchen  | 1     | 1 | 312        | 2 1 lamp 1x4     | 98         | 98         | 0.31      |              |            |            |           |        | 98         | 98         | 0.31      | 25.4        | 7.0        |      |
| 6-serving  | 1     | 2 | 748        | 3 1 lamp 1x4     | 262        | 262        | 0.35      |              |            |            |           |        | 262        | 262        | 0.35      | 19.6        | 7.8        |      |
| 7-kitchen  | 1     | 1 | 1344       | 8 1 lamp 1x4     | 262        | 262        | 0.19      |              |            |            |           |        | 262        | 262        | 0.19      | 8.3         | 4.9        |      |
| 8-food pre | 1     | 1 | 320        | 2 1 lamp 1x4     | 131        | 131        | 0.41      |              |            |            |           |        | 131        | 131        | 0.41      | 9.3         | 8.5        |      |
| 9-office   | 1     | 1 | 252        | 2 4 lamp 2x4     | 232        | 232        | 0.92      |              |            |            |           |        | 232        | 232        | 0.92      | 0.0         | 18.5       |      |
| 10-kitchen | 1     | 1 | 192        | 2 1 lamp 1x4     | 131        | 131        | 0.68      |              |            |            |           |        | 131        | 131        | 0.68      | 13.0        | 13.8       |      |

Total Rooms : 12  
 Total Area Sqft : 12052  
 Total People : 416  
 Total Working kW : 9.281  
 Total Potential kW : 9.281  
 Power Density W/sqft : 0.770

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350B.WBR

Date: 10/16/1993

Lighting Annual : 63168 kWh  
 Lighting Capacity : 14.863 kW  
 Annual Cooling Effect : 88205 kWh  
 Annual Heating Effect : 9024 kWh  
 Total Surveyed Floor Area: 12052 SqFt  
 Percent Survey Completed : 1205200 %  
 Lighting Power Density : 1.233 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| PVLCC \$ | 0       | 65920  | 10760  | 93640   | -1548   | 168771 |
| AVLCC \$ | 0       | 4850   | 792    | 6890    | -114    | 12418  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1350\BLD1350B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 1 lamp 1x4 lay-in

Rooms Served: 8  
Floor Area: 9412 SqFt  
Possible kW: 3.087  
Working kW: 2.891  
Capacity kW: 3.087  
Lighting: 13120 Annual kWh  
Heating: 1874 Annual kWh  
Cooling: 18150 Annual kWh  
Op Hours/Year: 4250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 92.7 Months  
Power Density: 0.307 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 63       | 63    | 63.0     |
| Working       | 63       | 59    | 59.0     |
| Capacity      | 63       | 63    | 63.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 4     | 4.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 13691  | 2696   | 19224   | -322    | 35291 |
| AVLCC \$ | 1007   | 198    | 1415    | -24     | 2597  |

System Number: 2      Descrip: 2x4 lay-in w/acrylic

Rooms Served: 2  
Floor Area: 6496 SqFt  
Possible kW: 0.384  
Working kW: 0.384  
Capacity kW: 0.384  
Lighting: 1632 Annual kWh  
Heating: 233 Annual kWh  
Cooling: 2258 Annual kWh  
Op Hours/Year: 4250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 92.7 Months  
Power Density: 0.059 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 8     | 4.0      |
| Working       | 4        | 8     | 4.0      |
| Capacity      | 4        | 8     | 4.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1703   | 239    | 2391    | -40     | 4294  |
| AVLCC \$ | 125    | 18     | 176     | -3      | 316   |

System Number: 3      Descrip: cove

Rooms Served: 2  
 Floor Area: 6496 SqFt  
 Possible kW: 6.784  
 Working kW: 6.784  
 Capacity kW: 6.784  
 Lighting: 28832 Annual kWh  
 Heating: 4119 Annual kWh  
 Cooling: 40706 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 1.044 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 128      | 128   | 128.0    |
| Working       | 128      | 128   | 128.0    |
| Capacity      | 128      | 128   | 128.0    |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 30088  | 5430   | 43328   | -707    | 78139 |
| AVLCC \$ | 2214   | 400    | 3188    | -52     | 5750  |

System Number: 4      Descrip: 4 lamp 2x4 lay-in w/ acrylic

Rooms Served: 4  
 Floor Area: 2640 SqFt  
 Possible kW: 4.608  
 Working kW: 4.608  
 Capacity kW: 4.608  
 Lighting: 19584 Annual kWh  
 Heating: 2798 Annual kWh  
 Cooling: 27092 Annual kWh  
 Op Hours/Year: 4250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 92.7 Months  
 Power Density: 1.745 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 24       | 96    | 24.0     |
| Working       | 24       | 96    | 24.0     |
| Capacity      | 24       | 96    | 24.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 20437  | 2394   | 28697   | -480    | 51048 |
| AVLCC \$ | 1504   | 176    | 2112    | -35     | 3756  |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1350 - ECO VII D. & IX C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |     |         |
|----------------------------------------|---------|-----|---------|
| A. CONSTRUCTION COST                   | \$8,188 |     |         |
| B. SIOH                                | \$450   |     |         |
| C. DESIGN COST                         | \$491   |     |         |
| D. TOTAL COST (1A+1B+1C)               | \$9,130 |     |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |         |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     | \$9,130 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 80.97              | \$854                | 11.77              | \$10,054              |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 113.1              | \$1,193              | 11.12              | \$13,268              |
| M. DEMAND SAVINGS |                 |                    | \$447                | 11.12              | \$4,965               |
| N. TOTAL          |                 | 194.07             | \$2,494              |                    | \$28,288              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |      |         |
|---------------------------------------|-------|------|---------|
| A. ANNUAL RECURRING (+/-)             | \$289 |      |         |
| 1. DISCOUNT FACTOR (TABLE A)          |       | 11.1 |         |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       |      | \$3,208 |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

|    | ITEM  | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----|-------|-----------------------|-------------------|--------------------|----------------------------------|
| a. | N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. | N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. | N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. | N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. | N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. | N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. | N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. | N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. | N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. | N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. | N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. | N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. | N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. | N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. | N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. | TOTAL | \$0                   |                   |                    | \$0                              |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$3,208

4. SIMPLE PAYBACK  $1G / (2N3 + 3A + (3Bp1 / \text{ECONOMIC LIFE}))$ : 3.3 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$31,496

6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ : 3.45

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 13.0%



## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 1387 - MINI-MALL**

Building 1387 is a one story brick facility consisting of several retail shops. This facility contains a small kitchen and dining area which consists of 3,700 square feet.

The operating hours for this facility are from 10:00 am to 9:00 pm, seven days per week.

The lighting system is primarily fluorescent.

The mechanical system consists of DX split systems with gas heating.

Hot water is provided to the kitchen by a gas fired heater. Dishwashing is done by hand using a rinse sink with an electric hot water booster heater.

The following ECO's are recommended for Building 1387:

1. VII. D - Reduce indoor/outdoor lighting to AEI levels
2. IX. A - Replace incandescent lamps with compact fluorescents
3. IX. C - Replace standard lamps with energy saving lamps
4. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1387

ECO NO: VII D. & IX A. C. D.

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

KWH Savings: 19,311 KWH/yr  
Demand Savings: 29.9 KW/yr  
Gas Savings: n/a MCF/yr  
Cost Savings: \$ 1,022 /yr  
Implementation Cost: \$ 2,592  
Simple Payback: 2.5 Years  
Savings to Investment:  
Ratio (SIR): 4.46

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE               | ACTION                                      |
|-----|----------------------------|---------------------------------------------|
| 2   | 1-Lamp, 4' Fluor.          | Retrofit with T8 lamps and elect. ballasts. |
| 20  | 2-Lamp, 4' Fluor.          | Retrofit with T8 lamps and elect. ballasts. |
| 20  | 4-Lamp, 4' Fluor.          | Retrofit with T8 lamps and elect. ballasts. |
| 14  | Incandescent<br>downlights | Retrofit with compact fluor. lamps.         |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (6.544 \text{ KWH} - 4.052 \text{ KWH}) \times 4 \text{ mo.} \times \$7.50 + (6.544 - 4.052) \times 8 \text{ mo.} \times \$6.25 \\ &= \$199.36/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD1387A                | 13170                | 20952                   | 40013                         | 2944                         | 8098                         | 9.015                          | 0.542                              | 2324                     | 2949                          | 34740                          | 217                          | 2556                          |
| *BLD1387B               | 21268                | 0                       | 60965                         | 4486                         | 0                            | 0.000                          | 0.000                              | 0                        | 4676                          | 56288                          | 344                          | 4142                          |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD1387A   | POST RETROFIT CONDITIONS |
| BLD1387B   | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387A.WBR

Date: 10/16/1993

Lighting Annual : 13170 kWh  
 Lighting Capacity : 4.052 kW  
 Annual Cooling Effect : 18073 kWh  
 Annual Heating Effect : 1881 kWh  
 Total Surveyed Floor Area: 3666 SqFt  
 Percent Survey Completed : 366600 %  
 Lighting Power Density : 1.105 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2324    | 14813  | 2949   | 20250   | -323    | 40013 |
| AVLCC \$ | 171     | 1090   | 217    | 1490    | -24     | 2944  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387A.LLR

Date: 10/16/1993

| Room<br>Foot Candles | MAX  | MIN  | AVG  | SDEV  | MAX Room    | MIN Room |
|----------------------|------|------|------|-------|-------------|----------|
| Calculated           | 75.7 | 14.0 | 33.9 | 23.73 | 6-prep/stor | 1-game   |
| Measured             | 51.3 | 8.5  | 26.9 | 17.10 | 4-kitchen   | 1-game   |
| Required             | 75.0 | 20.0 | 54.2 | 24.78 | 2-dining    | 1-game   |

| Foot Candle<br>Comparison | MAX   | MIN   | AVG   | SDEV  | MAX Room    | MIN Room  |
|---------------------------|-------|-------|-------|-------|-------------|-----------|
| Calc - Req.               | 25.7  | -55.0 | -20.3 | 28.59 | 6-prep/stor | 2-dining  |
| Meas - Req.               | -11.5 | -44.6 | -27.3 | 13.20 | 1-game      | 5-kitchen |

Lighting System Survey Summary  
One Page for Each Defined System

ject: FT SAM HOUSTON EEAP  
ile: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387A.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 2x4 2 lamp

Rooms Served: 3  
Floor Area: 2536 SqFt  
Possible kW: 1.256  
Working kW: 1.256  
Capacity kW: 1.256  
Lighting: 4082 Annual kWh  
Heating: 583 Annual kWh  
Cooling: 5594 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 110.7 Months  
Power Density: 0.495 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 20       | 40    | 20.0     |
| Working       | 20       | 40    | 20.0     |
| Capacity      | 20       | 40    | 20.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4591   | 542    | 6263    | -100    | 12117 |
| AVLCC \$ | 338    | 40     | 461     | -7      | 892   |

System Number: 2      Descrip: PL downlight

ms Served: 1  
Floor Area: 648 SqFt  
Possible kW: 0.048  
Working kW: 0.048  
Capacity kW: 0.048  
Lighting: 156 Annual kWh  
Heating: 22 Annual kWh  
Cooling: 219 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 49.8 Months  
Power Density: 0.074 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 2.0      |
| Working       | 2        | 2     | 2.0      |
| Capacity      | 2        | 2     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 175    | 182    | 249     | -4      | 646   |
| AVLCC \$ | 13     | 13     | 18      | -0      | 48    |

System Number: 3      Descrip: decor. fluor. (pool)

Rooms Served: 1  
 Floor Area: 648 SqFt  
 Possible kW: 0.065  
 Working kW: 0.065  
 Capacity kW: 0.065  
 Lighting: 213 Annual kWh  
 Heating: 30 Annual kWh  
 Cooling: 298 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 110.7 Months  
 Power Density: 0.101 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 2.0      |
| Working       | 2        | 2     | 2.0      |
| Capacity      | 2        | 2     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 239    | 51     | 339     | -5      | 735   |
| AVLCC \$ | 18     | 4      | 25      | -0      | 54    |

System Number: 4      Descrip: PL downlight

Rooms Served: 1  
 Floor Area: 1696 SqFt  
 Possible kW: 0.264  
 Working kW: 0.264  
 Capacity kW: 0.264  
 Lighting: 858 Annual kWh  
 Heating: 123 Annual kWh  
 Cooling: 1176 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 49.8 Months  
 Power Density: 0.156 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 11       | 11    | 11.0     |
| Working       | 11       | 11    | 11.0     |
| Capacity      | 11       | 11    | 11.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 965    | 1000   | 1316    | -21     | 3459  |
| AVLCC \$ | 71     | 74     | 97      | -2      | 255   |



System Number: 5      Descrip: track w/ 27w PL

Rooms Served: 1  
 Floor Area: 1696 SqFt  
 Possible kW: 0.027  
 Working kW: 0.027  
 Capacity kW: 0.027  
 Lighting: 88 Annual kWh  
 Heating: 13 Annual kWh  
 Cooling: 123 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 55.3 Months  
 Power Density: 0.016 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 1.0      |
| Working       | 1        | 1     | 1.0      |
| Capacity      | 1        | 1     | 1.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 99     | 88     | 140     | -2      | 351   |
| AVLCC \$ | 7      | 6      | 10      | -0      | 26    |

System Number: 6      Descrip: rec. fluor.

Rooms Served: 3  
 Floor Area: 1130 SqFt  
 Possible kW: 2.320  
 Working kW: 2.320  
 Capacity kW: 2.320  
 Lighting: 7540 Annual kWh  
 Heating: 1077 Annual kWh  
 Cooling: 10333 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 110.7 Months  
 Power Density: 2.053 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 20       | 80    | 20.0     |
| Working       | 20       | 80    | 20.0     |
| Capacity      | 20       | 80    | 20.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 8480   | 812    | 11569   | -185    | 21736 |
| AVLCC \$ | 624    | 60     | 851     | -14     | 1599  |

System Number: 7      Descrip: incan. decorative

Rooms Served: 1  
Floor Area: 456 SqFt  
Possible kW: 0.072  
Working kW: 0.072  
Capacity kW: 0.072  
Lighting: 234 Annual kWh  
Heating: 33 Annual kWh  
Cooling: 329 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 49.8 Months  
Power Density: 0.158 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 3     | 3.0      |
| Working       | 3        | 3     | 3.0      |
| Capacity      | 3        | 3     | 3.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 263    | 273    | 374     | -6      | 969   |
| AVLCC \$ | 19     | 20     | 27      | -0      | 71    |

=====  
 | Room-By-Room Summary Report |  
 =====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387A.RRR  
 Date: 10/16/1993

| Room Name  | Floor | # | Total Area | SYSTEM1 #Pr Name | Work Watts | Pot. Watts | Watt SYSTEM2 Name | Work Watts | Pot. Watts | Watt SYSTEM3 Name | Work Watts | Pot. Watts | Watt sqft | Watt sqft | Pot. Watts | Watt sqft | Watt Meas. FootC | Calc. FootC | Req. FootC |
|------------|-------|---|------------|------------------|------------|------------|-------------------|------------|------------|-------------------|------------|------------|-----------|-----------|------------|-----------|------------------|-------------|------------|
| 1-gene     | 1     | 1 | 648        | 6 2x4 2 lamp     | 251        | 251        | 0.39 PL downlig   | 48         | 48         | 0.07 decor. flu   | 65         | 65         | 0.10      | 365       | 365        | 0.56      | 8.5              | 14.0        | 20.0       |
| 2-dining   | 1     | 1 | 1696       | 9 2x4 2 lamp     | 879        | 879        | 0.52 PL downlig   | 264        | 264        | 0.16 track w/ 2   | 27         | 27         | 0.02      | 1170      | 1170       | 0.69      | 41.6             | 20.0        | 75.0       |
| 3-office   | 10    | 1 | 192        | 2 2x4 2 lamp     | 126        | 126        | 0.65              |            |            |                   |            |            |           | 126       | 126        | 0.65      | 16.3             | 14.9        | 30.0       |
| 4-kitchen  | 1     | 1 | 456        | 3 rec. fluor     | 696        | 696        | incan. dec        | 72         | 72         | 0.16              |            |            |           | 768       | 768        | 1.68      | 51.3             | 44.6        | 75.0       |
| 5-kitchen  | 1     | 1 | 418        | 2 rec. fluor     | 696        | 696        |                   |            |            |                   |            |            |           | 696       | 696        | 1.67      | 30.4             | 33.9        | 75.0       |
| 6-prep/sto | 1     | 1 | 256        | 0 rec. fluor     | 928        | 928        |                   |            |            |                   |            |            |           | 928       | 928        | 3.63      | 13.3             | 75.7        | 50.0       |

Total Rooms : 6  
 Total Area Sqft : 3666  
 Total People : 22  
 Total Working kW : 4.052  
 Total Potential kW : 4.052  
 Power Density W/sqft : 1.105

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387B.WBR

Date: 10/16/1993

Lighting Annual : 21268 kWh  
 Lighting Capacity : 6.544 kW  
 Annual Cooling Effect : 29286 kWh  
 Annual Heating Effect : 3038 kWh  
 Total Surveyed Floor Area: 3666 Sqft  
 Percent Survey Completed : 366600 %  
 Lighting Power Density : 1.785 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 0       | 23920  | 4676   | 32889   | -521    | 60965 |
| AVLCC \$ | 0       | 1760   | 344    | 2420    | -38     | 4486  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1387\BLD1387B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 2x4 2 lamp

Rooms Served: 3  
Floor Area: 2536 SqFt  
Possible kW: 1.920  
Working kW: 1.920  
Capacity kW: 1.920  
Lighting: 6240 Annual kWh  
Heating: 891 Annual kWh  
Cooling: 8552 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 110.7 Months  
Power Density: 0.757 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 20       | 40    | 20.0     |
| Working       | 20       | 40    | 20.0     |
| Capacity      | 20       | 40    | 20.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 7018   | 898    | 9574    | -153    | 17337 |
| AVLCC \$ | 516    | 66     | 704     | -11     | 1276  |

System Number: 2      Descrip: furface incan. can

Rooms Served: 1  
Floor Area: 648 SqFt  
Possible kW: 0.120  
Working kW: 0.120  
Capacity kW: 0.120  
Lighting: 390 Annual kWh  
Heating: 56 Annual kWh  
Cooling: 548 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 3.7 Months  
Power Density: 0.185 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 0.0      |
| Working       | 2        | 2     | 0.0      |
| Capacity      | 2        | 2     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 439    | 252    | 623     | -10     | 1304  |
| AVLCC \$ | 32     | 19     | 46      | -1      | 96    |

System Number: 3      Descrip: decor. fluor. (pool)

Rooms Served: 1  
 Floor Area: 648 SqFt  
 Possible kW: 0.106  
 Working kW: 0.106  
 Capacity kW: 0.106  
 Lighting: 345 Annual kWh  
 Heating: 49 Annual kWh  
 Cooling: 484 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 110.7 Months  
 Power Density: 0.164 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 2.0      |
| Working       | 2        | 2     | 2.0      |
| Capacity      | 2        | 2     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 387    | 63     | 550     | -8      | 992   |
| AVLCC \$ | 29     | 5      | 40      | -1      | 73    |

System Number: 4      Descrip: rec. incan. can

Rooms Served: 1  
 Floor Area: 1696 SqFt  
 Possible kW: 0.660  
 Working kW: 0.660  
 Capacity kW: 0.660  
 Lighting: 2145 Annual kWh  
 Heating: 306 Annual kWh  
 Cooling: 2940 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 3.7 Months  
 Power Density: 0.389 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 11       | 11    | 0.0      |
| Working       | 11       | 11    | 0.0      |
| Capacity      | 11       | 11    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2412   | 1388   | 3291    | -53     | 7039  |
| AVLCC \$ | 178    | 102    | 242     | -4      | 518   |

System Number: 5      Descrip: track

Rooms Served: 1  
 Floor Area: 1696 SqFt  
 Possible kW: 0.750  
 Working kW: 0.750  
 Capacity kW: 0.750  
 Lighting: 2438 Annual kWh  
 Heating: 348 Annual kWh  
 Cooling: 3422 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 7.0 Months  
 Power Density: 0.442 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 5     | 0.0      |
| Working       | 1        | 5     | 0.0      |
| Capacity      | 1        | 5     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2741   | 516    | 3891    | -60     | 7089  |
| AVLCC \$ | 202    | 38     | 286     | -4      | 522   |

System Number: 6      Descrip: rec. fluor.

Rooms Served: 3  
 Floor Area: 1130 SqFt  
 Possible kW: 2.688  
 Working kW: 2.544  
 Capacity kW: 3.840  
 Lighting: 8736 Annual kWh  
 Heating: 1248 Annual kWh  
 Cooling: 11972 Annual kWh  
 Op Hours/Year: 3250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 110.7 Months  
 Power Density: 2.251 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 16       | 56    | 14.0     |
| Working       | 16       | 53    | 12.0     |
| Capacity      | 20       | 80    | 20.0     |
| Disconnected  | 4        | 8     | 6.0      |
| Broken/Burned | 0        | 3     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 9825   | 1054   | 13404   | -214    | 24069 |
| AVLCC \$ | 723    | 78     | 986     | -16     | 1771  |

System Number: 7      Descrip: incan. decorating

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Rooms Served: 1  
Floor Area: 456 SqFt  
Possible kW: 0.300  
Working kW: 0.300  
Capacity kW: 0.300  
Lighting: 975 Annual kWh  
Heating: 139 Annual kWh  
Cooling: 1369 Annual kWh  
Op Hours/Year: 3250 Annual Hrs  
Relamp Method: Spot  
Relamp Time: 2.8 Months  
Power Density: 0.658 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 3     | 0.0      |
| Working       | 3        | 3     | 0.0      |
| Capacity      | 3        | 3     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1097   | 505    | 1557    | -24     | 3134  |
| AVLCC \$ | 81     | 37     | 115     | -2      | 231   |



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1387 - ECO VII D. & IX A, C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |                |                |
|----------------------------------------|----------------|----------------|
| A. CONSTRUCTION COST                   | <u>\$2,324</u> |                |
| B. SIOH                                | <u>\$128</u>   |                |
| C. DESIGN COST                         | <u>\$139</u>   |                |
| D. TOTAL COST (1A+1B+1C)               | <u>\$2,591</u> |                |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | <u>\$0</u>     |                |
| F. PUBLIC UTILITY COMPANY REBATE       | <u>\$0</u>     |                |
| G. TOTAL INVESTMENT (1D-1E-1F)         |                | <u>\$2,591</u> |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | <u>\$10.55</u>  | <u>27.64</u>       | <u>\$292</u>         | <u>11.77</u>       | <u>\$3,432</u>        |
| B. DIST           |                 |                    | <u>\$0</u>           | <u>13.83</u>       | <u>\$0</u>            |
| C. RESID          |                 |                    | <u>\$0</u>           | <u>16.15</u>       | <u>\$0</u>            |
| D. NG             | <u>\$3.31</u>   | <u>0.00</u>        | <u>\$0</u>           | <u>15.34</u>       | <u>\$0</u>            |
| E. PPG            |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| F. COAL           |                 |                    | <u>\$0</u>           | <u>12.82</u>       | <u>\$0</u>            |
| G. SOLAR          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| H. GEOTH          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| I. BIOMA          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| J. REFUS          |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| K. WIND           |                 |                    | <u>\$0</u>           | <u>11.12</u>       | <u>\$0</u>            |
| L. COOLING        | <u>\$10.55</u>  | <u>38.27</u>       | <u>\$404</u>         | <u>11.12</u>       | <u>\$4,490</u>        |
| M. DEMAND SAVINGS |                 |                    | <u>\$199</u>         | <u>11.12</u>       | <u>\$2,217</u>        |
| N. TOTAL          |                 | <u>65.91</u>       | <u>\$895</u>         |                    | <u>\$10,139</u>       |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |              |                |
|---------------------------------------|--------------|----------------|
| A. ANNUAL RECURRING (+/-)             | <u>\$127</u> |                |
| 1. DISCOUNT FACTOR (TABLE A)          | <u>11.1</u>  |                |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |              | <u>\$1,410</u> |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)**

\$1,410

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :**

2.5 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):**

\$11,548

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :**

4.46

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):**

14.9%

## ENERGY CONSERVATION ANALYSIS

### BUILDING 1395 - NCE CLUB

Building 1395 is a one story rock building consisting of 26,000 square feet. This facility contains a full service kitchen and a large ballroom/dining area which consists of 6,000 square feet.

The operating hours are from 10:00 am to 10:00 pm Monday thru Friday and 10:00 am to 12:00 midnight on Saturday.

The lighting systems in the dining/ballroom are primarily incandescents with dimmers. The kitchen area lighting system is primarily fluorescent.

The mechanical system consists of multizone air handling units served by one air cooled reciprocating chiller and one water cooled centrifugal chiller. Heating is supplied by a gas fired boiler in the main mechanical room.

Hot water is provided by a gas fired water heater located in the main mechanical room. Dishwashing is accomplished using an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 1395:

1. IV.D. 1) - Replace chiller with higher EFF/CFC free chiller
2. VII. D - Reduce indoor/outdoor lighting to AEI levels
3. IX A. - Replace incandescent lamps with compact fluorescents
4. IX C. - Replace standard lamps with energy saving lamps
5. IX D. - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1395

ECO NO: IV.D 1)

ECO NAME: Replace chiller with higher efficiency, CFC free chiller.

#### SUMMARY DATA (DEPENDENT):

|                                        |                   |        |
|----------------------------------------|-------------------|--------|
| KWH Savings:                           | <u>123,020</u>    | KWH/yr |
| Demand Savings:                        | <u>1,152</u>      | KW/yr  |
| Gas Savings:                           | <u>n/a</u>        | MCF/yr |
| Cost Savings:                          | <u>\$ 12,302</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 159,262</u> |        |
| Simple Payback:                        | <u>8.2</u>        | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>1.81</u>       |        |

#### ECO DESCRIPTION:

Currently, two chillers serve Building 1395. One is an 80 ton air cooled chiller with an efficiency of 1.33 KW/ton which was installed in 1986. The other chiller is a 160 ton water cooled centrifugal chiller with an efficiency of 1.04 KW/ton which was installed in 1968. The air cooled chiller utilizes R-22 refrigerant and the water cooled chiller utilizes R-11 refrigerant. This ECO analyzes replacing these two chillers with one 234 ton, CFC free, high efficiency, water cooled chiller with an efficiency of .632 KW/ton.

The new chiller should be specified with part-load operation down to 10% of the maximum chiller output to provide adequate turndown. Currently, there is not redundance or back-up capacity due to the fact that the existing chillers serve separate areas. This ECO accounts for the interdependencies related to the UMCS system and the proposed lighting retrofit.

#### COST SAVINGS CALCULATIONS:

(Refer to following Trace Output)

$$\begin{aligned}\text{Demand Savings} &= (495 \text{ KW} - 396 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (495 \text{ KW} - 396 \text{ KW}) \times 8 \text{ mo.} \times \$6.50/\text{KW} \\ &= \$8,118/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| LINE # |                                         |
|--------|-----------------------------------------|
| 1      | JOB - 1                                 |
| 2      | 01/FORT SAM HOUSTON EEAP                |
| 3      | 01/SAN ANTONIO                          |
|        | 01/FWD-COE                              |
|        | 01/SCOTT CLARK                          |
| 6      | 01/EEAP ALTERNATIVES                    |
| 7      | 08/SANANTON///97/74/29                  |
| 8      | 09/JAN/DEC                              |
| 9      | 10/CLTD-CLF                             |
| 10     | LOAD - 1                                |
| 11     | 19/1/ENERGY CONSERVATION SIMULATION     |
| 12     | 20/110/11/MZ AHU-1 ZONE 1/86/32/8/4//14 |
| 13     | 20/120/12/MZ AHU-1 ZONE 2/80/76/8/4//14 |
| 14     | 20/130/13/MZ AHU-1 ZONE 3/17/19/8/4//14 |
| 15     | 20/210/21/SZ AHU-2/51/37/8/4//14        |
| 16     | 20/300/30/MZ AC-1 ZONE A/92/78/8/4//14  |
| 17     | 20/310/31/MZ AC-1 ZONE B/26/53/8/4//14  |
| 18     | 20/320/32/MZ AC-1 ZONE C/2124/1/8/4//14 |
| 19     | 20/330/33/MZ AC-1 ZONE D/70/54/8/4//14  |
| 20     | 20/410/41/SZ AC-2/90/34/8/4//14         |
| 21     | 20/510/51/SZ AC-3/46/64/8/4//14         |
| 22     | 20/610/61/SZ AC-4/42/25/8/4//14         |
| 23     | 21/M/78/50/78//70/70//ZONE//NO          |
| 24     | 22/110/1/YES///.07/47                   |
| 25     | 22/120/1/YES///.07/47                   |
| 26     | 22/130/1/YES///.07/47                   |
| 27     | 22/210/1/YES///.07/47                   |
| 28     | 22/300/1/YES///.07/47                   |
| 29     | 22/310/1/YES///.07/47                   |
| 30     | 22/320/1/YES///.07/47                   |
| 31     | 22/330/1/YES///.07/47                   |
| 32     | 22/410/1/YES///.07/47                   |
| 33     | 22/510/1/YES///.07/47                   |
| 34     | 22/610/1/YES///.07/47                   |
| 35     | 24/110/1/86/14/0.15/64/270              |
| 36     | 24/120/1/60/14/0.15/64/180              |
| 37     | 24/130/1/19/14/0.15/64/180              |
| 38     | 24/210/1/51/14/0.15/64/90               |
| 39     | 24/210/2/37/14/0.15/64/180              |
| 40     | 24/300/1/78/14/0.15/64/180              |
| 41     | 24/320/1/12/14/0.15/64/334              |
| 42     | 24/320/2/12/14/0.15/64/0                |
| 43     | 24/320/3/12/14/0.15/64/26               |
| 44     | 24/320/4/12/14/0.15/64/52               |
| 45     | 24/320/5/12/14/0.15/64/78               |
| 46     | 24/330/1/44/14/0.15/64/0                |
| 47     | 24/510/1/150/14/0.15/64/90              |
| 48     | 24/510/2/16/14/0.15/64/0                |
| 49     | 24/510/3/16/14/0.15/64/180              |
| 50     | 24/610/1/42/14/0.15/64/90               |
| 51     | 24/610/2/25/14/0.15/64/180              |
| 52     | 24/610/3/42/14/0.15/64/270              |
| 53     | 25/130/1///100/1.1/0.9                  |
| 54     | 25/320/1///100/1.1/0.9                  |
| 55     | 25/320/2///100/1.1/0.9                  |
| 56     | 25/320/3///100/1.1/0.9                  |
| 57     | 25/320/4///100/1.1/0.9                  |
| 58     | 25/320/5///100/1.1/0.9                  |

LINE # -----

59 25/330/1///100/1.1/0.9

60 25/510/1/23/10/1/1.1/0.9

25/610/1/4/10/1/1.1/0.9

62 26/M/1395PLP/1395LT/AVAIL/AVAIL//AVAIL

63 27/M/50/SF-PERS/350/325/3.0/WATT-SF/ASHRAE2/1.25/15

64 28/M/1/MISC EQUIPMENT/2.0/WATT-SF//ELEC/80

65 28/110/1/MISC EQUIPMENT/5/WATT-SF//ELEC/80

66 28/300/1/MISC EQUIPMENT/.5/WATT-SF//ELEC/80

67 28/610/1/MISC EQUIPMENT/.5/WATT-SF//ELEC/80

68 29/M110/25/CFM-P/25/CFM-P/0.1/ACH-HR/0.1/ACH-HR

69 29/M210/25/CFM-P/25/CFM-P/0.1/ACH-HR/0.1/ACH-HR

70 29/M300/25/CFM-P/25/CFM-P/0.1/ACH-HR/0.1/ACH-HR/35/PCT-MCLG

71 30/M/1.75/CFM-SF

72 32/110/1/86/0.8

73 32/120/1/60/0.8

74 32/130/1/19/0.8

75 32/210/1/88/0.8

76 32/300/1/78/0.8

77 32/320/1/60/0.8

78 32/330/1/44/0.8

79 32/510/1/182/0.8

80 32/610/1/109/0.8

81 SYSTEM - 1

82 39/1/AS-BUILT CONDITIONS

83 40/1/BPM2

84 41/1/11/13

85 42/1/3.0/3/////RETAIR///OTHER/DUCTED

86 43/1/53/53

87 45/1/AVAIL

88 47/1//////////BLOW

40/2/VTCV

41/2/21/21

91 42/2/3.0/3////////OTHER/DUCTED

92 43/2/57.5/57.5

93 45/2/AVAIL

94 40/3/BPM2

95 41/3/30/33

96 42/3/3.0/3/////RETAIR///OTHER/DUCTED

97 43/3/59/59

98 45/3/AVAIL

99 47/3//////////BLOW

100 40/4/VTCV

101 41/4/41/41

102 42/4/2.0/2////////OTHER/DUCTED

103 43/4/57.5/57.5

104 45/4/AVAIL

105 40/5/VTCV

106 41/5/51/51

107 42/5/2.0/2////////OTHER/DUCTED

108 43/5/57.5/57.5

109 45/5/AVAIL

110 40/6/VTCV

111 41/6/61/61

112 42/6/2.0/2////////OTHER/DUCTED

113 43/6/58.5/58.5

114 45/6/AVAIL

115 EQUIPMENT - 1

116 60/1/1/BLKPLANT/1/2

| LINE # |                                          |
|--------|------------------------------------------|
| 117    | 60/2/2/BLKPLANT/3/6                      |
| 118    | 62/1/EQ1100L/1/80/TONS/1.33/KW-TON       |
| 119    | 62/2/EQ1001S/1/160/TONS/1.04/KW-TON      |
| 120    | 63/1/7.5/HP                              |
| 121    | 63/2/11.5/HP/15/HP////////1              |
| 122    | 65/1/1/1/2                               |
| 123    | 65/2/2/3/6                               |
| 124    | 67/1/EQ2001/1/7.5/HP///80/PCTEFF         |
| 125    | 67/2/EQ2001/1/.75/HP///80/PCTEFF////2    |
| 126    | 69/1/EQ4003/EQ4003                       |
| 127    | 69/2/EQ4003                              |
| 128    | 69/3/EQ4001                              |
| 129    | 69/4/EQ4003                              |
| 130    | 69/5/EQ4003                              |
| 131    | 69/6/EQ4003                              |
| 132    | 70/1/13.01                               |
| 133    | 70/2/1.89                                |
| 134    | 70/3/17.15                               |
| 135    | 70/4/1.45                                |
| 136    | 70/5/1.45                                |
| 137    | 70/6/1.0                                 |
| 138    | SYSTEM - 2                               |
| 139    | 39/2/AS-BUILT CONDITIONS WITH STOP-START |
| 140    | 40/1/BPMZ                                |
| 141    | 41/1/11/13                               |
| 142    | 42/1/3.0/3/////RETAIR///OTHER/DUCTED     |
| 143    | 43/1/53/53                               |
| 144    | 45/1/1395C                               |
| 145    | 47/1//////////BLOW                       |
| 146    | 40/2/VTCV                                |
| 147    | 41/2/21/21                               |
| 148    | 42/2/3.0/3/////OTHER/DUCTED              |
| 149    | 43/2/57.5/57.5                           |
| 150    | 45/2/1395C                               |
| 151    | 40/3/BPMZ                                |
| 152    | 41/3/30/33                               |
| 153    | 42/3/3.0/3/////RETAIR///OTHER/DUCTED     |
| 154    | 43/3/59/59                               |
| 155    | 45/3/1395C                               |
| 156    | 47/3//////////BLOW                       |
| 157    | 40/4/VTCV                                |
| 158    | 41/4/41/41                               |
| 159    | 42/4/2.0/2////////OTHER/DUCTED           |
| 160    | 43/4/57.5/57.5                           |
| 161    | 45/4/1395C                               |
| 162    | 40/5/VTCV                                |
| 163    | 41/5/51/51                               |
| 164    | 42/5/2.0/2////////OTHER/DUCTED           |
| 165    | 43/5/57.5/57.5                           |
| 166    | 45/5/1395C                               |
| 167    | 40/6/VTCV                                |
| 168    | 41/6/61/61                               |
| 169    | 42/6/2.0/2////////OTHER/DUCTED           |
| 170    | 43/6/58.5/58.5                           |
| 171    | 45/6/1395C                               |
| 172    | EQUIPMENT - 2                            |
| 173    | 60/1/1/BLKPLANT/1/2                      |
| 174    | 60/2/2/BLKPLANT/3/6                      |



LINE # -----

175 62/1/EQ1100L/1/80/TONS/1.33/KW-TON

176 62/2/EQ1001S/1/160/TONS/1.04/KW-TON

177 63/1/7.5/HP

178 63/2/11.5/HP/15/HP/////1

179 65/1/1/1/2

180 65/2/2/3/6

181 67/1/EQ2001/1/7.5/HP///80/PCTEFF

182 67/2/EQ2001/1/.75/HP///80/PCTEFF///2

183 69/1/EQ4003/EQ4003

184 69/2/EQ4003

185 69/3/EQ4001

186 69/4/EQ4003

187 69/5/EQ4003

188 69/6/EQ4003

189 70/1/13.01

190 70/2/1.89

191 70/3/17.15

192 70/4/1.45

193 70/5/1.45

194 70/6/1.0

195 SYSTEM - 3

196 39/3/NEW CHILLER WITH STOP-START

197 40/1/BPM2

198 41/1/11/13

199 42/1/3.0/3/////RETAIR///OTHER/DUCTED

200 43/1/53/53

201 45/1/1395C

202 47/1//////////BLOW

203 40/2/VTCV

204 41/2/21/21

205 42/2/3.0/3////////OTHER/DUCTED

206 43/2/57.5/57.5

207 45/2/1395C

208 40/3/BPM2

209 41/3/30/33

210 42/3/3.0/3/////RETAIR///OTHER/DUCTED

211 43/3/59/59

212 45/3/1395C

213 47/3//////////BLOW

214 40/4/VTCV

215 41/4/41/41

216 42/4/2.0/2////////OTHER/DUCTED

217 43/4/57.5/57.5

218 45/4/1395C

219 40/5/VTCV

220 41/5/51/51

221 42/5/2.0/2////////OTHER/DUCTED

222 43/5/57.5/57.5

223 45/5/1395C

224 40/6/VTCV

225 41/6/61/61

226 42/6/2.0/2////////OTHER/DUCTED

227 43/6/58.5/58.5

228 45/6/1395C

229 EQUIPMENT - 3

230 60/1/1/BLKPLANT/1/6

231 62/1/EQ1001S/1/234/TONS/.632/KW-TON

232 63/1/25/HP/15/HP

CONTENTS OF : H:\JOB\911099\12F\HVAC\TRACE\B1395.TM

| LINE # |                                      |
|--------|--------------------------------------|
| 233    | 65/1/1/1/6                           |
| 234    | 67/1/EQ2001/1/7.5/HP///80/PCTEFF     |
|        | 67/2/EQ2001/1/.75/HP///80/PCTEFF///2 |
|        | 69/1/EQ4003/EQ4003                   |
| 237    | 69/2/EQ4003                          |
| 238    | 69/3/EQ4001                          |
| 239    | 69/4/EQ4003                          |
| 240    | 69/5/EQ4003                          |
| 241    | 69/6/EQ4003                          |
| 242    | 70/1/13.01                           |
| 243    | 70/2/1.89                            |
| 244    | 70/3/17.15                           |
| 245    | 70/4/1.45                            |
| 246    | 70/5/1.45                            |
| 247    | 70/6/1.0                             |

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TRACE 600 ANALYSIS \*\*  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
EEAP ALTERNATIVES

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 74 (F)  
Winter Design Dry Bulb: 29 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 14:26:11 4/17/94  
Dataset Name: B1395 .TM

AIRFLOW - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System Number | System Type | Outside Airflow (Cfm) | Cooling Airflow (Cfm) | Main Heating Airflow (Cfm) | Return Airflow (Cfm) | Exhaust Airflow (Cfm) | Auxil. Supply Airflow (Cfm) | Room Exhaust Airflow (Cfm) |
|---------------|-------------|-----------------------|-----------------------|----------------------------|----------------------|-----------------------|-----------------------------|----------------------------|
| 1             | BPMZ        | 4,577                 | 16,796                | 16,796                     | 16,949               | 4,730                 | 0                           | 0                          |
| 2             | VTCV        | 944                   | 3,302                 | 3,302                      | 3,334                | 975                   | 0                           | 0                          |
| 3             | BPMZ        | 7,229                 | 26,084                | 26,084                     | 26,325               | 7,470                 | 0                           | 0                          |
| 4             | VTCV        | 1,530                 | 5,355                 | 5,355                      | 5,406                | 1,581                 | 0                           | 0                          |
| 5             | VTCV        | 1,472                 | 5,152                 | 5,152                      | 5,201                | 1,521                 | 0                           | 0                          |
| 6             | VTCV        | 525                   | 1,837                 | 1,838                      | 1,855                | 542                   | 0                           | 0                          |
| Totals        |             | 16,277                | 58,527                | 58,527                     | 59,069               | 16,820                | 0                           | 0                          |

CAPACITY - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

|                                                                                    |        | Cooling   |           |           |         | Heating   |           |          |          |          |           |          |
|------------------------------------------------------------------------------------|--------|-----------|-----------|-----------|---------|-----------|-----------|----------|----------|----------|-----------|----------|
|                                                                                    |        | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys. | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating  |
| System                                                                             | System | Capacity  | Capacity  | Capacity  | Totals  | Capacity  | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals   |
| Number                                                                             | Type   | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)    | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)   |
|  | 1 BPMZ | 61.9      | 0.0       | 0.0       | 61.9    | -234,377  | 0         | 0        | 0        | 0        | 0         | -234,377 |
|                                                                                    | 2 VTCV | 11.2      | 0.0       | 0.0       | 11.2    | -50,285   | 0         | 0        | 0        | 0        | 0         | -50,285  |
|                                                                                    | 3 BPMZ | 79.5      | 0.0       | 0.0       | 79.5    | -407,841  | 0         | 0        | 0        | 0        | 0         | -407,841 |
|                                                                                    | 4 VTCV | 17.7      | 0.0       | 0.0       | 17.7    | -69,699   | 0         | 0        | 0        | 0        | 0         | -69,699  |
|                                                                                    | 5 VTCV | 17.4      | 0.0       | 0.0       | 17.4    | -96,956   | 0         | 0        | 0        | 0        | 0         | -96,956  |
|                                                                                    | 6 VTCV | 5.9       | 0.0       | 0.0       | 5.9     | -37,483   | 0         | 0        | 0        | 0        | 0         | -37,483  |
| Totals                                                                             |        | 193.6     | 0.0       | 0.0       | 193.6   | -896,640  | 0         | 0        | 0        | 0        | 0         | -896,640 |

The building peaked at hour 13 month 8 with a capacity of 193.6 tons

ENGINEERING CHECKS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | ----- Cooling ----- |             |               |                | --- Heating --- |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------------|-------------|---------------|----------------|-----------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft       | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft   | Btuh/<br>Sq Ft |                     |
| 1                | Main               | BPMZ           | 27.25                     | 1.83                | 271.5       | 148.0         | 81.10          | 1.83            | -25.60         | 9,155               |
| 2                | Main               | VTCV           | 28.57                     | 1.75                | 295.1       | 168.6         | 71.17          | 1.75            | -26.65         | 1,887               |
| 3                | Main               | BPMZ           | 27.71                     | 1.80                | 328.0       | 181.8         | 66.00          | 1.80            | -28.21         | 14,458              |
| 4                | Main               | VTCV           | 28.57                     | 1.75                | 302.2       | 172.7         | 69.48          | 1.75            | -22.78         | 3,060               |
| 5                | Main               | VTCV           | 28.57                     | 1.75                | 295.4       | 168.8         | 71.09          | 1.75            | -32.93         | 2,944               |
| 6                | Main               | VTCV           | 28.57                     | 1.75                | 312.6       | 178.6         | 67.17          | 1.75            | -35.70         | 1,050               |

System 1 Block BPMZ - BYPASS MULTIZONE

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  |                   |                  | ***** HEATING COIL PEAK ***** |                   |                  |                  |  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|-------------------|------------------|-------------------------------|-------------------|------------------|------------------|--|
| Peak at Time ==> Mo/Hr: 8/14             |                         |                          |                        |                  | Mo/Hr: 8/14                |                       |                  |                   |                  | Mo/Hr: 13/ 1                  |                   |                  |                  |  |
| Outside Air ==> OADB/WB/HR: 95/ 76/111.1 |                         |                          |                        |                  | OADB: 95                   |                       |                  |                   |                  | OADB: 29                      |                   |                  |                  |  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak (Btuh) | Coil Peak (Btuh) | Perct Of Tot (%)              | Space Sens (Btuh) | Coil Peak (Btuh) | Perct Of Tot (%) |  |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Roof Cond                                | 0                       | 39,522                   |                        | 39,522           | 5.32                       | 0                     | 0.00             | 0                 | -21,001          | 8.96                          | 0                 | -21,001          | 8.96             |  |
| Glass Solar                              | 12,236                  | 0                        |                        | 12,236           | 1.65                       | 32,186                | 7.09             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Glass Cond                               | 4,272                   | 0                        |                        | 4,272            | 0.58                       | -2,136                | -0.47            | -13,196           | -13,196          | 5.63                          | -13,196           | -13,196          | 5.63             |  |
| Wall Cond                                | 3,452                   | -96                      |                        | 3,356            | 0.45                       | 3,833                 | 0.84             | -8,979            | -11,850          | 5.06                          | -8,979            | -11,850          | 5.06             |  |
| Partition                                | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | -5,412            | -5,412           | 2.31                          | -5,412            | -5,412           | 2.31             |  |
| Infiltration                             | 7,080                   |                          |                        | 7,080            | 0.95                       | 2,279                 | 0.50             | -6,767            | -6,767           | 2.89                          | -6,767            | -6,767           | 2.89             |  |
| Sub Total==>                             | 27,040                  | 39,426                   |                        | 66,466           | 8.95                       | 36,163                | 7.96             | -34,355           | -58,227          | 24.84                         | -34,355           | -58,227          | 24.84            |  |
| Internal Loads                           |                         |                          |                        |                  |                            |                       |                  |                   |                  |                               |                   |                  |                  |  |
| Lights                                   | 60,854                  | 10,739                   |                        | 71,592           | 9.64                       | 62,084                | 13.67            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| People                                   | 70,503                  |                          |                        | 70,503           | 9.50                       | 47,163                | 10.38            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Misc                                     | 90,670                  | 0                        | 0                      | 90,670           | 12.21                      | 72,536                | 15.97            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Sub Total==>                             | 222,026                 | 10,739                   | 0                      | 232,765          | 31.35                      | 181,783               | 40.02            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Ceiling Load                             | 39,977                  | -39,977                  |                        | 0                | 0.00                       | 38,884                | 8.56             | -23,872           | 0                | 0.00                          | -23,872           | 0                | 0.00             |  |
| Outside Air                              | 0                       | 0                        | 0                      | 212,410          | 28.61                      | 0                     | 0.00             | 0                 | -203,024         | 86.62                         | 0                 | -203,024         | 86.62            |  |
| Sup. Fan Heat                            |                         |                          |                        | 26,874           | 3.62                       |                       | 0.00             |                   | 26,874           | -11.47                        |                   | 26,874           | -11.47           |  |
| Ret. Fan Heat                            |                         | 8,958                    |                        | 8,958            | 1.21                       |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| OV/UNDR Sizing                           | 197,419                 |                          |                        | 197,419          | 26.59                      | 197,419               | 43.46            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Exhaust Heat                             |                         | -2,441                   | 0                      | -2,441           | -0.33                      |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Minimal Bypass                           |                         | 0                        | 0                      | 0                | -0.00                      |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Grand Total==>                           | 486,462                 | 16,705                   | 0                      | 742,451          | 100.00                     | 454,248               | 100.00           | -58,227           | -234,377         | 100.00                        | -58,227           | -234,377         | 100.00           |  |

| -----COOLING COIL SELECTION----- |                 |                  |                   |        |        |                  |       |        |             | -----AREAS----- |       |  |
|----------------------------------|-----------------|------------------|-------------------|--------|--------|------------------|-------|--------|-------------|-----------------|-------|--|
| Total Capacity (Tons)            | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |        |        | Leaving DB/WB/HR |       |        | Gross Total | Glass (sf)      | (%)   |  |
|                                  |                 |                  | Deg F             | Deg F  | Grains | Deg F            | Deg F | Grains | Floor       |                 |       |  |
| Main Clg                         | 61.9            | 742.5            | 558.6             | 16,796 | 83.5   | 68.1             | 81.7  | 51.9   | 50.9        | 55.6            | 9,155 |  |
| Aux Clg                          | 0.0             | 0.0              | 0.0               | 0      | 0.0    | 0.0              | 0.0   | 0.0    | 0.0         | 0.0             | 0     |  |
| Opt Vent                         | 0.0             | 0.0              | 0.0               | 0      | 0.0    | 0.0              | 0.0   | 0.0    | 0.0         | 0.0             | 165   |  |
| Totals                           | 61.9            | 742.5            |                   |        |        |                  |       |        |             |                 | 9,155 |  |
|                                  |                 |                  |                   |        |        |                  |       |        |             |                 | 2,310 |  |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |          | --ENGINEERING CHECKS-- |              |             | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|----------|------------------------|--------------|-------------|-----------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating | Clg % OA | Clg % OA               | Clg Cfm/Sqft | Clg Cfm/Ton | Type                  | Clg  | Htg  |
|                                  |                  |           |           |      |                          |         |          |                        |              |             |                       |      |      |
| Main Htg                         | -234.4           | 16,796    | 60.3      | 73.2 | Vent                     | 4,577   | 4,577    | 1.83                   | 1.83         | 271.48      | SADB                  | 53.0 | 73.2 |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Infil                    | 153     | 153      | 1.83                   | 1.83         | 271.48      | Plenum                | 91.8 | 61.8 |
| Preheat                          | -0.0             | 16,796    | 60.3      | 53.0 | Supply                   | 16,796  | 16,796   | 1.83                   | 1.83         | 147.97      | Return                | 78.5 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Mincfm                   | 0       | 0        | 1.83                   | 1.83         | 81.10       | Ret/OA                | 83.1 | 58.8 |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Return                   | 16,796  | 16,796   | 1.83                   | 1.83         | 183         | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 4,577   | 4,577    | 1.83                   | 1.83         | 27.3        | Fn MtrTD              | 0.5  | 0.5  |
| Total                            | -234.4           |           |           |      | Rm Exh                   | 0       | 0        | 1.83                   | 1.83         | 1.83        | Fn BldTD              | 0.4  | 0.4  |
|                                  |                  |           |           |      | Auxil                    | 0       | 0        | 1.83                   | 1.83         | -25.60      | Fn Frict              | 1.1  | 1.1  |

System 2 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  | ***** HEATING COIL PEAK ***** |                           |                  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|-------------------------------|---------------------------|------------------|
| Peak at Time ==> Mo/Hr: 8/12             |                         |                          |                        |                  | Mo/Hr: 7/18                |                       |                  | Mo/Hr: 13/ 1                  |                           |                  |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |                         |                          |                        |                  | OADB: 92                   |                       |                  | OADB: 29                      |                           |                  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Space Sens (Btuh)  | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%) |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Roof Cond                                | 0                       | 5,958                    |                        | 5,958            | 4.44                       | 0                     | 0.00             | 0                             | -4,137                    | 8.23             |
| Glass Solar                              | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Glass Cond                               | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Wall Cond                                | 2,086                   | 106                      |                        | 2,191            | 1.63                       | 2,759                 | 3.77             | -5,412                        | -7,065                    | 14.05            |
| Partition                                | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | -2,886                        | -2,886                    | 5.74             |
| Infiltration                             | 1,475                   |                          |                        | 1,475            | 1.10                       | 493                   | 0.67             | -1,395                        | -1,395                    | 2.77             |
| Sub Total==>                             | 3,560                   | 6,064                    |                        | 9,624            | 7.17                       | 3,252                 | 4.44             | -9,693                        | -15,483                   | 30.79            |
| *****                                    |                         |                          |                        |                  |                            |                       |                  |                               |                           |                  |
| Internal Loads                           |                         |                          |                        |                  |                            |                       |                  |                               |                           |                  |
| Lights                                   | 12,382                  | 2,185                    |                        | 14,567           | 10.85                      | 12,865                | 17.57            | 0                             | 0                         | 0.00             |
| People                                   | 17,351                  |                          |                        | 17,351           | 12.92                      | 9,907                 | 13.53            | 0                             | 0                         | 0.00             |
| Misc                                     | 12,881                  | 0                        | 0                      | 12,881           | 9.59                       | 10,305                | 14.07            | 0                             | 0                         | 0.00             |
| Sub Total==>                             | 42,614                  | 2,185                    | 0                      | 44,799           | 33.36                      | 33,076                | 45.17            | 0                             | 0                         | 0.00             |
| Ceiling Load                             | 8,249                   | -8,249                   |                        | 0                | 0.00                       | 8,318                 | 11.36            | -5,790                        | 0                         | 0.00             |
| Outside Air                              | 0                       | 0                        | 0                      | 44,242           | 32.94                      | 0                     | 0.00             | 0                             | -41,847                   | 83.22            |
| Sup. Fan Heat                            |                         |                          |                        | 7,045            | 5.25                       |                       | 0.00             |                               | 7,045                     | -14.01           |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| OV/UNDR Sizing                           | 28,587                  |                          |                        | 28,587           | 21.29                      | 28,587                | 39.04            | 0                             | 0                         | 0.00             |
| Exhaust Heat                             |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Terminal Bypass                          |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Grand Total==>                           | 83,010                  | 0                        | 0                      | 134,296          | 100.00                     | 73,232                | 100.00           | -15,483                       | -50,285                   | 100.00           |

| -----COOLING COIL SELECTION----- |                       |                 |                  |                   |      |      |                  |      |      | -----AREAS----- |            |       |
|----------------------------------|-----------------------|-----------------|------------------|-------------------|------|------|------------------|------|------|-----------------|------------|-------|
|                                  | Total Capacity (Tons) | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |      |      | Leaving DB/WB/HR |      |      | Gross Total     | Glass (sf) | (%)   |
| Main Clg                         | 11.2                  | 134.3           | 90.5             | 3,302             | 81.8 | 67.9 | 83.1             | 55.5 | 54.8 | 64.9            | Floor      | 1,887 |
| Aux Clg                          | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | 0.0             | Part       | 0     |
| Opt Vent                         | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | 0.0             | ExFlr      | 88    |
| Totals                           | 11.2                  | 134.3           |                  |                   |      |      |                  |      |      |                 | Roof       | 1,887 |
|                                  |                       |                 |                  |                   |      |      |                  |      |      |                 | Wall       | 1,232 |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |       | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|-------|------------------------|--------|-----------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating |       | Clg % OA               |        | Type                  | Clg  | Htg  |
| Main Htg                         | -50.3            | 3,302     | 58.3      | 72.4 | Vent                     | 944     | 944   | Clg Cfm/Sqft           | 1.75   | SADB                  | 57.5 | 74.3 |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Infil                    | 31      | 31    | Clg Cfm/Ton            | 295.07 | Plenum                | 91.8 | 60.3 |
| Preheat                          | -0.0             | 3,302     | 58.3      | 55.5 | Supply                   | 3,302   | 3,302 | Clg Sqft/Ton           | 168.61 | Return                | 78.0 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Mincfm                   | 0       | 0     | Clg Btuh/Sqft          | 71.17  | Ret/OA                | 81.8 | 58.3 |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Return                   | 3,302   | 3,302 | No. People             | 38     | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 944     | 944   | Htg % OA               | 28.6   | Fn MtrTD              | 0.5  | 0.5  |
| Total                            | -50.3            |           |           |      | Rm Exh                   | 0       | 0     | Htg Cfm/Sqft           | 1.75   | Fn BldTD              | 0.4  | 0.4  |
|                                  |                  |           |           |      | Auxil                    | 0       | 0     | Htg Btuh/Sqft          | -26.65 | Fn Frict              | 1.1  | 1.1  |

System 3 Block BPMZ - BYPASS MULTIZONE

| ***** COOLING COIL PEAK ***** |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  |                   |                  | ***** HEATING COIL PEAK ***** |                   |                  |                  |  |
|-------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|-------------------|------------------|-------------------------------|-------------------|------------------|------------------|--|
| Peaked at Time ==>            |                         |                          |                        |                  | Mo/Hr: 8/14                |                       |                  |                   |                  | Mo/Hr: 7/18                   |                   |                  |                  |  |
| Outside Air ==>               |                         |                          |                        |                  | OADB/WB/HR: 95/ 76/111.1   |                       |                  |                   |                  | OADB: 92                      |                   |                  |                  |  |
|                               |                         |                          |                        |                  |                            |                       |                  |                   |                  |                               |                   |                  |                  |  |
| Envelope Loads                | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak (Btuh) | Coil Peak (Btuh) | Perct Of Tot (%)              | Space Sens (Btuh) | Coil Peak (Btuh) | Perct Of Tot (%) |  |
| Skylite Solr                  | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Skylite Cond                  | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Roof Cond                     | 0                       | 61,082                   |                        | 61,082           | 6.40                       | 0                     | 0.00             | 0                 | -33,704          | 8.26                          | 0                 | -33,704          | 8.26             |  |
| Glass Solar                   | 42,112                  | 0                        |                        | 42,112           | 4.41                       | 52,528                | 9.80             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Glass Cond                    | 23,383                  | 0                        |                        | 23,383           | 2.45                       | 21,917                | 4.09             | -72,232           | -72,232          | 17.71                         | -72,232           | -72,232          | 17.71            |  |
| Wall Cond                     | 1,603                   | -70                      |                        | 1,533            | 0.16                       | 1,697                 | 0.32             | -4,797            | -6,356           | 1.56                          | -4,797            | -6,356           | 1.56             |  |
| Partition                     | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Exposed Floor                 | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Infiltration                  | 10,238                  |                          |                        | 10,238           | 1.07                       | 3,858                 | 0.72             | -5,970            | -5,970           | 1.46                          | -5,970            | -5,970           | 1.46             |  |
| Sub Total==>                  | 77,336                  | 61,012                   |                        | 138,348          | 14.50                      | 80,000                | 14.92            | -93,686           | -128,949         | 31.62                         | -93,686           | -128,949         | 31.62            |  |
| Internal Loads                |                         |                          |                        |                  |                            |                       |                  |                   |                  |                               |                   |                  |                  |  |
| Lights                        | 96,103                  | 16,959                   |                        | 113,062          | 11.85                      | 98,463                | 18.37            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| People                        | 111,037                 |                          |                        | 111,037          | 11.64                      | 73,321                | 13.68            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Misc                          | 61,953                  | 0                        | 0                      | 61,953           | 6.49                       | 49,562                | 9.24             | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Sub Total==>                  | 269,093                 | 16,959                   | 0                      | 286,052          | 29.98                      | 221,346               | 41.29            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Ceiling Load                  | 69,613                  | -69,613                  |                        | 0                | 0.00                       | 63,871                | 11.91            | -35,263           | 0                | 0.00                          | -35,263           | 0                | 0.00             |  |
| Outside Air                   | 0                       | 0                        | 0                      | 307,136          | 32.19                      | 0                     | 0.00             | 0                 | -320,625         | 78.62                         | 0                 | -320,625         | 78.62            |  |
| Sup. Fan Heat                 |                         |                          |                        | 41,734           | 4.37                       |                       | 0.00             |                   | 41,734           | -10.23                        |                   | 41,734           | -10.23           |  |
| Ret. Fan Heat                 |                         | 13,911                   |                        | 13,911           | 1.46                       |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Duct Heat PkUp                |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| OV/UNDR Sizing                | 170,896                 |                          |                        | 170,896          | 17.91                      | 170,896               | 31.88            | 0                 | 0                | 0.00                          | 0                 | 0                | 0.00             |  |
| Exhaust Heat                  |                         | -3,855                   | 0                      | -3,855           | -0.40                      |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Minimal Bypass                |                         | 0                        | 0                      | 0                | -0.00                      |                       | 0.00             |                   | 0                | 0.00                          |                   | 0                | 0.00             |  |
| Grand Total==>                | 586,938                 | 18,414                   | 0                      | 954,222          | 100.00                     | 536,113               | 100.00           | -128,949          | -407,841         | 100.00                        | -128,949          | -407,841         | 100.00           |  |

| -----COOLING COIL SELECTION----- |                       |                 |                  |                   |       |       |                  |       |       | -----AREAS----- |            |          |
|----------------------------------|-----------------------|-----------------|------------------|-------------------|-------|-------|------------------|-------|-------|-----------------|------------|----------|
|                                  | Total Capacity (Tons) | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |       |       | Leaving DB/WB/HR |       |       | Gross Total     | Glass (sf) | (%)      |
| Main Clg                         | 79.5                  | 954.2           | 709.4            | 26,084            | Deg F | Deg F | Grains           | Deg F | Deg F | Floor           | 14,458     |          |
| Aux Clg                          | 0.0                   | 0.0             | 0.0              | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | Part            | 0          |          |
| Opt Vent                         | 0.0                   | 0.0             | 0.0              | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | ExFlr           | 182        |          |
| Totals                           | 79.5                  | 954.2           |                  |                   |       |       |                  |       |       | Roof            | 14,458     | 0 0      |
|                                  |                       |                 |                  |                   |       |       |                  |       |       | Wall            | 2,548      | 1,456 57 |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |        | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|--------|------------------------|--------|-----------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating |        | Clg % OA               | 27.7   | Type                  | Clg  | Htg  |
| Main Htg                         | -407.8           | 26,084    | 60.1      | 74.6 | Vent                     | 7,229   | 7,229  | Clg Cfm/Sqft           | 1.80   | SADB                  | 59.0 | 74.6 |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Infil                    | 241     | 241    | Clg Cfm/Ton            | 328.02 | Plenum                | 93.2 | 62.3 |
| Preheat                          | -0.0             | 26,084    | 60.1      | 59.0 | Supply                   | 26,084  | 26,084 | Clg Sqft/Ton           | 181.82 | Return                | 78.5 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Mincfm                   | 9,129   | 9,129  | Clg Btuh/Sqft          | 66.00  | Ret/OA                | 83.2 | 58.6 |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Return                   | 26,084  | 26,084 | No. People             | 289    | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 7,229   | 7,229  | Htg % OA               | 27.7   | Fn MtrTD              | 0.5  | 0.5  |
| Total                            | -407.8           |           |           |      | Rm Exh                   | 0       | 0      | Htg Cfm/SqFt           | 1.80   | Fn BldTD              | 0.4  | 0.4  |
|                                  |                  |           |           |      | Auxil                    | 0       | 0      | Htg Btuh/SqFt          | -28.21 | Fn Frict              | 1.1  | 1.1  |



System 4 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/14 \* Mo/Hr: 7/18 \* Mo/Hr: 13/ 1 \*  
Outside Air ==> OADB/WB/HR: 95/ 76/111.1 \* OADB: 92 \* OADB: 29 \*

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 12,596                         |                              | 12,596                 | 5.92                   | * | 0                           | 0.00                   | * | 0                                  | -7,193                          | 10.32                  |
| Glass Solar     | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Wall Cond       | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Infiltration    | 2,365                         |                                |                              | 2,365                  | 1.11                   | * | 799                         | 0.67                   | * | -2,262                             | -2,262                          | 3.25                   |
| Sub Total==>    | 2,365                         | 12,596                         |                              | 14,962                 | 7.04                   | * | 799                         | 0.67                   | * | -2,262                             | -9,455                          | 13.57                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 20,340                        | 3,589                          |                              | 23,929                 | 11.25                  | * | 21,122                      | 17.79                  | * | 0                                  | 0                               | 0.00                   |
| People          | 23,501                        |                                |                              | 23,501                 | 11.05                  | * | 16,065                      | 13.53                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 20,888                        | 0                              | 0                            | 20,888                 | 9.82                   | * | 16,710                      | 14.07                  | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 64,728                        | 3,589                          | 0                            | 68,318                 | 32.13                  | * | 53,897                      | 45.39                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 16,186                        | -16,186                        |                              | 0                      | 0.00                   | * | 13,299                      | 11.20                  | * | -7,193                             | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 70,963                 | 33.38                  | * | 0                           | 0.00                   | * | 0                                  | -67,860                         | 97.36                  |
| Sup. Fan Heat   |                               |                                |                              | 7,616                  | 3.58                   | * |                             | 0.00                   | * |                                    | 7,616                           | -10.93                 |
| Ret. Fan Heat   |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat Pkup  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 50,759                        |                                |                              | 50,759                 | 23.87                  | * | 50,759                      | 42.74                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat    |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 134,039                       | 0                              | 0                            | 212,618                | 100.00                 | * | 118,754                     | 100.00                 | * | -9,455                             | -69,699                         | 100.00                 |

| -----COOLING COIL SELECTION----- |                          |                    |                     |                   |       |        |                  |       |        | -----AREAS----- |            |     |
|----------------------------------|--------------------------|--------------------|---------------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|-----|
|                                  | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%) |
|                                  |                          |                    |                     | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           | 3,060      |     |
| Main Clg                         | 17.7                     | 212.6              | 5,355               | 83.0              | 68.0  | 82.2   | 56.2             | 55.5  | 66.7   | Part            | 0          |     |
| Aux Clg                          | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | ExFlr           | 0          |     |
| Opt Vent                         | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | Roof            | 3,060      | 0 0 |
| Totals                           | 17.7                     | 212.6              |                     |                   |       |        |                  |       |        | Wall            | 0          | 0 0 |

| -----HEATING COIL SELECTION----- |                   |                     |              |              | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)-- |      |      |
|----------------------------------|-------------------|---------------------|--------------|--------------|--------------------------|---------|---------|------------------------|--------|----------------------|------|------|
|                                  | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F | Type                     | Cooling | Heating | Clg % OA               |        | Type                 | Clg  | Htg  |
|                                  |                   |                     |              |              | Vent                     | 1,530   | 1,530   | Clg Cfm/Sqft           | 28.6   | SADB                 | 57.5 | 71.6 |
| Main Htg                         | -69.7             | 5,355               | 58.3         | 70.3         | Infil                    | 51      | 51      | Clg Cfm/Ton            | 1.75   | Plenum               | 94.7 | 62.6 |
| Aux Htg                          | 0.0               | 0                   | 0.0          | 0.0          | Supply                   | 5,355   | 5,355   | Clg Sqft/Ton           | 302.23 | Return               | 78.0 | 70.0 |
| Preheat                          | -0.0              | 5,355               | 58.3         | 56.2         | Mincfm                   | 1,874   | 1,874   | Clg Btuh/Sqft          | 172.70 | Ret/OA               | 83.0 | 58.3 |
| Reheat                           | 0.0               | 0                   | 0.0          | 0.0          | Return                   | 5,355   | 5,355   | No. People             | 69.48  | Runarnd              | 78.0 | 70.0 |
| Humidif                          | 0.0               | 0                   | 0.0          | 0.0          | Exhaust                  | 1,530   | 1,530   | Htg % OA               | 61     | Fn MtrTD             | 0.3  | 0.3  |
| Opt Vent                         | 0.0               | 0                   | 0.0          | 0.0          | Rm Exh                   | 0       | 0       | Htg Cfm/SqFt           | 28.6   | Fn BldTD             | 0.2  | 0.2  |
| Total                            | -69.7             |                     |              |              | Auxil                    | 0       | 0       | Htg Btuh/SqFt          | 1.75   | Fn Frict             | 0.7  | 0.7  |
|                                  |                   |                     |              |              |                          |         |         |                        | -22.78 |                      |      |      |

System 5 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/12 \* Mo/Hr: 7/13 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 91/ 76/117.0 \* OADB: 95 \* OADB: 29

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 9,277                          |                              | 9,277                  | 4.43                   | * | 0                           | 0.00                   | * | 0                                  | -6,315                          | 6.51                   |
| Glass Solar     | 17,940                        | 0                              |                              | 17,940                 | 8.57                   | * | 15,410                      | 13.49                  | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 2,758                         | 0                              |                              | 2,758                  | 1.32                   | * | 3,441                       | 3.01                   | * | -11,410                            | -11,410                         | 11.77                  |
| Wall Cond       | 3,888                         | 264                            |                              | 4,152                  | 1.98                   | * | 4,317                       | 3.78                   | * | -9,779                             | -13,125                         | 13.54                  |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | -5,970                             | -5,970                          | 6.16                   |
| Infiltration    | 2,283                         |                                |                              | 2,283                  | 1.09                   | * | 883                         | 0.77                   | * | -2,176                             | -2,176                          | 2.24                   |
| Sub Total==>    | 26,868                        | 9,541                          |                              | 36,409                 | 17.40                  | * | 24,051                      | 21.05                  | * | -29,335                            | -38,996                         | 40.22                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 19,318                        | 3,409                          |                              | 22,727                 | 10.86                  | * | 19,318                      | 16.91                  | * | 0                                  | 0                               | 0.00                   |
| People          | 27,261                        |                                |                              | 27,261                 | 13.03                  | * | 12,777                      | 11.18                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 20,096                        | 0                              | 0                            | 20,096                 | 9.60                   | * | 16,077                      | 14.07                  | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 66,675                        | 3,409                          | 0                            | 70,084                 | 33.49                  | * | 48,172                      | 42.16                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 12,950                        | -12,950                        |                              | 0                      | 0.00                   | * | 15,038                      | 13.16                  | * | -9,661                             | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 68,479                 | 32.72                  | * | 0                           | 0.00                   | * | 0                                  | -65,287                         | 67.34                  |
| Sup. Fan Heat   |                               |                                |                              | 7,327                  | 3.50                   | * |                             | 0.00                   | * |                                    | 7,327                           | -7.56                  |
| Ret. Fan Heat   |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat PkUp  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 26,993                        |                                |                              | 26,993                 | 12.90                  | * | 26,993                      | 23.63                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat    |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 133,486                       | 0                              | 0                            | 209,292                | 100.00                 | * | 114,252                     | 100.00                 | * | -38,996                            | -96,956                         | 100.00                 |

-----COOLING COIL SELECTION-----

|          | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR<br>Deg F Deg F Grains | Leaving DB/WB/HR<br>Deg F Deg F Grains |
|----------|--------------------------|--------------------|---------------------|-----------------------------------------|----------------------------------------|
| Main Clg | 17.4                     | 209.3              | 141.3               | 5,152 81.8 67.9 83.5                    | 56.2 55.0 64.9                         |
| Aux Clg  | 0.0                      | 0.0                | 0.0                 | 0.0 0.0 0.0 0.0                         | 0.0 0.0 0.0 0.0                        |
| Opt Vent | 0.0                      | 0.0                | 0.0                 | 0.0 0.0 0.0 0.0                         | 0.0 0.0 0.0 0.0                        |
| Totals   | 17.4                     | 209.3              |                     |                                         |                                        |

-----AREAS-----

|       | Gross Total | Glass (sf) | (%) |
|-------|-------------|------------|-----|
| Floor | 2,944       |            |     |
| Part  | 0           |            |     |
| ExFlr | 182         |            |     |
| Roof  | 2,944       | 0          | 0   |
| Wall  | 2,548       | 230        | 9   |

-----HEATING COIL SELECTION-----

|          | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F |
|----------|-------------------|---------------------|--------------|--------------|
| Main Htg | -97.0             | 5,152               | 58.3         | 75.7         |
| Aux Htg  | 0.0               | 0                   | 0.0          | 0.0          |
| Preheat  | -0.0              | 5,152               | 58.3         | 56.2         |
| Reheat   | 0.0               | 0                   | 0.0          | 0.0          |
| Humidif  | 0.0               | 0                   | 0.0          | 0.0          |
| Opt Vent | 0.0               | 0                   | 0.0          | 0.0          |
| Total    | -97.0             |                     |              |              |

-----AIRFLOWS (cfm)-----

|         | Type | Cooling | Heating |
|---------|------|---------|---------|
| Vent    |      | 1,472   | 1,472   |
| Infil   |      | 49      | 49      |
| Supply  |      | 5,152   | 5,152   |
| Mincfm  |      | 1,803   | 1,803   |
| Return  |      | 5,152   | 5,152   |
| Exhaust |      | 1,472   | 1,472   |
| Rm Exh  |      | 0       | 0       |
| Auxil   |      | 0       | 0       |

-----ENGINEERING CHECKS-----

|               |        |
|---------------|--------|
| Clg % OA      | 28.6   |
| Clg Cfm/Sqft  | 1.75   |
| Clg Cfm/Ton   | 295.40 |
| Clg Sqft/Ton  | 168.80 |
| Clg Btuh/Sqft | 71.09  |
| No. People    | 59     |
| Htg % OA      | 28.6   |
| Htg Cfm/Sqft  | 1.75   |
| Htg Btuh/Sqft | -32.93 |

-----TEMPERATURES (F)-----

| Type     | Clg  | Htg  |
|----------|------|------|
| SADB     | 57.5 | 77.0 |
| Plenum   | 91.9 | 59.6 |
| Return   | 78.0 | 70.0 |
| Ret/OA   | 81.8 | 58.3 |
| Runarnd  | 78.0 | 70.0 |
| Fn MtrTD | 0.3  | 0.3  |
| Fn BldTD | 0.2  | 0.2  |
| Fn Frict | 0.7  | 0.7  |

System 6 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
 Peaked at Time ==> Mo/Hr: 8/12 \* Mo/Hr: 7/18 \* Mo/Hr: 13/ 1 \*  
 Outside Air ==> OADB/WB/HR: 91/ 76/117.0 \* OADB: 92 \* OADB: 29 \*

|                | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr   | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond   | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond      | 0                             | 3,295                          |                              | 3,295                  | 4.67                   | * | 0                           | 0.00                   | * | 0                                  | -2,126                          | 5.67                   |
| Glass Solar    | 3,120                         | 0                              |                              | 3,120                  | 4.42                   | * | 1,600                       | 4.13                   | * | 0                                  | 0                               | 0.00                   |
| Glass Cond     | 480                           | 0                              |                              | 480                    | 0.68                   | * | 594                         | 1.53                   | * | -1,984                             | -1,984                          | 5.29                   |
| Wall Cond      | 2,630                         | 172                            |                              | 2,802                  | 3.97                   | * | 3,245                       | 8.37                   | * | -6,457                             | -8,349                          | 22.27                  |
| Partition      | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor  | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | -3,575                             | -3,575                          | 9.54                   |
| Infiltration   | 789                           |                                |                              | 789                    | 1.12                   | * | 274                         | 0.71                   | * | -776                               | -776                            | 2.07                   |
| Sub Total==>   | 7,019                         | 3,466                          |                              | 10,485                 | 14.87                  | * | 5,713                       | 14.74                  | * | -12,793                            | -16,811                         | 44.85                  |
| Internal Loads |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights         | 6,890                         | 1,216                          |                              | 8,106                  | 11.49                  | * | 7,158                       | 18.47                  | * | 0                                  | 0                               | 0.00                   |
| People         | 9,723                         |                                |                              | 9,723                  | 13.78                  | * | 5,512                       | 14.22                  | * | 0                                  | 0                               | 0.00                   |
| Misc           | 1,792                         | 0                              | 0                            | 1,792                  | 2.54                   | * | 1,433                       | 3.70                   | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>   | 18,405                        | 1,216                          | 0                            | 19,621                 | 27.82                  | * | 14,104                      | 36.39                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load   | 4,682                         | -4,682                         |                              | 0                      | 0.00                   | * | 4,792                       | 12.36                  | * | -4,018                             | 0                               | 0.00                   |
| Outside Air    | 0                             | 0                              | 0                            | 23,662                 | 33.55                  | * | 0                           | 0.00                   | * | 0                                  | -23,285                         | 62.12                  |
| Sup. Fan Heat  |                               |                                |                              | 2,613                  | 3.71                   | * |                             | 0.00                   | * |                                    | 2,613                           | -6.97                  |
| Ret. Fan Heat  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat PkUp |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing | 14,152                        |                                |                              | 14,152                 | 20.06                  | * | 14,152                      | 36.51                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat   |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Minimal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==> | 44,258                        | 0                              | 0                            | 70,533                 | 100.00                 | * | 38,761                      | 100.00                 | * | -16,811                            | -37,483                         | 100.00                 |

-----COOLING COIL SELECTION-----

|          | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        |
|----------|--------------------------|--------------------|---------------------|-------------------|-------|--------|------------------|-------|--------|
|          |                          |                    |                     | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains |
| Main Clg | 5.9                      | 70.5               | 1,837               | 81.8              | 68.2  | 85.0   | 57.2             | 56.2  | 68.1   |
| Aux Clg  | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    |
| Opt Vent | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    |
| Totals   | 5.9                      | 70.5               |                     |                   |       |        |                  |       |        |

-----AREAS-----

|       | Gross Total | Glass (sf) | (%) |
|-------|-------------|------------|-----|
| Floor | 1,050       |            |     |
| Part  | 0           |            |     |
| ExFlr | 109         |            |     |
| Roof  | 1,050       | 0          | 0   |
| Wall  | 1,526       | 40         | 3   |

-----HEATING COIL SELECTION-----

|          | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F |
|----------|-------------------|---------------------|--------------|--------------|
| Main Htg | -37.5             | 1,838               | 58.3         | 77.1         |
| Aux Htg  | 0.0               | 0                   | 0.0          | 0.0          |
| Preheat  | -0.0              | 1,837               | 58.3         | 57.2         |
| Reheat   | 0.0               | 0                   | 0.0          | 0.0          |
| Humidif  | 0.0               | 0                   | 0.0          | 0.0          |
| Opt Vent | 0.0               | 0                   | 0.0          | 0.0          |
| Total    | -37.5             |                     |              |              |

-----AIRFLOWS (cfm)-----

|         | Type | Cooling | Heating |
|---------|------|---------|---------|
| Vent    |      | 525     | 525     |
| Infil   |      | 18      | 18      |
| Supply  |      | 1,837   | 1,838   |
| Mincfm  |      | 643     | 643     |
| Return  |      | 1,837   | 1,838   |
| Exhaust |      | 525     | 525     |
| Rm Exh  |      | 0       | 0       |
| Auxil   |      | 0       | 0       |

-----ENGINEERING CHECKS-----

|               |        |
|---------------|--------|
| Clg % OA      | 28.6   |
| Clg Cfm/Sqft  | 1.75   |
| Clg Cfm/Ton   | 312.62 |
| Clg Sqft/Ton  | 178.64 |
| Clg Btuh/Sqft | 67.17  |
| No. People    | 21     |
| Htg % OA      | 28.6   |
| Htg Cfm/Sqft  | 1.75   |
| Htg Btuh/Sqft | -35.70 |

-----TEMPERATURES (F)-----

| Type     | Clg  | Htg  |
|----------|------|------|
| SADB     | 58.5 | 78.5 |
| Plenum   | 92.1 | 57.9 |
| Return   | 78.0 | 70.0 |
| Ret/OA   | 81.8 | 58.3 |
| Runarnd  | 78.0 | 70.0 |
| Fn MtrTD | 0.3  | 0.3  |
| Fn BldTD | 0.2  | 0.2  |
| Fn Frict | 0.7  | 0.7  |



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 Gl) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 116,013                  | 306                       | 282                       | 3                  | 3                                |
| Feb   | 104,732                  | 292                       | 334                       | 2                  | 3                                |
| March | 151,018                  | 318                       | 88                        | 31                 | 1                                |
| April | 167,217                  | 343                       | 14                        | 60                 | 0                                |
| May   | 192,471                  | 366                       | 0                         | 89                 | 0                                |
| June  | 199,377                  | 380                       | 0                         | 110                | 0                                |
| July  | 213,154                  | 400                       | 0                         | 131                | 0                                |
| Aug   | 218,128                  | 406                       | 0                         | 137                | 0                                |
| Sept  | 197,447                  | 380                       | 0                         | 105                | 0                                |
| Oct   | 162,718                  | 342                       | 67                        | 49                 | 1                                |
| Nov   | 140,908                  | 325                       | 115                       | 28                 | 1                                |
| Dec   | 126,077                  | 307                       | 380                       | 5                  | 3                                |
| Total | 1,989,258                | 406                       | 1,279                     | 751                | 3                                |

Building Energy Consumption = 212,484 (Btu/Sq Ft/Year)  
Source Energy Consumption = 629,866 (Btu/Sq Ft/Year)

Floor Area = 32,554 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

| ----- EQUIPMENT ENERGY CONSUMPTION ----- |          |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|------------------------------------------|----------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Ref                                      | Equip    | Monthly Consumption     |       |       |       |       |       |       |       |       |       |       |       | Total   |
| Num                                      | Code     | Jan                     | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0                                        | LIGHTS   |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 30601                   | 28153 | 33049 | 30601 | 31825 | 31825 | 30601 | 33049 | 30601 | 31825 | 28153 | 30601 | 370,881 |
|                                          | PK       | 95.6                    | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6  | 95.6    |
| 1                                        | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 45403                   | 41009 | 45403 | 43938 | 45403 | 43938 | 45403 | 45403 | 43938 | 45403 | 43938 | 45403 | 534,579 |
|                                          | PK       | 61.0                    | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0    |
| 2                                        | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | GAS      | 0                       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3                                        | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | OIL      | 0                       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4                                        | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P STEAM  | 0                       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P HOTH2O | 0                       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6                                        | MISC LD  |                         |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P CHILL  | 0                       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1                                        | EQ1100L  | AIR-CLD RECIP >45 TONS  |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 3961                    | 3061  | 13116 | 19518 | 25930 | 30024 | 35358 | 36735 | 30008 | 18291 | 13301 | 5858  | 235,160 |
|                                          | PK       | 37.5                    | 37.5  | 40.4  | 49.1  | 58.6  | 65.2  | 72.3  | 74.2  | 64.9  | 50.3  | 43.1  | 37.5  | 74.2    |
| 1                                        | EQ5200   | CONDENSER FANS          |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 171                     | 122   | 758   | 1401  | 1981  | 2387  | 3369  | 3038  | 2428  | 1300  | 770   | 258   | 17,982  |
|                                          | PK       | 1.0                     | 1.0   | 3.1   | 4.2   | 5.1   | 5.6   | 10.5  | 10.5  | 5.8   | 4.4   | 3.3   | 1.7   | 10.5    |
| 1                                        | EQ5001   | CHILLED WATER PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 2379                    | 2185  | 4847  | 5369  | 5548  | 5369  | 5548  | 5548  | 5369  | 5362  | 4728  | 2565  | 54,817  |
|                                          | PK       | 7.5                     | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5     |
| 1                                        | EQ5303   | CONTROLS                |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 96                      | 88    | 195   | 216   | 223   | 216   | 223   | 223   | 216   | 216   | 190   | 103   | 2,205   |
|                                          | PK       | 0.3                     | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3     |
| 2                                        | EQ1001S  | 2-STG CTV <555 TONS     |       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 983                     | 777   | 9515  | 16955 | 25107 | 30192 | 35378 | 36857 | 29461 | 13431 | 8396  | 1806  | 208,857 |
|                                          | PK       | 26.4                    | 26.4  | 34.4  | 48.5  | 60.5  | 67.9  | 76.6  | 80.4  | 67.9  | 45.7  | 36.9  | 26.4  | 80.4    |
|                                          | EQ5100   | COOLING TOWER           |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|          |                            |       |       |       |       |       |       |       |       |       |       |       |         |
|----------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| ELEC     | 1026                       | 0     | 5337  | 7731  | 9907  | 9852  | 10181 | 10181 | 9852  | 6445  | 4693  | 2573  | 77,777  |
| PK       | 13.7                       | 0.0   | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7    |
| 2 EQ5100 | COOLING TOWER              |       |       |       |       |       |       |       |       |       |       |       |         |
| WATER    | 3                          | 2     | 31    | 60    | 89    | 110   | 131   | 137   | 105   | 49    | 28    | 5     | 751     |
| PK       | 0.0                        | 0.0   | 0.1   | 0.2   | 0.2   | 0.3   | 0.3   | 0.3   | 0.3   | 0.2   | 0.1   | 0.0   | 0.3     |
| 2 EQ5001 | CHILLED WATER PUMP C.V.    |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1475                       | 1315  | 4459  | 6460  | 8278  | 8233  | 8507  | 8507  | 8233  | 5385  | 3922  | 2687  | 67,461  |
| PK       | 11.4                       | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4    |
| 2 EQ5010 | CONDENSER WATER PUMP C.V.  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1924                       | 1715  | 5816  | 8426  | 10798 | 10738 | 11096 | 11096 | 10738 | 7025  | 5116  | 3505  | 87,993  |
| PK       | 14.9                       | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9    |
| 2 EQ5300 | CONTROL PANEL & INTERLOCK  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 129                        | 115   | 390   | 565   | 724   | 720   | 744   | 744   | 720   | 471   | 343   | 235   | 5,900   |
| PK       | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 9679                       | 8743  | 9679  | 9367  | 9679  | 9367  | 9679  | 9679  | 9367  | 9679  | 9367  | 9679  | 113,968 |
| PK       | 13.0                       | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0    |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 0                          | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
| PK       | 0.0                        | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| EQ4003   | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1406                       | 1270  | 1406  | 1361  | 1406  | 1361  | 1406  | 1406  | 1361  | 1406  | 1361  | 1406  | 16,556  |
| PK       | 1.9                        | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9     |
| 3 EQ4001 | AIRFOIL CENTRIF. FAN C.V.  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 12760                      | 11525 | 12760 | 12348 | 12760 | 12348 | 12760 | 12760 | 12348 | 12760 | 12348 | 12760 | 150,234 |
| PK       | 17.1                       | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1    |
| 4 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
| PK       | 1.5                        | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.5     |
| 5 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
| PK       | 1.5                        | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5     |
| 6 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 744                        | 672   | 744   | 720   | 744   | 720   | 744   | 744   | 720   | 744   | 720   | 744   | 8,760   |
| PK       | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 EQ2001 | GAS FIRE TUBE HOT WATER    |       |       |       |       |       |       |       |       |       |       |       |         |
| GAS      | 5                          | 40    | 13    | 0     | 0     | 0     | 0     | 0     | 0     | 7     | 14    | 78    | 157     |
| PK       | 0.6                        | 0.5   | 0.2   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.4   | 0.6     |
| 1 EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 380                        | 1260  | 902   | 37    | 0     | 0     | 0     | 0     | 0     | 455   | 917   | 2759  | 6,711   |
| PK       | 7.5                        | 7.5   | 7.5   | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.5   | 7.5   | 7.5   | 7.5     |
| EQ5240   | BOILER FORCED DRAFT FAN    |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|   |        |                            |     |     |     |     |     |     |     |     |     |     |     |       |
|---|--------|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
|   | ELEC   | 15                         | 48  | 34  | 1   | 0   | 0   | 0   | 0   | 0   | 17  | 35  | 105 | 256   |
|   | PK     | 0.3                        | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.3   |
| 1 | EQ5307 | BOILER CONTROLS            |     |     |     |     |     |     |     |     |     |     |     |       |
|   | ELEC   | 25                         | 84  | 61  | 3   | 0   | 0   | 0   | 0   | 0   | 30  | 62  | 185 | 450   |
|   | PK     | 0.5                        | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.5   |
| 2 | EQ2001 | GAS FIRE TUBE HOT WATER    |     |     |     |     |     |     |     |     |     |     |     |       |
|   | GAS    | 277                        | 294 | 74  | 13  | 0   | 0   | 0   | 0   | 0   | 60  | 101 | 302 | 1,121 |
|   | PK     | 2.8                        | 2.9 | 0.7 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.7 | 2.2 | 2.9   |
| 2 | EQ5020 | HEAT WATER CIRC. PUMP C.V. |     |     |     |     |     |     |     |     |     |     |     |       |
|   | ELEC   | 280                        | 257 | 157 | 45  | 0   | 0   | 0   | 0   | 0   | 127 | 185 | 276 | 1,327 |
|   | PK     | 0.7                        | 0.7 | 0.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.7 | 0.7 | 0.7   |
| 2 | EQ5240 | BOILER FORCED DRAFT FAN    |     |     |     |     |     |     |     |     |     |     |     |       |
|   | ELEC   | 230                        | 211 | 129 | 37  | 0   | 0   | 0   | 0   | 0   | 104 | 152 | 226 | 1,089 |
|   | PK     | 0.6                        | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.6 | 0.6   |
| 2 | EQ5307 | BOILER CONTROLS            |     |     |     |     |     |     |     |     |     |     |     |       |
|   | ELEC   | 188                        | 173 | 105 | 30  | 0   | 0   | 0   | 0   | 0   | 85  | 124 | 185 | 890   |
|   | PK     | 0.5                        | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.5   |



UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

----- UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 406.5 (kW)  
Yearly Time of Peak 14 (hr) 8 (mo)  
Hour 14 Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name             | Equipment Description  | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------------------|------------------------|---------------------------|------------------------|
| Cooling Equipment    |                                    |                        |                           |                        |
| 1                    | EQ1100L                            | AIR-CLD RECIP >45 TONS | 92.5                      | 22.75                  |
| 2                    | EQ1001S                            | 2-STG CTV <555 TONS    | 121.4                     | 29.87                  |
| Sub Total            |                                    |                        | 213.9                     | 52.62                  |
| Sub Total            |                                    |                        | 0.0                       | 0.00                   |
| Air Moving Equipment |                                    |                        |                           |                        |
| 1                    | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 13.0                      | 3.20                   |
| 2                    | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 1.9                       | 0.46                   |
| 3                    | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 17.1                      | 4.22                   |
|                      | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 1.4                       | 0.36                   |
|                      | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 1.5                       | 0.36                   |
| 6                    | SUMMATION OF FAN ELECTRICAL DEMAND |                        | 1.0                       | 0.25                   |
| Sub Total            |                                    |                        | 36.0                      | 8.84                   |
| Sub Total            |                                    |                        | 0.0                       | 0.00                   |
| Miscellaneous        |                                    |                        |                           |                        |
| Lights               |                                    |                        | 95.6                      | 23.53                  |
| Base Utilities       |                                    |                        | 0.0                       | 0.00                   |
| Misc Equipment       |                                    |                        | 61.0                      | 15.01                  |
| Sub Total            |                                    |                        | 156.7                     | 38.54                  |
| Grand Total          |                                    |                        | 406.5                     | 100.00                 |

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TRACE 600 ANALYSIS \*\*  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
EEAP ALTERNATIVES

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 74 (F)  
Winter Design Dry Bulb: 29 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 8:22:11 4/18/94  
Dataset Name: B1395 .TM

AIRFLOW - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System Number | System Type | Outside Airflow (Cfm) | Cooling Airflow (Cfm) | Main Heating Airflow (Cfm) | Return Airflow (Cfm) | Exhaust Airflow (Cfm) | Auxil. Supply Airflow (Cfm) | Room Exhaust Airflow (Cfm) |
|---------------|-------------|-----------------------|-----------------------|----------------------------|----------------------|-----------------------|-----------------------------|----------------------------|
| 1             | BPMZ        | 4,577                 | 16,774                | 16,774                     | 16,926               | 4,730                 | 0                           | 0                          |
| 2             | VTCV        | 944                   | 3,302                 | 3,302                      | 3,334                | 975                   | 0                           | 0                          |
| 3             | BPMZ        | 7,229                 | 25,835                | 25,835                     | 26,076               | 7,470                 | 0                           | 0                          |
| 4             | VTCV        | 1,530                 | 5,355                 | 5,355                      | 5,406                | 1,581                 | 0                           | 0                          |
| 5             | VTCV        | 1,472                 | 5,152                 | 5,152                      | 5,201                | 1,521                 | 0                           | 0                          |
| 6             | VTCV        | 525                   | 1,837                 | 1,838                      | 1,855                | 542                   | 0                           | 0                          |
| Totals        |             | 16,277                | 58,255                | 58,255                     | 58,798               | 16,820                | 0                           | 0                          |

CAPACITY - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

| System Number | System Type | Cooling                   |                           |                           |                      |                       | Heating                   |                           |                         |                        |                          |                           |                       |
|---------------|-------------|---------------------------|---------------------------|---------------------------|----------------------|-----------------------|---------------------------|---------------------------|-------------------------|------------------------|--------------------------|---------------------------|-----------------------|
|               |             | Main Sys. Capacity (Tons) | Aux. Sys. Capacity (Tons) | Sys. Opt. Capacity (Tons) | Vent Capacity (Tons) | Cooling Totals (Tons) | Main Sys. Capacity (Btuh) | Aux. Sys. Capacity (Btuh) | Preheat Capacity (Btuh) | Reheat Capacity (Btuh) | Humidif. Capacity (Btuh) | Opt. Vent Capacity (Btuh) | Heating Totals (Btuh) |
| 1             | BPMZ        | 61.4                      | 0.0                       | 0.0                       | 0.0                  | 61.4                  | -234,413                  | 0                         | 0                       | 0                      | 0                        | 0                         | -234,413              |
| 2             | VTCV        | 11.2                      | 0.0                       | 0.0                       | 0.0                  | 11.2                  | -50,285                   | 0                         | 0                       | 0                      | 0                        | 0                         | -50,285               |
| 3             | BPMZ        | 78.9                      | 0.0                       | 0.0                       | 0.0                  | 78.9                  | -408,239                  | 0                         | 0                       | 0                      | 0                        | 0                         | -408,239              |
| 4             | VTCV        | 17.8                      | 0.0                       | 0.0                       | 0.0                  | 17.8                  | -69,699                   | 0                         | 0                       | 0                      | 0                        | 0                         | -69,699               |
| 5             | VTCV        | 17.4                      | 0.0                       | 0.0                       | 0.0                  | 17.4                  | -96,956                   | 0                         | 0                       | 0                      | 0                        | 0                         | -96,956               |
| 6             | VTCV        | 5.9                       | 0.0                       | 0.0                       | 0.0                  | 5.9                   | -37,483                   | 0                         | 0                       | 0                      | 0                        | 0                         | -37,483               |
| Totals        |             | 192.6                     | 0.0                       | 0.0                       | 0.0                  | 192.6                 | -897,074                  | 0                         | 0                       | 0                      | 0                        | 0                         | -897,074              |

The building peaked at hour 13 month 8 with a capacity of 192.6 tons

ENGINEERING CHECKS - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | ----- Cooling ----- |             |               |                | --- Heating --- |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------------|-------------|---------------|----------------|-----------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft       | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft   | Btuh/<br>Sq Ft |                     |
| 1                | Main               | BPMZ           | 27.29                     | 1.83                | 273.4       | 149.2         | 80.42          | 1.83            | -25.60         | 9,155               |
| 2                | Main               | VTCV           | 28.57                     | 1.75                | 294.7       | 168.4         | 71.26          | 1.75            | -26.65         | 1,887               |
| 3                | Main               | BPMZ           | 27.98                     | 1.79                | 327.6       | 183.3         | 65.45          | 1.79            | -28.24         | 14,458              |
| 4                | Main               | VTCV           | 28.57                     | 1.75                | 301.3       | 172.2         | 69.70          | 1.75            | -22.78         | 3,060               |
| 5                | Main               | VTCV           | 28.57                     | 1.75                | 295.4       | 168.8         | 71.09          | 1.75            | -32.93         | 2,944               |
| 6                | Main               | VTCV           | 28.57                     | 1.75                | 310.6       | 177.5         | 67.61          | 1.75            | -35.70         | 1,050               |

System 1 Block BPMZ - BYPASS MULTIZONE

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/14 \* Mo/Hr: 8/14 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 95/ 76/111.1 \* OADB: 95 \* OADB: 29

|                 | Space      | Ret. Air | Ret. Air | Net     | Perct  |  | Space    | Perct  |  | Space Peak | Coil Peak | Perct  |
|-----------------|------------|----------|----------|---------|--------|--|----------|--------|--|------------|-----------|--------|
|                 | Sens.+Lat. | Sensible | Latent   | Total   | Of Tot |  | Sensible | Of Tot |  | Space Sens | Tot Sens  | Of Tot |
|                 | (Btuh)     | (Btuh)   | (Btuh)   | (Btuh)  | (%)    |  | (Btuh)   | (%)    |  | (Btuh)     | (Btuh)    | (%)    |
| Envelope Loads  |            |          |          |         |        |  |          |        |  |            |           |        |
| Skylite Solr    | 0          | 0        |          | 0       | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Skylite Cond    | 0          | 0        |          | 0       | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Roof Cond       | 0          | 40,114   |          | 40,114  | 5.45   |  | 0        | 0.00   |  | 0          | -21,001   | 8.96   |
| Glass Solar     | 12,236     | 0        |          | 12,236  | 1.66   |  | 32,186   | 7.11   |  | 0          | 0         | 0.00   |
| Glass Cond      | 4,272      | 0        |          | 4,272   | 0.58   |  | -2,136   | -0.47  |  | -13,196    | -13,196   | 5.63   |
| Wall Cond       | 3,452      | -1,645   |          | 1,807   | 0.25   |  | 3,833    | 0.85   |  | -8,979     | -11,850   | 5.06   |
| Partition       | 0          |          |          | 0       | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Exposed Floor   | 0          |          |          | 0       | 0.00   |  | 0        | 0.00   |  | -5,412     | -5,412    | 2.31   |
| Infiltration    | 6,974      |          |          | 6,974   | 0.95   |  | 2,279    | 0.50   |  | -6,767     | -6,767    | 2.89   |
| Sub Total==>    | 26,933     | 38,470   |          | 65,403  | 8.88   |  | 36,163   | 7.99   |  | -34,355    | -58,227   | 24.84  |
| Internal Loads  |            |          |          |         |        |  |          |        |  |            |           |        |
| Lights          | 41,432     | 7,312    |          | 48,744  | 6.62   |  | 42,270   | 9.34   |  | 0          | 0         | 0.00   |
| People          | 70,503     |          |          | 70,503  | 9.58   |  | 47,163   | 10.42  |  | 0          | 0         | 0.00   |
| Misc            | 90,670     | 0        | 0        | 90,670  | 12.31  |  | 72,536   | 16.03  |  | 0          | 0         | 0.00   |
| Sub Total==>    | 202,605    | 7,312    | 0        | 209,917 | 28.51  |  | 161,969  | 35.78  |  | 0          | 0         | 0.00   |
| Ceiling Load    | 37,295     | -37,295  |          | 0       | 0.00   |  | 36,089   | 7.97   |  | -23,872    | 0         | 0.00   |
| Outside Air     | 0          | 0        | 0        | 209,207 | 28.41  |  | 0        | 0.00   |  | 0          | -203,024  | 86.61  |
| Sup. Fan Heat   |            |          |          | 26,838  | 3.65   |  |          | 0.00   |  |            | 26,838    | -11.45 |
| Ret. Fan Heat   |            | 8,946    |          | 8,946   | 1.22   |  |          | 0.00   |  |            | 0         | 0.00   |
| Duct Heat Pkup  |            | 0        |          | 0       | 0.00   |  |          | 0.00   |  |            | 0         | 0.00   |
| OV/UNDR Sizing  | 218,400    |          |          | 218,400 | 29.66  |  | 218,400  | 48.25  |  | 0          | 0         | 0.00   |
| Exhaust Heat    |            | -2,441   | 0        | -2,441  | -0.33  |  |          | 0.00   |  |            | 0         | 0.00   |
| Terminal Bypass |            | 0        | 0        | 0       | -0.00  |  |          | 0.00   |  |            | 0         | 0.00   |
| Grand Total==>  | 485,234    | 14,991   | 0        | 736,270 | 100.00 |  | 452,621  | 100.00 |  | -58,227    | -234,413  | 100.00 |

| -----COOLING COIL SELECTION----- |                |           |            |                   |       |        |                  |       |        | -----AREAS----- |            |        |
|----------------------------------|----------------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|--------|
|                                  | Total Capacity | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)    |
|                                  | (Tons)         | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |            |        |
| Main Clg                         | 61.4           | 736.3     | 555.8      | 16,774            | 83.5  | 68.2   | 82.4             | 51.9  | 51.0   | 55.7            | 9,155      |        |
| Aux Clg                          | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |        |
| Opt Vent                         | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 165        |        |
| Totals                           | 61.4           | 736.3     |            |                   |       |        |                  |       |        |                 | 9,155      | 0 0    |
|                                  |                |           |            |                   |       |        |                  |       |        |                 | 2,310      | 266 12 |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | -----ENGINEERING CHECKS----- |        | -----TEMPERATURES (F)----- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------------|--------|----------------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA                     |        | Type                       | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     |         |         |                              |        |                            |      |      |
| Main Htg                         | -234.4   | 16,774     | 60.3  | 73.2  | Infil                    | 4,577   | 4,577   | Clg Cfm/Sqft                 | 27.3   | SADB                       | 53.1 | 73.2 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 153     | 153     | Clg Cfm/Ton                  | 1.83   | Plenum                     | 90.9 | 61.8 |
| Preheat                          | -0.0     | 16,774     | 60.3  | 53.1  | Mincfm                   | 16,774  | 16,774  | Clg Sqft/Ton                 | 273.38 | Return                     | 78.5 | 70.0 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 0       | 0       | Clg Btuh/Sqft                | 149.21 | Ret/OA                     | 83.1 | 58.8 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 16,774  | 16,774  | No. People                   | 80.42  | Runarnd                    | 78.0 | 70.0 |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 4,577   | 4,577   | Htg % OA                     | 183    | Fn MtrTD                   | 0.5  | 0.5  |
| Total                            | -234.4   |            |       |       | Auxil                    | 0       | 0       | Htg Cfm/Sqft                 | 27.3   | Fn BldTD                   | 0.4  | 0.4  |
|                                  |          |            |       |       |                          |         |         | Htg Btuh/Sqft                | 1.83   | Fn Frict                   | 1.1  | 1.1  |
|                                  |          |            |       |       |                          |         |         |                              | -25.60 |                            |      |      |

System 2 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  |                              |                           | ***** HEATING COIL PEAK ***** |  |  |  |  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|------------------------------|---------------------------|-------------------------------|--|--|--|--|
| Peak at Time ==> Mo/Hr: 8/12             |                         |                          |                        |                  | Mo/Hr: 7/18                |                       |                  |                              |                           | Mo/Hr: 13/ 1                  |  |  |  |  |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |                         |                          |                        |                  | OADB: 92                   |                       |                  |                              |                           | OADB: 29                      |  |  |  |  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Space Sens (Btuh) | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%)              |  |  |  |  |
| Skyline Solr                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                            | 0                         | 0.00                          |  |  |  |  |
| Skyline Cond                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                            | 0                         | 0.00                          |  |  |  |  |
| Roof Cond                                | 0                       | 6,075                    |                        | 6,075            | 4.52                       | 0                     | 0.00             | 0                            | -4,137                    | 8.23                          |  |  |  |  |
| Glass Solar                              | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                            | 0                         | 0.00                          |  |  |  |  |
| Glass Cond                               | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                            | 0                         | 0.00                          |  |  |  |  |
| Wall Cond                                | 2,086                   | 153                      |                        | 2,238            | 1.66                       | 2,759                 | 3.77             | -5,412                       | -7,065                    | 14.05                         |  |  |  |  |
| Partition                                | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                            | 0                         | 0.00                          |  |  |  |  |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | -2,886                       | -2,886                    | 5.74                          |  |  |  |  |
| Infiltration                             | 1,475                   |                          |                        | 1,475            | 1.10                       | 493                   | 0.67             | -1,395                       | -1,395                    | 2.77                          |  |  |  |  |
| Sub Total==>                             | 3,560                   | 6,228                    |                        | 9,789            | 7.28                       | 3,252                 | 4.44             | -9,693                       | -15,483                   | 30.79                         |  |  |  |  |
| Internal Loads                           |                         |                          |                        |                  |                            |                       |                  |                              |                           |                               |  |  |  |  |
| Lights                                   | 8,430                   | 1,488                    |                        | 9,918            | 7.38                       | 8,759                 | 11.96            | 0                            | 0                         | 0.00                          |  |  |  |  |
| People                                   | 17,351                  |                          |                        | 17,351           | 12.90                      | 9,907                 | 13.53            | 0                            | 0                         | 0.00                          |  |  |  |  |
| Misc                                     | 12,881                  | 0                        | 0                      | 12,881           | 9.58                       | 10,305                | 14.07            | 0                            | 0                         | 0.00                          |  |  |  |  |
| Sub Total==>                             | 38,662                  | 1,488                    | 0                      | 40,150           | 29.86                      | 28,970                | 39.56            | 0                            | 0                         | 0.00                          |  |  |  |  |
| Ceiling Load                             | 7,716                   | -7,716                   |                        | 0                | 0.00                       | 7,764                 | 10.60            | -5,790                       | 0                         | 0.00                          |  |  |  |  |
| Outside Air                              | 0                       | 0                        | 0                      | 44,242           | 32.90                      | 0                     | 0.00             | 0                            | -41,847                   | 83.22                         |  |  |  |  |
| Sup. Fan Heat                            |                         |                          |                        | 7,045            | 5.24                       |                       | 0.00             |                              | 7,045                     | -14.01                        |  |  |  |  |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                              | 0                         | 0.00                          |  |  |  |  |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                              | 0                         | 0.00                          |  |  |  |  |
| OV/UNDR Sizing                           | 33,246                  |                          |                        | 33,246           | 24.72                      | 33,246                | 45.40            | 0                            | 0                         | 0.00                          |  |  |  |  |
| Exhaust Heat                             |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                              | 0                         | 0.00                          |  |  |  |  |
| Minimal Bypass                           |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                              | 0                         | 0.00                          |  |  |  |  |
| Grand Total==>                           | 83,184                  | 0                        | 0                      | 134,471          | 100.00                     | 73,232                | 100.00           | -15,483                      | -50,285                   | 100.00                        |  |  |  |  |

| -----COOLING COIL SELECTION----- |                       |                 |                  |                   |      |      |                  |      |      | -----AREAS----- |            |       |
|----------------------------------|-----------------------|-----------------|------------------|-------------------|------|------|------------------|------|------|-----------------|------------|-------|
|                                  | Total Capacity (Tons) | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |      |      | Leaving DB/WB/HR |      |      | Gross Total     | Glass (sf) | (%)   |
| Main Clg                         | 11.2                  | 134.5           | 90.7             | 3,302             | 81.8 | 67.9 | 83.1             | 55.5 | 54.8 | 64.9            | Floor      | 1,887 |
| Aux Clg                          | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | 0.0             | Part       | 0     |
| Opt Vent                         | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | 0.0             | ExFlr      | 88    |
| Totals                           | 11.2                  | 134.5           |                  |                   |      |      |                  |      |      |                 | Roof       | 1,887 |
|                                  |                       |                 |                  |                   |      |      |                  |      |      |                 | Wall       | 1,232 |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |       | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|-------|------------------------|--------|-----------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating |       | Clg % OA               |        | Type                  | Clg  | Htg  |
| Main Htg                         | -50.3            | 3,302     | 58.3      | 72.4 | Vent                     | 944     | 944   | Clg Cfm/Sqft           | 1.75   | SADB                  | 57.5 | 74.3 |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Infil                    | 31      | 31    | Clg Cfm/Ton            | 294.69 | Plenum                | 90.9 | 60.3 |
| Preheat                          | -0.0             | 3,302     | 58.3      | 55.5 | Supply                   | 3,302   | 3,302 | Clg Sqft/Ton           | 168.39 | Return                | 78.0 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Mincfm                   | 0       | 0     | Clg Btuh/Sqft          | 71.26  | Ret/OA                | 81.8 | 58.3 |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Return                   | 3,302   | 3,302 | No. People             | 38     | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 944     | 944   | Htg % OA               | 28.6   | Fn MtrTD              | 0.5  | 0.5  |
| Total                            | -50.3            |           |           |      | Rm Exh                   | 0       | 0     | Htg Cfm/Sqft           | 1.75   | Fn BldTD              | 0.4  | 0.4  |
|                                  |                  |           |           |      | Auxil                    | 0       | 0     | Htg Btuh/Sqft          | -26.65 | Fn Frict              | 1.1  | 1.1  |

System 3 Block BPMZ - BYPASS MULTIZONE

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/14 \* Mo/Hr: 7/18 \* Mo/Hr: 13/ 1 \*  
Outside Air ==> OADB/WB/HR: 95/ 76/111.1 \* OADB: 92 \* OADB: 29 \*

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 62,339                         |                              | 62,339                 | 6.59                   | * | 0                           | 0.00                   | * | 0                                  | -33,704                         | 8.26                   |
| Glass Solar     | 42,112                        | 0                              |                              | 42,112                 | 4.45                   | * | 52,528                      | 9.89                   | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 23,383                        | 0                              |                              | 23,383                 | 2.47                   | * | 21,917                      | 4.13                   | * | -72,232                            | -72,232                         | 17.69                  |
| Wall Cond       | 1,603                         | -12                            |                              | 1,591                  | 0.17                   | * | 1,697                       | 0.32                   | * | -4,797                             | -6,356                          | 1.56                   |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | -5,970                             | -5,970                          | 1.46                   |
| Infiltration    | 10,128                        |                                |                              | 10,128                 | 1.07                   | * | 3,858                       | 0.73                   | * | -10,688                            | -10,688                         | 2.62                   |
| Sub Total==>    | 77,226                        | 62,327                         |                              | 139,553                | 14.75                  | * | 80,000                      | 15.07                  | * | -93,686                            | -128,949                        | 31.59                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 65,432                        | 11,547                         |                              | 76,978                 | 8.13                   | * | 67,039                      | 12.62                  | * | 0                                  | 0                               | 0.00                   |
| People          | 111,037                       |                                |                              | 111,037                | 11.73                  | * | 73,321                      | 13.81                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 61,953                        | 0                              | 0                            | 61,953                 | 6.55                   | * | 49,562                      | 9.33                   | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 238,422                       | 11,547                         | 0                            | 249,969                | 26.41                  | * | 189,922                     | 35.77                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 63,922                        | -63,922                        |                              | 0                      | 0.00                   | * | 59,367                      | 11.18                  | * | -35,263                            | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 303,836                | 32.11                  | * | 0                           | 0.00                   | * | 0                                  | -320,625                        | 78.54                  |
| Sup. Fan Heat   |                               |                                |                              | 41,336                 | 4.37                   | * |                             | 0.00                   | * |                                    | 41,336                          | -10.13                 |
| Ret. Fan Heat   |                               | 13,779                         |                              | 13,779                 | 1.46                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat Pkup  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 201,715                       |                                |                              | 201,715                | 21.32                  | * | 201,715                     | 37.99                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat    |                               | -3,855                         | 0                            | -3,855                 | -0.41                  | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | -0.00                  | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 581,285                       | 19,875                         | 0                            | 946,332                | 100.00                 | * | 531,003                     | 100.00                 | * | -128,949                           | -408,239                        | 100.00                 |

-----COOLING COIL SELECTION-----

|          | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total | Glass (sf) | (%)      |
|----------|--------------------------|--------------------|---------------------|-------------------|-------|--------|------------------|-------|--------|-------------|------------|----------|
|          |                          |                    |                     | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor       |            |          |
| Main Clg | 78.9                     | 946.3              | 25,835              | 83.6              | 69.0  | 86.6   | 57.9             | 57.3  | 71.7   | Part        | 0          |          |
| Aux Clg  | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | ExFlr       | 182        |          |
| Opt Vent | 0.0                      | 0.0                | 0                   | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | Roof        | 14,458     | 0 0      |
| Totals   | 78.9                     | 946.3              |                     |                   |       |        |                  |       |        | Wall        | 2,548      | 1,456 57 |

-----HEATING COIL SELECTION-----

|          | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F | Type    | Cooling | Heating | --ENGINEERING CHECKS-- |        |  | --TEMPERATURES (F)-- |      |      |
|----------|-------------------|---------------------|--------------|--------------|---------|---------|---------|------------------------|--------|--|----------------------|------|------|
|          |                   |                     |              |              |         |         |         | Clg % OA               | 28.0   |  | Type                 | Clg  | Htg  |
| Main Htg | -408.2            | 25,835              | 60.0         | 74.6         | Vent    | 7,229   | 7,229   | Clg Cfm/Sqft           | 1.79   |  | SADB                 | 59.0 | 74.6 |
| Aux Htg  | 0.0               | 0                   | 0.0          | 0.0          | Infil   | 241     | 241     | Clg Cfm/Ton            | 327.60 |  | Plenum               | 92.0 | 62.3 |
| Preheat  | -0.0              | 25,835              | 60.0         | 59.0         | Supply  | 25,835  | 25,835  | Clg Sqft/Ton           | 183.34 |  | Return               | 78.5 | 70.0 |
| Reheat   | 0.0               | 0                   | 0.0          | 0.0          | Mincfm  | 9,042   | 9,042   | Clg Btuh/Sqft          | 65.45  |  | Ret/OA               | 83.3 | 58.5 |
| Humidif  | 0.0               | 0                   | 0.0          | 0.0          | Return  | 25,835  | 25,835  | No. People             | 289    |  | Runarnd              | 78.0 | 70.0 |
| Opt Vent | 0.0               | 0                   | 0.0          | 0.0          | Exhaust | 7,229   | 7,229   | Htg % OA               | 28.0   |  | Fn MtrTD             | 0.5  | 0.5  |
| Total    | -408.2            |                     |              |              | Rm Exh  | 0       | 0       | Htg Cfm/SqFt           | 1.79   |  | Fn BldTD             | 0.4  | 0.4  |
|          |                   |                     |              |              | Auxil   | 0       | 0       | Htg Btuh/SqFt          | -28.24 |  | Fn Frict             | 1.1  | 1.1  |

System 4 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
 Peaked at Time ==> Mo/Hr: 8/12 \* Mo/Hr: 7/18 \* Mo/Hr: 13/ 1 \*  
 Outside Air ==> OADB/WB/HR: 91/ 76/117.0 \* OADB: 92 \* OADB: 29 \*

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 9,873                          |                              | 9,873                  | 4.63                   | * | 0                           | 0.00                   | * | 0                                  | -7,193                          | 10.32                  |
| Glass Solar     | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Wall Cond       | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Infiltration    | 2,343                         |                                |                              | 2,343                  | 1.10                   | * | 799                         | 0.67                   | * | -2,262                             | -2,262                          | 3.25                   |
| Sub Total==>    | 2,343                         | 9,873                          |                              | 12,216                 | 5.73                   | * | 799                         | 0.67                   | * | -2,262                             | -9,455                          | 13.57                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 13,316                        | 2,350                          |                              | 15,666                 | 7.35                   | * | 14,381                      | 12.11                  | * | 0                                  | 0                               | 0.00                   |
| People          | 28,121                        |                                |                              | 28,121                 | 13.19                  | * | 16,065                      | 13.53                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 20,888                        | 0                              | 0                            | 20,888                 | 9.79                   | * | 16,710                      | 14.07                  | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 62,325                        | 2,350                          | 0                            | 64,675                 | 30.33                  | * | 47,156                      | 39.71                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 12,223                        | -12,223                        |                              | 0                      | 0.00                   | * | 12,324                      | 10.38                  | * | -7,193                             | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 70,287                 | 32.96                  | * | 0                           | 0.00                   | * | 0                                  | -67,860                         | 97.36                  |
| Sup. Fan Heat   |                               |                                |                              | 7,616                  | 3.57                   | * |                             | 0.00                   | * |                                    | 7,616                           | -10.93                 |
| Ret. Fan Heat   |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat PkUp  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 58,475                        |                                |                              | 58,475                 | 27.42                  | * | 58,475                      | 49.24                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat    |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 135,365                       | 0                              | 0                            | 213,268                | 100.00                 | * | 118,754                     | 100.00                 | * | -9,455                             | -69,699                         | 100.00                 |

-----COOLING COIL SELECTION-----

|          | Total Capacity |       | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        |
|----------|----------------|-------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|
|          | (Tons)         | (Mbh) | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains |
| Main Clg | 17.8           | 213.3 | 143.6     | 5,355      | 81.8              | 68.0  | 84.1   | 56.2             | 55.5  | 66.7   |
| Aux Clg  | 0.0            | 0.0   | 0.0       | 0          | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    |
| Opt Vent | 0.0            | 0.0   | 0.0       | 0          | 0.0               | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    |
| Totals   | 17.8           | 213.3 |           |            |                   |       |        |                  |       |        |

-----AREAS-----

|       | Gross Total | Glass (sf) | (%) |
|-------|-------------|------------|-----|
| Floor | 3,060       |            |     |
| Part  | 0           |            |     |
| ExFlr | 0           |            |     |
| Roof  | 3,060       | 0          | 0   |
| Wall  | 0           | 0          | 0   |

-----HEATING COIL SELECTION-----

|          | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F |
|----------|-------------------|---------------------|--------------|--------------|
| Main Htg | -69.7             | 5,355               | 58.3         | 70.3         |
| Aux Htg  | 0.0               | 0                   | 0.0          | 0.0          |
| Preheat  | -0.0              | 5,355               | 58.3         | 56.2         |
| Reheat   | 0.0               | 0                   | 0.0          | 0.0          |
| Humidif  | 0.0               | 0                   | 0.0          | 0.0          |
| Opt Vent | 0.0               | 0                   | 0.0          | 0.0          |
| Total    | -69.7             |                     |              |              |

-----AIRFLOWS (cfm)-----

|         | Type | Cooling | Heating |
|---------|------|---------|---------|
| Vent    |      | 1,530   | 1,530   |
| Infil   |      | 51      | 51      |
| Supply  |      | 5,355   | 5,355   |
| Mincfm  |      | 1,874   | 1,874   |
| Return  |      | 5,355   | 5,355   |
| Exhaust |      | 1,530   | 1,530   |
| Rm Exh  |      | 0       | 0       |
| Auxil   |      | 0       | 0       |

-----ENGINEERING CHECKS-----

|               |        |
|---------------|--------|
| Clg % OA      | 28.6   |
| Clg Cfm/Sqft  | 1.75   |
| Clg Cfm/Ton   | 301.31 |
| Clg Sqft/Ton  | 172.18 |
| Clg Btuh/Sqft | 69.70  |
| No. People    | 61     |
| Htg % OA      | 28.6   |
| Htg Cfm/Sqft  | 1.75   |
| Htg Btuh/Sqft | -22.78 |

-----TEMPERATURES (F)-----

| Type     | Clg  | Htg  |
|----------|------|------|
| SADB     | 57.5 | 71.6 |
| Plenum   | 90.6 | 62.6 |
| Return   | 78.0 | 70.0 |
| Ret/OA   | 81.8 | 58.3 |
| Runarnd  | 78.0 | 70.0 |
| Fn MtrTD | 0.3  | 0.3  |
| Fn BldTD | 0.2  | 0.2  |
| Fn Frict | 0.7  | 0.7  |



System 5 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |          |          |         |        |   | CLG SPACE PEAK ***** |        |   | ***** HEATING COIL PEAK ***** |           |        |
|------------------------------------------|----------|----------|---------|--------|---|----------------------|--------|---|-------------------------------|-----------|--------|
| Peaked at Time ==> Mo/Hr: 8/12           |          |          |         |        |   | Mo/Hr: 7/13          |        |   | Mo/Hr: 13/ 1                  |           |        |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |          |          |         |        |   | OADB: 95             |        |   | OADB: 29                      |           |        |
| Space                                    | Ret. Air | Ret. Air | Net     | Perct  |   | Space                | Perct  |   | Space Peak                    | Coil Peak | Perct  |
| Sens.+Lat.                               | Sensible | Latent   | Total   | Of Tot |   | Sensible             | Of Tot |   | Space Sens                    | Tot Sens  | Of Tot |
| (Btuh)                                   | (Btuh)   | (Btuh)   | (Btuh)  | (%)    |   | (Btuh)               | (%)    |   | (Btuh)                        | (Btuh)    | (%)    |
| Envelope Loads                           |          |          |         |        |   |                      |        |   |                               |           |        |
| Skylite Solr                             | 0        | 0        | 0       | 0.00   | * | 0                    | 0.00   | * | 0                             | 0         | 0.00   |
| Skylite Cond                             | 0        | 0        | 0       | 0.00   | * | 0                    | 0.00   | * | 0                             | 0         | 0.00   |
| Roof Cond                                | 0        | 9,457    | 9,457   | 4.52   | * | 0                    | 0.00   | * | 0                             | -6,315    | 6.51   |
| Glass Solar                              | 17,940   | 0        | 17,940  | 8.57   | * | 15,410               | 13.49  | * | 0                             | 0         | 0.00   |
| Glass Cond                               | 2,758    | 0        | 2,758   | 1.32   | * | 3,441                | 3.01   | * | -11,410                       | -11,410   | 11.77  |
| Wall Cond                                | 3,888    | 359      | 4,247   | 2.03   | * | 4,317                | 3.78   | * | -9,779                        | -13,125   | 13.54  |
| Partition                                | 0        | 0        | 0       | 0.00   | * | 0                    | 0.00   | * | 0                             | 0         | 0.00   |
| Exposed Floor                            | 0        | 0        | 0       | 0.00   | * | 0                    | 0.00   | * | -5,970                        | -5,970    | 6.16   |
| Infiltration                             | 2,283    | 0        | 2,283   | 1.09   | * | 883                  | 0.77   | * | -2,176                        | -2,176    | 2.24   |
| Sub Total==>                             | 26,868   | 9,816    | 36,684  | 17.53  | * | 24,051               | 21.05  | * | -29,335                       | -38,996   | 40.22  |
| Internal Loads                           |          |          |         |        |   |                      |        |   |                               |           |        |
| Lights                                   | 13,153   | 2,321    | 15,474  | 7.39   | * | 13,153               | 11.51  | * | 0                             | 0         | 0.00   |
| People                                   | 27,261   | 0        | 27,261  | 13.03  | * | 12,777               | 11.18  | * | 0                             | 0         | 0.00   |
| Misc                                     | 20,096   | 0        | 20,096  | 9.60   | * | 16,077               | 14.07  | * | 0                             | 0         | 0.00   |
| Sub Total==>                             | 60,510   | 2,321    | 62,831  | 30.02  | * | 42,006               | 36.77  | * | 0                             | 0         | 0.00   |
| Ceiling Load                             | 12,137   | -12,137  | 0       | 0.00   | * | 14,225               | 12.45  | * | -9,661                        | 0         | 0.00   |
| Outside Air                              | 0        | 0        | 68,479  | 32.72  | * | 0                    | 0.00   | * | 0                             | -65,287   | 67.34  |
| Sup. Fan Heat                            |          |          | 7,327   | 3.50   | * |                      | 0.00   | * |                               | 7,327     | -7.56  |
| Ret. Fan Heat                            |          | 0        | 0       | 0.00   | * |                      | 0.00   | * |                               | 0         | 0.00   |
| Duct Heat Pkup                           |          | 0        | 0       | 0.00   | * |                      | 0.00   | * |                               | 0         | 0.00   |
| OV/UNDR Sizing                           | 33,971   |          | 33,971  | 16.23  | * | 33,971               | 29.73  | * | 0                             | 0         | 0.00   |
| Exhaust Heat                             |          | 0        | 0       | 0.00   | * |                      | 0.00   | * |                               | 0         | 0.00   |
| Terminal Bypass                          |          | 0        | 0       | 0.00   | * |                      | 0.00   | * |                               | 0         | 0.00   |
| Grand Total==>                           | 133,486  | 0        | 209,292 | 100.00 | * | 114,252              | 100.00 | * | -38,996                       | -96,956   | 100.00 |

| -----COOLING COIL SELECTION----- |           |            |                   |       |       |                  |       |       |             | -----AREAS----- |       |       |
|----------------------------------|-----------|------------|-------------------|-------|-------|------------------|-------|-------|-------------|-----------------|-------|-------|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |       | Leaving DB/WB/HR |       |       | Gross Total | Glass (sf)      | (%)   |       |
| (Tons)                           | (Mbh)     | (Mbh)      | (cfm)             | Deg F | Deg F | Grains           | Deg F | Deg F | Grains      | Floor           | 2,944 |       |
| Main Clg                         | 17.4      | 209.3      | 141.3             | 5,152 | 81.8  | 67.9             | 83.5  | 56.2  | 55.0        | 64.9            | Part  | 0     |
| Aux Clg                          | 0.0       | 0.0        | 0.0               | 0     | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | ExFlr | 182   |
| Opt Vent                         | 0.0       | 0.0        | 0.0               | 0     | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | Roof  | 2,944 |
| Totals                           | 17.4      | 209.3      |                   |       |       |                  |       |       |             |                 | Wall  | 2,548 |
|                                  |           |            |                   |       |       |                  |       |       |             |                 |       | 230   |
|                                  |           |            |                   |       |       |                  |       |       |             |                 |       | 9     |

| -----HEATING COIL SELECTION----- |            |       |       |      | -----AIRFLOWS (cfm)----- |         |              | --ENGINEERING CHECKS-- |        |          | --TEMPERATURES (F)--- |      |  |
|----------------------------------|------------|-------|-------|------|--------------------------|---------|--------------|------------------------|--------|----------|-----------------------|------|--|
| Capacity                         | Coil Airfl | Ent   | Lvg   | Type | Cooling                  | Heating | Clg % OA     | 28.6                   | Type   | Clg      | Htg                   |      |  |
| (Mbh)                            | (cfm)      | Deg F | Deg F | Vent | 1,472                    | 1,472   | Clg Cfm/Sqft | 1.75                   | SADB   | 57.5     | 77.0                  |      |  |
| Main Htg                         | -97.0      | 5,152 | 58.3  | 75.7 | Infil                    | 49      | 49           | Clg Cfm/Ton            | 295.40 | Plenum   | 91.0                  | 59.6 |  |
| Aux Htg                          | 0.0        | 0     | 0.0   | 0.0  | Supply                   | 5,152   | 5,152        | Clg Sqft/Ton           | 168.80 | Return   | 78.0                  | 70.0 |  |
| Preheat                          | -0.0       | 5,152 | 58.3  | 56.2 | Mincfm                   | 1,803   | 1,803        | Clg Btuh/Sqft          | 71.09  | Ret/OA   | 81.8                  | 58.3 |  |
| Reheat                           | 0.0        | 0     | 0.0   | 0.0  | Return                   | 5,152   | 5,152        | No. People             | 59     | Runarnd  | 78.0                  | 70.0 |  |
| Humidif                          | 0.0        | 0     | 0.0   | 0.0  | Exhaust                  | 1,472   | 1,472        | Htg % OA               | 28.6   | Fn MtrTD | 0.3                   | 0.3  |  |
| Opt Vent                         | 0.0        | 0     | 0.0   | 0.0  | Rm Exh                   | 0       | 0            | Htg Cfm/Sqft           | 1.75   | Fn BldTD | 0.2                   | 0.2  |  |
| Total                            | -97.0      |       |       |      | Auxil                    | 0       | 0            | Htg Btuh/Sqft          | -32.93 | Fn Frict | 0.7                   | 0.7  |  |

System 6 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/12 \* Mo/Hr: 7/13 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 91/ 76/117.0 \* OADB: 95 \* OADB: 29

|                 | Space      | Ret. Air | Ret. Air | Net    | Perct  |  | Space    | Perct  |  | Space Peak | Coil Peak | Perct  |
|-----------------|------------|----------|----------|--------|--------|--|----------|--------|--|------------|-----------|--------|
|                 | Sens.+Lat. | Sensible | Latent   | Total  | Of Tot |  | Sensible | Of Tot |  | Space Sens | Tot Sens  | Of Tot |
|                 | (Btuh)     | (Btuh)   | (Btuh)   | (Btuh) | (%)    |  | (Btuh)   | (%)    |  | (Btuh)     | (Btuh)    | (%)    |
| Envelope Loads  |            |          |          |        |        |  |          |        |  |            |           |        |
| Skylite Solr    | 0          | 0        |          | 0      | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Skylite Cond    | 0          | 0        |          | 0      | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Roof Cond       | 0          | 3,355    |          | 3,355  | 4.73   |  | 0        | 0.00   |  | 0          | -2,126    | 5.67   |
| Glass Solar     | 3,120      | 0        |          | 3,120  | 4.39   |  | 2,680    | 6.91   |  | 0          | 0         | 0.00   |
| Glass Cond      | 480        | 0        |          | 480    | 0.68   |  | 598      | 1.54   |  | -1,984     | -1,984    | 5.29   |
| Wall Cond       | 2,630      | 226      |          | 2,856  | 4.02   |  | 2,709    | 6.99   |  | -6,457     | -8,349    | 22.27  |
| Partition       | 0          |          |          | 0      | 0.00   |  | 0        | 0.00   |  | 0          | 0         | 0.00   |
| Exposed Floor   | 0          |          |          | 0      | 0.00   |  | 0        | 0.00   |  | -3,575     | -3,575    | 9.54   |
| Infiltration    | 801        |          |          | 801    | 1.13   |  | 315      | 0.81   |  | -776       | -776      | 2.07   |
| Sub Total==>    | 7,031      | 3,581    |          | 10,612 | 14.95  |  | 6,302    | 16.26  |  | -12,793    | -16,811   | 44.85  |
| Internal Loads  |            |          |          |        |        |  |          |        |  |            |           |        |
| Lights          | 4,691      | 828      |          | 5,519  | 7.77   |  | 4,691    | 12.10  |  | 0          | 0         | 0.00   |
| People          | 9,723      |          |          | 9,723  | 13.70  |  | 4,557    | 11.76  |  | 0          | 0         | 0.00   |
| Misc            | 1,792      | 0        | 0        | 1,792  | 2.52   |  | 1,433    | 3.70   |  | 0          | 0         | 0.00   |
| Sub Total==>    | 16,206     | 828      | 0        | 17,034 | 23.99  |  | 10,681   | 27.56  |  | 0          | 0         | 0.00   |
| Ceiling Load    | 4,409      | -4,409   |          | 0      | 0.00   |  | 5,085    | 13.12  |  | -4,018     | 0         | 0.00   |
| Outside Air     | 0          | 0        | 0        | 24,042 | 33.87  |  | 0        | 0.00   |  | 0          | -23,285   | 62.12  |
| Sup. Fan Heat   |            |          |          | 2,613  | 3.68   |  |          | 0.00   |  |            | 2,613     | -6.97  |
| Ret. Fan Heat   |            | 0        |          | 0      | 0.00   |  |          | 0.00   |  |            | 0         | 0.00   |
| Duct Heat Pkup  |            | 0        |          | 0      | 0.00   |  |          | 0.00   |  |            | 0         | 0.00   |
| OV/UNDR Sizing  | 16,692     |          |          | 16,692 | 23.51  |  | 16,692   | 43.06  |  | 0          | 0         | 0.00   |
| Exhaust Heat    |            | 0        | 0        | 0      | 0.00   |  |          | 0.00   |  |            | 0         | 0.00   |
| Terminal Bypass |            | 0        | 0        | 0      | 0.00   |  |          | 0.00   |  |            | 0         | 0.00   |
| Grand Total==>  | 44,338     | 0        | 0        | 70,994 | 100.00 |  | 38,761   | 100.00 |  | -16,811    | -37,483   | 100.00 |

| -----COOLING COIL SELECTION----- |                |           |            |                   |       |       |                  |       |       |        | -----AREAS----- |            |      |
|----------------------------------|----------------|-----------|------------|-------------------|-------|-------|------------------|-------|-------|--------|-----------------|------------|------|
|                                  | Total Capacity | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |       | Leaving DB/WB/HR |       |       |        | Gross Total     | Glass (sf) | (%)  |
|                                  | (Tons)         | (Mbh)     | (Mbh)      | (cfm)             | Deg F | Deg F | Grains           | Deg F | Deg F | Grains | Floor           |            |      |
| Main Clg                         | 5.9            | 71.0      | 48.2       | 1,837             | 81.8  | 68.1  | 84.2             | 57.2  | 55.9  | 67.0   | Part            | 0          |      |
| Aux Clg                          | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | 0.0    | ExFlr           | 109        |      |
| Opt Vent                         | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | 0.0    | Roof            | 1,050      | 0 0  |
| Totals                           | 5.9            | 71.0      |            |                   |       |       |                  |       |       |        | Wall            | 1,526      | 40 3 |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        |  | --TEMPERATURES (F)--- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------|--------|--|-----------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA               |        |  | Type                  | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     |         |         | Clg Cfm/Sqft           |        |  | SADB                  |      |      |
| Main Htg                         | -37.5    | 1,838      | 58.3  | 77.1  | Infil                    | 18      | 18      | Clg Cfm/Ton            | 310.59 |  | Plenum                | 91.3 | 57.9 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 1,837   | 1,838   | Clg Sqft/Ton           | 177.48 |  | Return                | 78.0 | 70.0 |
| Preheat                          | -0.0     | 1,837      | 58.3  | 57.2  | Mincfm                   | 643     | 643     | Clg Btuh/Sqft          | 67.61  |  | Ret/OA                | 81.8 | 58.3 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 1,837   | 1,838   | No. People             | 21     |  | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 525     | 525     | Htg % OA               | 28.6   |  | Fn MtrTD              | 0.3  | 0.3  |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 0       | 0       | Htg Cfm/Sqft           | 1.75   |  | Fn BldTD              | 0.2  | 0.2  |
| Total                            | -37.5    |            |       |       | Auxil                    | 0       | 0       | Htg Btuh/Sqft          | -35.70 |  | Fn Frict              | 0.7  | 0.7  |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 GL) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 99,942                   | 275                       | 333                       | 1                  | 4                                |
| Feb   | 91,512                   | 262                       | 438                       | 1                  | 3                                |
| March | 130,513                  | 283                       | 84                        | 23                 | 1                                |
| April | 136,166                  | 335                       | 10                        | 49                 | 0                                |
| May   | 149,138                  | 382                       | 0                         | 72                 | 0                                |
| June  | 153,772                  | 406                       | 0                         | 90                 | 0                                |
| July  | 161,171                  | 427                       | 0                         | 105                | 0                                |
| Aug   | 168,454                  | 433                       | 0                         | 114                | 0                                |
| Sept  | 151,379                  | 415                       | 0                         | 86                 | 0                                |
| Oct   | 137,693                  | 306                       | 51                        | 39                 | 1                                |
| Nov   | 121,654                  | 289                       | 114                       | 20                 | 1                                |
| Dec   | 110,713                  | 276                       | 471                       | 3                  | 3                                |
| Total | 1,612,106                | 433                       | 1,501                     | 602                | 4                                |

Building Energy Consumption = 173,625 (Btu/Sq Ft/Year)  
Source Energy Consumption = 511,949 (Btu/Sq Ft/Year)

Floor Area = 32,554 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

----- EQUIPMENT ENERGY CONSUMPTION -----

| Ref<br>Num | Equip<br>Code | ----- Monthly Consumption ----- |       |       |       |       |       |       |       |       |       |       |       | Total   |
|------------|---------------|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|            |               | Jan                             | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0          | LIGHTS        |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 20835                           | 19168 | 22501 | 20835 | 21668 | 21668 | 20835 | 22501 | 20835 | 21668 | 19168 | 20835 | 252,515 |
|            | PK            | 65.1                            | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1    |
| 1          | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 45403                           | 41009 | 45403 | 43938 | 45403 | 43938 | 45403 | 45403 | 43938 | 45403 | 43938 | 45403 | 534,579 |
|            | PK            | 61.0                            | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0    |
| 2          | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | GAS           | 0                               | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3          | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | OIL           | 0                               | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4          | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P STEAM       | 0                               | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|            | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P HOTH2O      | 0                               | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6          | MISC LD       |                                 |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P CHILL       | 0                               | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1          | EQ1100L       | AIR-CLD RECIP >45 TONS          |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 2397                            | 1744  | 10502 | 14864 | 18798 | 21700 | 24137 | 26187 | 21193 | 14718 | 10618 | 3974  | 170,832 |
|            | PK            | 37.5                            | 37.5  | 42.4  | 69.2  | 80.8  | 91.3  | 98.7  | 98.4  | 91.5  | 63.9  | 49.5  | 37.5  | 98.7    |
| 1          | EQ5200        | CONDENSER FANS                  |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 103                             | 70    | 612   | 1208  | 1655  | 1988  | 2559  | 2448  | 2003  | 1104  | 618   | 178   | 14,547  |
|            | PK            | 0.8                             | 0.7   | 2.5   | 7.0   | 8.5   | 9.3   | 10.5  | 10.5  | 9.4   | 4.6   | 3.1   | 1.4   | 10.5    |
| 1          | EQ5001        | CHILLED WATER PUMP C.V.         |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 1864                            | 1655  | 2677  | 2498  | 2580  | 2580  | 2498  | 2677  | 2498  | 2580  | 2274  | 2081  | 28,463  |
|            | PK            | 7.5                             | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5   | 7.5     |
| 1          | EQ5303        | CONTROLS                        |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 75                              | 67    | 108   | 100   | 104   | 104   | 100   | 108   | 100   | 104   | 91    | 84    | 1,145   |
|            | PK            | 0.3                             | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3     |
| 2          | EQ1001S       | 2-STG CTV <555 TONS             |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC          | 212                             | 443   | 7155  | 12986 | 17986 | 21714 | 25147 | 27652 | 21182 | 10645 | 6201  | 1116  | 152,438 |
|            | PK            | 26.4                            | 26.4  | 32.0  | 64.5  | 82.8  | 97.3  | 112.6 | 116.6 | 106.7 | 42.7  | 33.8  | 26.4  | 116.6   |
|            | EQ5100        | COOLING TOWER                   |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|          |                            |       |       |       |       |       |       |       |       |       |       |       |         |
|----------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| ELEC     | 328                        | 0     | 4543  | 4584  | 4735  | 4735  | 4584  | 4912  | 4584  | 4735  | 3859  | 1970  | 43,569  |
| PK       | 13.7                       | 0.0   | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7  | 13.7    |
| 2 EQ5100 | COOLING TOWER              |       |       |       |       |       |       |       |       |       |       |       |         |
| WATER    | 1                          | 1     | 23    | 49    | 72    | 90    | 105   | 114   | 86    | 39    | 20    | 3     | 602     |
| PK       | 0.0                        | 0.0   | 0.1   | 0.3   | 0.4   | 0.4   | 0.5   | 0.5   | 0.5   | 0.2   | 0.1   | 0.0   | 0.5     |
| 2 EQ5001 | CHILLED WATER PUMP C.V.    |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 366                        | 789   | 3796  | 3830  | 3956  | 3956  | 3830  | 4105  | 3830  | 3956  | 3224  | 1898  | 37,538  |
| PK       | 11.4                       | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4  | 11.4    |
| 2 EQ5010 | CONDENSER WATER PUMP C.V.  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 477                        | 1029  | 4951  | 4996  | 5160  | 5160  | 4996  | 5354  | 4996  | 5160  | 4206  | 2476  | 48,963  |
| PK       | 14.9                       | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9    |
| 2 EQ5300 | CONTROL PANEL & INTERLOCK  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 32                         | 69    | 332   | 335   | 346   | 346   | 335   | 359   | 335   | 346   | 282   | 166   | 3,283   |
| PK       | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 9679                       | 8743  | 9679  | 9367  | 9679  | 9367  | 9679  | 9679  | 9367  | 9679  | 9367  | 9679  | 113,968 |
| PK       | 13.0                       | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0    |
| 1 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 0                          | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
| PK       | 0.0                        | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1406                       | 1270  | 1406  | 1361  | 1406  | 1361  | 1406  | 1406  | 1361  | 1406  | 1361  | 1406  | 16,556  |
| PK       | 1.9                        | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9     |
| 3 EQ4001 | AIRFOIL CENTRIF. FAN C.V.  |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 12760                      | 11525 | 12760 | 12348 | 12760 | 12348 | 12760 | 12760 | 12348 | 12760 | 12348 | 12760 | 150,234 |
| PK       | 17.1                       | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1    |
| 4 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
| PK       | 1.5                        | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.5     |
| 5 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
| PK       | 1.5                        | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5     |
| 6 EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 744                        | 672   | 744   | 720   | 744   | 720   | 744   | 744   | 720   | 744   | 720   | 744   | 8,760   |
| PK       | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 EQ2001 | GAS FIRE TUBE HOT WATER    |       |       |       |       |       |       |       |       |       |       |       |         |
| GAS      | 6                          | 8     | 11    | 0     | 0     | 0     | 0     | 0     | 0     | 4     | 12    | 84    | 126     |
| PK       | 0.7                        | 0.1   | 0.2   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.4   | 0.7     |
| 1 EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
| ELEC     | 410                        | 559   | 753   | 37    | 0     | 0     | 0     | 0     | 0     | 261   | 761   | 2759  | 5,541   |
| PK       | 7.5                        | 7.5   | 7.5   | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.5   | 7.5   | 7.5   | 7.5     |
| EQ5240   | BOILER FORCED DRAFT FAN    |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|          |                            |     |     |     |     |     |     |     |     |     |     |     |       |
|----------|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| ELEC     | 16                         | 21  | 29  | 1   | 0   | 0   | 0   | 0   | 0   | 10  | 29  | 105 | 212   |
| PK       | 0.3                        | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.3   |
| 1 EQ5307 | BOILER CONTROLS            |     |     |     |     |     |     |     |     |     |     |     |       |
| ELEC     | 28                         | 38  | 51  | 3   | 0   | 0   | 0   | 0   | 0   | 18  | 51  | 185 | 372   |
| PK       | 0.5                        | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.5   |
| 2 EQ2001 | GAS FIRE TUBE HOT WATER    |     |     |     |     |     |     |     |     |     |     |     |       |
| GAS      | 327                        | 430 | 73  | 9   | 0   | 0   | 0   | 0   | 0   | 47  | 102 | 387 | 1,375 |
| PK       | 3.0                        | 3.2 | 0.7 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.7 | 2.7 | 3.2   |
| 2 EQ5020 | HEAT WATER CIRC. PUMP C.V. |     |     |     |     |     |     |     |     |     |     |     |       |
| ELEC     | 261                        | 278 | 142 | 26  | 0   | 0   | 0   | 0   | 0   | 96  | 180 | 296 | 1,280 |
| PK       | 0.7                        | 0.7 | 0.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.7 | 0.7 | 0.7   |
| 2 EQ5240 | BOILER FORCED DRAFT FAN    |     |     |     |     |     |     |     |     |     |     |     |       |
| ELEC     | 214                        | 228 | 116 | 21  | 0   | 0   | 0   | 0   | 0   | 79  | 148 | 243 | 1,051 |
| PK       | 0.6                        | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.6 | 0.6   |
| 2 EQ5307 | BOILER CONTROLS            |     |     |     |     |     |     |     |     |     |     |     |       |
| ELEC     | 175                        | 186 | 95  | 18  | 0   | 0   | 0   | 0   | 0   | 65  | 121 | 199 | 858   |
| PK       | 0.5                        | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.5   |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

----- UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 432.7 (kW)  
Yearly Time of Peak 12 (hr) 8 (mo)

Hour 12 Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Percnt<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|

Cooling Equipment

|   |         |                        |       |       |
|---|---------|------------------------|-------|-------|
| 1 | EQ1100L | AIR-CLD RECIP >45 TONS | 113.0 | 26.11 |
| 2 | EQ1001S | 2-STG CTV <555 TONS    | 157.7 | 36.44 |

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 270.6 | 62.54 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |      |      |
|---|--|------------------------------------|------|------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 13.0 | 3.01 |
| 2 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 1.9  | 0.44 |
| 3 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 17.1 | 3.96 |
|   |  | SUMMATION OF FAN ELECTRICAL DEMAND | 1.4  | 0.34 |
|   |  | SUMMATION OF FAN ELECTRICAL DEMAND | 1.5  | 0.34 |
| 6 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 1.0  | 0.23 |

|           |  |  |      |      |
|-----------|--|--|------|------|
| Sub Total |  |  | 36.0 | 8.31 |
|-----------|--|--|------|------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Miscellaneous

|                |  |  |       |       |
|----------------|--|--|-------|-------|
| Lights         |  |  | 65.1  | 15.05 |
| Base Utilities |  |  | 0.0   | 0.00  |
| Misc Equipment |  |  | 61.0  | 14.10 |
| Sub Total      |  |  | 126.1 | 29.15 |

|             |  |  |       |        |
|-------------|--|--|-------|--------|
| Grand Total |  |  | 432.7 | 100.00 |
|-------------|--|--|-------|--------|

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TRACE 600 ANALYSIS  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
EEAP ALTERNATIVES

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 74 (F)  
Winter Design Dry Bulb: 29 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 15:10:27 4/17/94  
Dataset Name: B1395 .TM



AIRFLOW - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Main<br>Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-------------------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
| 1                | BPMZ           | 4,577                       | 16,774                      | 16,774                              | 16,926                     | 4,730                       | 0                                    | 0                                   |
| 2                | VTCV           | 944                         | 3,302                       | 3,302                               | 3,334                      | 975                         | 0                                    | 0                                   |
| 3                | BPMZ           | 7,229                       | 25,835                      | 25,835                              | 26,076                     | 7,470                       | 0                                    | 0                                   |
| 4                | VTCV           | 1,530                       | 5,355                       | 5,355                               | 5,406                      | 1,581                       | 0                                    | 0                                   |
| 5                | VTCV           | 1,472                       | 5,152                       | 5,152                               | 5,201                      | 1,521                       | 0                                    | 0                                   |
| 6                | VTCV           | 525                         | 1,837                       | 1,838                               | 1,855                      | 542                         | 0                                    | 0                                   |
| Totals           |                | 16,277                      | 58,255                      | 58,255                              | 58,798                     | 16,820                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

| System<br>Number | System<br>Type | Cooling                         |                                 |                                 |                             | Heating                         |                                 |                               |                              |                                |                                 |                             |
|------------------|----------------|---------------------------------|---------------------------------|---------------------------------|-----------------------------|---------------------------------|---------------------------------|-------------------------------|------------------------------|--------------------------------|---------------------------------|-----------------------------|
|                  |                | Main Sys.<br>Capacity<br>(Tons) | Aux. Sys.<br>Capacity<br>(Tons) | Opt. Vent<br>Capacity<br>(Tons) | Cooling<br>Totals<br>(Tons) | Main Sys.<br>Capacity<br>(Btuh) | Aux. Sys.<br>Capacity<br>(Btuh) | Preheat<br>Capacity<br>(Btuh) | Reheat<br>Capacity<br>(Btuh) | Humidif.<br>Capacity<br>(Btuh) | Opt. Vent<br>Capacity<br>(Btuh) | Heating<br>Totals<br>(Btuh) |
| 1                | BPMZ           | 61.4                            | 0.0                             | 0.0                             | 61.4                        | -234,413                        | 0                               | 0                             | 0                            | 0                              | 0                               | -234,413                    |
| 2                | VTCV           | 11.2                            | 0.0                             | 0.0                             | 11.2                        | -50,285                         | 0                               | 0                             | 0                            | 0                              | 0                               | -50,285                     |
| 3                | BPMZ           | 78.9                            | 0.0                             | 0.0                             | 78.9                        | -408,239                        | 0                               | 0                             | 0                            | 0                              | 0                               | -408,239                    |
| 4                | VTCV           | 17.8                            | 0.0                             | 0.0                             | 17.8                        | -69,699                         | 0                               | 0                             | 0                            | 0                              | 0                               | -69,699                     |
| 5                | VTCV           | 17.4                            | 0.0                             | 0.0                             | 17.4                        | -96,956                         | 0                               | 0                             | 0                            | 0                              | 0                               | -96,956                     |
| 6                | VTCV           | 5.9                             | 0.0                             | 0.0                             | 5.9                         | -37,483                         | 0                               | 0                             | 0                            | 0                              | 0                               | -37,483                     |
| Totals           |                | 192.6                           | 0.0                             | 0.0                             | 192.6                       | -897,074                        | 0                               | 0                             | 0                            | 0                              | 0                               | -897,074                    |

The building peaked at hour 13 month 8 with a capacity of 192.6 tons

ENGINEERING CHECKS - ALTERNATIVE 3  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | ----- Cooling ----- |             |               |                | --- Heating --- |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------------|-------------|---------------|----------------|-----------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft       | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft   | Btuh/<br>Sq Ft |                     |
| 1                | Main               | BPMZ           | 27.29                     | 1.83                | 273.4       | 149.2         | 80.42          | 1.83            | -25.60         | 9,155               |
| 2                | Main               | VTCV           | 28.57                     | 1.75                | 294.7       | 168.4         | 71.26          | 1.75            | -26.65         | 1,887               |
| 3                | Main               | BPMZ           | 27.98                     | 1.79                | 327.6       | 183.3         | 65.45          | 1.79            | -28.24         | 14,458              |
| 4                | Main               | VTCV           | 28.57                     | 1.75                | 301.3       | 172.2         | 69.70          | 1.75            | -22.78         | 3,060               |
| 5                | Main               | VTCV           | 28.57                     | 1.75                | 295.4       | 168.8         | 71.09          | 1.75            | -32.93         | 2,944               |
| 6                | Main               | VTCV           | 28.57                     | 1.75                | 310.6       | 177.5         | 67.61          | 1.75            | -35.70         | 1,050               |

System 1 Block BPMZ - BYPASS MULTIZONE

| ***** COOLING COIL PEAK *****            |          |          |         |         | ***** CLG SPACE PEAK ***** |         |            |           |          | ***** HEATING COIL PEAK ***** |           |          |            |           |
|------------------------------------------|----------|----------|---------|---------|----------------------------|---------|------------|-----------|----------|-------------------------------|-----------|----------|------------|-----------|
| Peaked at Time ==> Mo/Hr: 8/14           |          |          |         |         | Mo/Hr: 8/14                |         |            |           |          | Mo/Hr: 13/ 1                  |           |          |            |           |
| Outside Air ==> OADB/WB/HR: 95/ 76/111.1 |          |          |         |         | OADB: 95                   |         |            |           |          | OADB: 29                      |           |          |            |           |
| Space                                    | Ret. Air | Ret. Air | Net     | Perct   | Space                      | Perct   | Space Peak | Coil Peak | Perct    | Space Peak                    | Coil Peak | Perct    | Space Peak | Coil Peak |
| Sens.+Lat.                               | Sensible | Latent   | Total   | Of Tot  | Sensible                   | Of Tot  | Space Sens | Tot Sens  | Of Tot   | Space Sens                    | Tot Sens  | Of Tot   | Space Sens | Tot Sens  |
| (Btuh)                                   | (Btuh)   | (Btuh)   | (Btuh)  | (%)     | (Btuh)                     | (%)     | (Btuh)     | (Btuh)    | (%)      | (Btuh)                        | (Btuh)    | (%)      | (Btuh)     | (Btuh)    |
| Envelope Loads                           |          |          |         |         |                            |         |            |           |          |                               |           |          |            |           |
| Skylite Solr                             | 0        | 0        | 0       | 0.00    | 0                          | 0.00    | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Skylite Cond                             | 0        | 0        | 0       | 0.00    | 0                          | 0.00    | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Roof Cond                                | 0        | 40,114   | 40,114  | 5.45    | 0                          | 0.00    | 0          | -21,001   | 8.96     | 0                             | -21,001   | 8.96     | 0          | 0         |
| Glass Solar                              | 12,236   | 0        | 12,236  | 1.66    | 32,186                     | 7.11    | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Glass Cond                               | 4,272    | 0        | 4,272   | 0.58    | -2,136                     | -0.47   | -13,196    | -13,196   | 5.63     | -13,196                       | -13,196   | 5.63     | -13,196    | -13,196   |
| Wall Cond                                | 3,452    | -1,645   | 1,807   | 0.25    | 3,833                      | 0.85    | -8,979     | -11,850   | 5.06     | -8,979                        | -11,850   | 5.06     | -8,979     | -11,850   |
| Partition                                | 0        | 0        | 0       | 0.00    | 0                          | 0.00    | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Exposed Floor                            | 0        | 0        | 0       | 0.00    | 0                          | 0.00    | -5,412     | -5,412    | 2.31     | -5,412                        | -5,412    | 2.31     | -5,412     | -5,412    |
| Infiltration                             | 6,974    | 0        | 6,974   | 0.95    | 2,279                      | 0.50    | -6,767     | -6,767    | 2.89     | -6,767                        | -6,767    | 2.89     | -6,767     | -6,767    |
| Sub Total==>                             | 26,933   | 38,470   | 65,403  | 8.88    | 36,163                     | 7.99    | -34,355    | -58,227   | 24.84    | -34,355                       | -58,227   | 24.84    | -34,355    | -58,227   |
| Internal Loads                           |          |          |         |         |                            |         |            |           |          |                               |           |          |            |           |
| Lights                                   | 41,432   | 7,312    | 48,744  | 6.62    | 42,270                     | 9.34    | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| People                                   | 70,503   | 0        | 70,503  | 9.58    | 47,163                     | 10.42   | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Misc                                     | 90,670   | 0        | 90,670  | 12.31   | 72,536                     | 16.03   | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Sub Total==>                             | 202,605  | 7,312    | 209,917 | 28.51   | 161,969                    | 35.78   | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Ceiling Load                             | 37,295   | -37,295  | 0       | 0.00    | 36,089                     | 7.97    | -23,872    | 0         | 0.00     | -23,872                       | 0         | 0.00     | -23,872    | 0         |
| Outside Air                              | 0        | 0        | 0       | 0.00    | 0                          | 0.00    | 0          | -203,024  | 86.61    | 0                             | -203,024  | 86.61    | 0          | 0         |
| Sup. Fan Heat                            |          |          | 26,838  | 3.65    |                            | 0.00    |            | 26,838    | -11.45   |                               | 26,838    | -11.45   |            | 0         |
| Ret. Fan Heat                            |          | 8,946    | 8,946   | 1.22    |                            | 0.00    |            | 0         | 0.00     |                               | 0         | 0.00     |            | 0         |
| Duct Heat Pkup                           |          | 0        | 0       | 0.00    |                            | 0.00    |            | 0         | 0.00     |                               | 0         | 0.00     |            | 0         |
| OV/UNDR Sizing                           | 218,400  |          | 218,400 | 29.66   | 218,400                    | 48.25   | 0          | 0         | 0.00     | 0                             | 0         | 0.00     | 0          | 0         |
| Exhaust Heat                             |          | -2,441   | -2,441  | -0.33   |                            | 0.00    |            | 0         | 0.00     |                               | 0         | 0.00     |            | 0         |
| Terminal Bypass                          |          | 0        | 0       | -0.00   |                            | 0.00    |            | 0         | 0.00     |                               | 0         | 0.00     |            | 0         |
| Grand Total==>                           | 485,234  | 14,991   | 0       | 736,270 | 100.00                     | 452,621 | 100.00     | -58,227   | -234,413 | 100.00                        | -58,227   | -234,413 | 100.00     | -234,413  |

| -----COOLING COIL SELECTION----- |           |            |                   |        |       |                  |       |       |             | -----AREAS----- |       |        |
|----------------------------------|-----------|------------|-------------------|--------|-------|------------------|-------|-------|-------------|-----------------|-------|--------|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |        |       | Leaving DB/WB/HR |       |       | Gross Total | Glass (sf)      | (%)   |        |
| (Tons)                           | (Mbh)     | (Mbh)      | (cfm)             | Deg F  | Deg F | Grains           | Deg F | Deg F | Floor       |                 |       |        |
| Main Clg                         | 61.4      | 736.3      | 555.8             | 16,774 | 83.5  | 68.2             | 82.4  | 51.9  | 51.0        | 55.7            | 9,155 |        |
| Aux Clg                          | 0.0       | 0.0        | 0.0               | 0      | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | 0     |        |
| Opt Vent                         | 0.0       | 0.0        | 0.0               | 0      | 0.0   | 0.0              | 0.0   | 0.0   | 0.0         | 0.0             | 165   |        |
| Totals                           | 61.4      | 736.3      |                   |        |       |                  |       |       |             |                 | 9,155 |        |
|                                  |           |            |                   |        |       |                  |       |       |             |                 | 2,310 | 266 12 |

| -----HEATING COIL SELECTION----- |            |        |       |      | -----AIRFLOWS (cfm)----- |         |              |               |        | --ENGINEERING CHECKS-- |      |      | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------|--------|-------|------|--------------------------|---------|--------------|---------------|--------|------------------------|------|------|-----------------------|------|------|
| Capacity                         | Coil Airfl | Ent    | Lvg   | Type | Cooling                  | Heating | Clg % OA     | 27.3          | Type   | Clg                    | Htg  |      | Type                  | Clg  | Htg  |
| (Mbh)                            | (cfm)      | Deg F  | Deg F | Vent | 4,577                    | 4,577   | Clg Cfm/Sqft | 1.83          | SADB   | 53.1                   | 73.2 |      | Plenum                | 90.9 | 61.8 |
| Main Htg                         | -234.4     | 16,774 | 60.3  | 73.2 | Infil                    | 153     | 153          | Clg Cfm/Ton   | 273.38 | Return                 | 78.5 | 70.0 | Ret/OA                | 83.1 | 58.8 |
| Aux Htg                          | 0.0        | 0      | 0.0   | 0.0  | Supply                   | 16,774  | 16,774       | Clg Sqft/Ton  | 149.21 | Runarnd                | 78.0 | 70.0 | Fn MtrTD              | 0.5  | 0.5  |
| Preheat                          | -0.0       | 16,774 | 60.3  | 53.1 | Mincfm                   | 0       | 0            | Clg Btuh/Sqft | 80.42  | Fn BldTD               | 0.4  | 0.4  | Fn Frict              | 1.1  | 1.1  |
| Reheat                           | 0.0        | 0      | 0.0   | 0.0  | Return                   | 16,774  | 16,774       | No. People    | 183    |                        |      |      |                       |      |      |
| Humidif                          | 0.0        | 0      | 0.0   | 0.0  | Exhaust                  | 4,577   | 4,577        | Htg % OA      | 27.3   |                        |      |      |                       |      |      |
| Opt Vent                         | 0.0        | 0      | 0.0   | 0.0  | Rm Exh                   | 0       | 0            | Htg Cfm/Sqft  | 1.83   |                        |      |      |                       |      |      |
| Total                            | -234.4     |        |       |      | Auxil                    | 0       | 0            | Htg Btuh/Sqft | -25.60 |                        |      |      |                       |      |      |

System 2 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  | ***** HEATING COIL PEAK ***** |                           |                  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|-------------------------------|---------------------------|------------------|
| Peak at Time ==> Mo/Hr: 8/12             |                         |                          |                        |                  | Mo/Hr: 7/18                |                       |                  | Mo/Hr: 13/ 1                  |                           |                  |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |                         |                          |                        |                  | OADB: 92                   |                       |                  | OADB: 29                      |                           |                  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Space Sens (Btuh)  | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%) |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Roof Cond                                | 0                       | 6,075                    |                        | 6,075            | 4.52                       | 0                     | 0.00             | 0                             | -4,137                    | 8.23             |
| Glass Solar                              | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Glass Cond                               | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Wall Cond                                | 2,086                   | 153                      |                        | 2,238            | 1.66                       | 2,759                 | 3.77             | -5,412                        | -7,065                    | 14.05            |
| Partition                                | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | -2,886                        | -2,886                    | 5.74             |
| Infiltration                             | 1,475                   |                          |                        | 1,475            | 1.10                       | 493                   | 0.67             | -1,395                        | -1,395                    | 2.77             |
| Sub Total==>                             | 3,560                   | 6,228                    |                        | 9,789            | 7.28                       | 3,252                 | 4.44             | -9,693                        | -15,483                   | 30.79            |
| Internal Loads                           |                         |                          |                        |                  |                            |                       |                  |                               |                           |                  |
| Lights                                   | 8,430                   | 1,488                    |                        | 9,918            | 7.38                       | 8,759                 | 11.96            | 0                             | 0                         | 0.00             |
| People                                   | 17,351                  |                          |                        | 17,351           | 12.90                      | 9,907                 | 13.53            | 0                             | 0                         | 0.00             |
| Misc                                     | 12,881                  | 0                        | 0                      | 12,881           | 9.58                       | 10,305                | 14.07            | 0                             | 0                         | 0.00             |
| Sub Total==>                             | 38,662                  | 1,488                    | 0                      | 40,150           | 29.86                      | 28,970                | 39.56            | 0                             | 0                         | 0.00             |
| Ceiling Load                             | 7,716                   | -7,716                   |                        | 0                | 0.00                       | 7,764                 | 10.60            | -5,790                        | 0                         | 0.00             |
| Outside Air                              | 0                       | 0                        | 0                      | 44,242           | 32.90                      | 0                     | 0.00             | 0                             | -41,847                   | 83.22            |
| Sup. Fan Heat                            |                         |                          |                        | 7,045            | 5.24                       |                       | 0.00             |                               | 7,045                     | -14.01           |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Duct Heat PkUp                           |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| OV/UNDR Sizing                           | 33,246                  |                          |                        | 33,246           | 24.72                      | 33,246                | 45.40            | 0                             | 0                         | 0.00             |
| Reheat                                   |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Terminal Bypass                          |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                               | 0                         | 0.00             |
| Grand Total==>                           | 83,184                  | 0                        | 0                      | 134,471          | 100.00                     | 73,232                | 100.00           | -15,483                       | -50,285                   | 100.00           |

| -----COOLING COIL SELECTION----- |      |                 |                  |                   |      |      |                  |      |      | -----AREAS----- |            |     |
|----------------------------------|------|-----------------|------------------|-------------------|------|------|------------------|------|------|-----------------|------------|-----|
| Total Capacity (Tons)            |      | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |      |      | Leaving DB/WB/HR |      |      | Gross Total     | Glass (sf) | (%) |
| Main Clg                         | 11.2 | 134.5           | 90.7             | 3,302             | 81.8 | 67.9 | 55.5             | 54.8 | 64.9 | Floor           | 1,887      |     |
| Aux Clg                          | 0.0  | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | Part            | 0          |     |
| Opt Vent                         | 0.0  | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | ExFlr           | 88         |     |
| Totals                           | 11.2 | 134.5           |                  |                   |      |      |                  |      |      | Roof            | 1,887      | 0 0 |
|                                  |      |                 |                  |                   |      |      |                  |      |      | Wall            | 1,232      | 0 0 |

| -----HEATING COIL SELECTION----- |                  |           |           |         | -----AIRFLOWS (cfm)----- |         |               | -----ENGINEERING CHECKS----- |  | -----TEMPERATURES (F)----- |      |      |
|----------------------------------|------------------|-----------|-----------|---------|--------------------------|---------|---------------|------------------------------|--|----------------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type    | Cooling                  | Heating | Clg % OA      |                              |  | Type                       | Clg  | Htg  |
| Main Htg                         | -50.3            | 3,302     | 58.3      | Vent    | 944                      | 944     | 28.6          |                              |  | SADB                       | 57.5 | 74.3 |
| Aux Htg                          | 0.0              | 0         | 0.0       | Infil   | 31                       | 31      | 1.75          |                              |  | Plenum                     | 90.9 | 60.3 |
| Preheat                          | -0.0             | 3,302     | 58.3      | Supply  | 3,302                    | 3,302   | 294.69        |                              |  | Return                     | 78.0 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | Mincfm  | 0                        | 0       | 168.39        |                              |  | Ret/OA                     | 81.8 | 58.3 |
| Humidif                          | 0.0              | 0         | 0.0       | Return  | 3,302                    | 3,302   | 71.26         |                              |  | Runarnd                    | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | Exhaust | 944                      | 944     | 38            |                              |  | Fn MtrTD                   | 0.5  | 0.5  |
| Total                            | -50.3            |           |           | Rm Exh  | 0                        | 0       | 28.6          |                              |  | Fn BldTD                   | 0.4  | 0.4  |
|                                  |                  |           |           | Auxil   | 0                        | 0       | 1.75          |                              |  | Fn Frict                   | 1.1  | 1.1  |
|                                  |                  |           |           |         |                          |         | Htg Btuh/SqFt | -26.65                       |  |                            |      |      |

System 3 Block BPMZ - BYPASS MULTIZONE

| ***** COOLING COIL PEAK ***** |          |          |         |        | ***** CLG SPACE PEAK ***** |        |            | ***** HEATING COIL PEAK ***** |        |  |
|-------------------------------|----------|----------|---------|--------|----------------------------|--------|------------|-------------------------------|--------|--|
| Peak at Time ==>              |          |          |         |        | Mo/Hr: 7/18                |        |            | Mo/Hr: 13/ 1                  |        |  |
| Outside Air ==>               |          |          |         |        | OADB: 92                   |        |            | OADB: 29                      |        |  |
| Space                         | Ret. Air | Ret. Air | Net     | Perct  | Space                      | Perct  | Space Peak | Coil Peak                     | Perct  |  |
| Sens.+Lat.                    | Sensible | Latent   | Total   | Of Tot | Sensible                   | Of Tot | Space Sens | Tot Sens                      | Of Tot |  |
| (Btuh)                        | (Btuh)   | (Btuh)   | (Btuh)  | (%)    | (Btuh)                     | (%)    | (Btuh)     | (Btuh)                        | (%)    |  |
| Envelope Loads                |          |          |         |        |                            |        |            |                               |        |  |
| Skylite Solr                  | 0        | 0        | 0       | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Skylite Cond                  | 0        | 0        | 0       | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Roof Cond                     | 0        | 62,339   | 62,339  | 6.59   | 0                          | 0.00   | 0          | -33,704                       | 8.26   |  |
| Glass Solar                   | 42,112   | 0        | 42,112  | 4.45   | 52,528                     | 9.89   | 0          | 0                             | 0.00   |  |
| Glass Cond                    | 23,383   | 0        | 23,383  | 2.47   | 21,917                     | 4.13   | -72,232    | -72,232                       | 17.69  |  |
| Wall Cond                     | 1,603    | -12      | 1,591   | 0.17   | 1,697                      | 0.32   | -4,797     | -6,356                        | 1.56   |  |
| Partition                     | 0        | 0        | 0       | 0.00   | 0                          | 0.00   | 0          | 0                             | 0.00   |  |
| Exposed Floor                 | 0        | 0        | 0       | 0.00   | 0                          | 0.00   | -5,970     | -5,970                        | 1.46   |  |
| Infiltration                  | 10,128   | 0        | 10,128  | 1.07   | 3,858                      | 0.73   | -10,688    | -10,688                       | 2.62   |  |
| Sub Total==>                  | 77,226   | 62,327   | 139,553 | 14.75  | 80,000                     | 15.07  | -93,686    | -128,949                      | 31.59  |  |
| Internal Loads                |          |          |         |        |                            |        |            |                               |        |  |
| Lights                        | 65,432   | 11,547   | 76,978  | 8.13   | 67,039                     | 12.62  | 0          | 0                             | 0.00   |  |
| People                        | 111,037  | 0        | 111,037 | 11.73  | 73,321                     | 13.81  | 0          | 0                             | 0.00   |  |
| Misc                          | 61,953   | 0        | 61,953  | 6.55   | 49,562                     | 9.33   | 0          | 0                             | 0.00   |  |
| Sub Total==>                  | 238,422  | 11,547   | 249,969 | 26.41  | 189,922                    | 35.77  | 0          | 0                             | 0.00   |  |
| Ceiling Load                  | 63,922   | -63,922  | 0       | 0.00   | 59,367                     | 11.18  | -35,263    | 0                             | 0.00   |  |
| Outside Air                   | 0        | 0        | 303,836 | 32.11  | 0                          | 0.00   | 0          | -320,625                      | 78.54  |  |
| Sup. Fan Heat                 |          |          | 41,336  | 4.37   |                            | 0.00   |            | 41,336                        | -10.13 |  |
| Ret. Fan Heat                 |          | 13,779   | 13,779  | 1.46   |                            | 0.00   |            | 0                             | 0.00   |  |
| Duct Heat Pkup                |          | 0        | 0       | 0.00   |                            | 0.00   |            | 0                             | 0.00   |  |
| OV/UNDR Sizing                | 201,715  |          | 201,715 | 21.32  | 201,715                    | 37.99  | 0          | 0                             | 0.00   |  |
| Exhaust Heat                  |          | -3,855   | -3,855  | -0.41  |                            | 0.00   |            | 0                             | 0.00   |  |
| Minimal Bypass                |          | 0        | 0       | -0.00  |                            | 0.00   |            | 0                             | 0.00   |  |
| Grand Total==>                | 581,285  | 19,875   | 946,332 | 100.00 | 531,003                    | 100.00 | -128,949   | -408,239                      | 100.00 |  |

| -----COOLING COIL SELECTION----- |           |            |                   |       |       |                  |       |       |             | -----AREAS----- |       |    |
|----------------------------------|-----------|------------|-------------------|-------|-------|------------------|-------|-------|-------------|-----------------|-------|----|
| Total Capacity                   | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |       | Leaving DB/WB/HR |       |       | Gross Total | Glass (sf)      | (%)   |    |
| (Tons)                           | (Mbh)     | (Mbh)      | (cfm)             | Deg F | Deg F | Grains           | Deg F | Deg F | Floor       |                 |       |    |
| Main Clg                         | 78.9      | 946.3      | 25,835            | 83.6  | 69.0  | 86.6             | 57.9  | 57.3  | Part        | 0               |       |    |
| Aux Clg                          | 0.0       | 0.0        | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | ExFlr       | 182             |       |    |
| Opt Vent                         | 0.0       | 0.0        | 0                 | 0.0   | 0.0   | 0.0              | 0.0   | 0.0   | Roof        | 14,458          | 0     | 0  |
| Totals                           | 78.9      | 946.3      |                   |       |       |                  |       |       | Wall        | 2,548           | 1,456 | 57 |

| -----HEATING COIL SELECTION----- |            |        |       |      | -----AIRFLOWS (cfm)----- |         |              | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------|--------|-------|------|--------------------------|---------|--------------|------------------------|--------|-----------------------|------|------|
| Capacity                         | Coil Airfl | Ent    | Lvg   | Type | Cooling                  | Heating | Clg % OA     |                        |        | Type                  | Clg  | Htg  |
| (Mbh)                            | (cfm)      | Deg F  | Deg F | Vent |                          |         | Clg Cfm/Sqft |                        |        | SADB                  | 59.0 | 74.6 |
| Main Htg                         | -408.2     | 25,835 | 60.0  | 74.6 | Infil                    | 241     | 241          | Clg Cfm/Ton            | 327.60 | Plenum                | 92.0 | 62.3 |
| Aux Htg                          | 0.0        | 0      | 0.0   | 0.0  | Supply                   | 25,835  | 25,835       | Clg Sqft/Ton           | 183.34 | Return                | 78.5 | 70.0 |
| Preheat                          | -0.0       | 25,835 | 60.0  | 59.0 | Mincfm                   | 9,042   | 9,042        | Clg Btuh/Sqft          | 65.45  | Ret/OA                | 83.3 | 58.5 |
| Reheat                           | 0.0        | 0      | 0.0   | 0.0  | Return                   | 25,835  | 25,835       | No. People             | 289    | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0        | 0      | 0.0   | 0.0  | Exhaust                  | 7,229   | 7,229        | Htg % OA               | 28.0   | Fn MtrTD              | 0.5  | 0.5  |
| Opt Vent                         | 0.0        | 0      | 0.0   | 0.0  | Rm Exh                   | 0       | 0            | Htg Cfm/SqFt           | 1.79   | Fn BldTD              | 0.4  | 0.4  |
| Total                            | -408.2     |        |       |      | Auxil                    | 0       | 0            | Htg Btuh/SqFt          | -28.24 | Fn Frict              | 1.1  | 1.1  |

System 4 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | CLG SPACE PEAK ***** |                       |                  | ***** HEATING COIL PEAK ***** |                           |                  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------|-----------------------|------------------|-------------------------------|---------------------------|------------------|
| Peak at Time ==> Mo/Hr: 8/12             |                         |                          |                        |                  | Mo/Hr: 7/18          |                       |                  | Mo/Hr: 13/ 1                  |                           |                  |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |                         |                          |                        |                  | OADB: 92             |                       |                  | OADB: 29                      |                           |                  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)     | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Sens (Btuh)        | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%) |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Roof Cond                                | 0                       | 9,873                    |                        | 9,873            | 4.63                 | 0                     | 0.00             | 0                             | -7,193                    | 10.32            |
| Glass Solar                              | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Glass Cond                               | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Wall Cond                                | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Partition                                | 0                       |                          |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Infiltration                             | 2,343                   |                          |                        | 2,343            | 1.10                 | 799                   | 0.67             | -2,262                        | -2,262                    | 3.25             |
| Sub Total==>                             | 2,343                   | 9,873                    |                        | 12,216           | 5.73                 | 799                   | 0.67             | -2,262                        | -9,455                    | 13.57            |
| Internal Loads                           |                         |                          |                        |                  |                      |                       |                  |                               |                           |                  |
| Lights                                   | 13,316                  | 2,350                    |                        | 15,666           | 7.35                 | 14,381                | 12.11            | 0                             | 0                         | 0.00             |
| People                                   | 28,121                  |                          |                        | 28,121           | 13.19                | 16,065                | 13.53            | 0                             | 0                         | 0.00             |
| Misc                                     | 20,888                  | 0                        | 0                      | 20,888           | 9.79                 | 16,710                | 14.07            | 0                             | 0                         | 0.00             |
| Sub Total==>                             | 62,325                  | 2,350                    | 0                      | 64,675           | 30.33                | 47,156                | 39.71            | 0                             | 0                         | 0.00             |
| Ceiling Load                             | 12,223                  | -12,223                  |                        | 0                | 0.00                 | 12,324                | 10.38            | -7,193                        | 0                         | 0.00             |
| Outside Air                              | 0                       | 0                        | 0                      | 70,287           | 32.96                | 0                     | 0.00             | 0                             | -67,860                   | 97.36            |
| Sup. Fan Heat                            |                         |                          |                        | 7,616            | 3.57                 |                       | 0.00             |                               | 7,616                     | -10.93           |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| Duct Heat PkUp                           |                         | 0                        |                        | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| OV/UNDR Sizing                           | 58,475                  |                          |                        | 58,475           | 27.42                | 58,475                | 49.24            | 0                             | 0                         | 0.00             |
| Exhaust Heat                             |                         | 0                        | 0                      | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| Terminal Bypass                          |                         | 0                        | 0                      | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| Grand Total==>                           | 135,365                 | 0                        | 0                      | 213,268          | 100.00               | 118,754               | 100.00           | -9,455                        | -69,699                   | 100.00           |

| -----COOLING COIL SELECTION----- |                       |                 |                  |                   |      |      |                  |      |      | -----AREAS----- |            |     |
|----------------------------------|-----------------------|-----------------|------------------|-------------------|------|------|------------------|------|------|-----------------|------------|-----|
|                                  | Total Capacity (Tons) | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |      |      | Leaving DB/WB/HR |      |      | Gross Total     | Glass (sf) | (%) |
| Main Clg                         | 17.8                  | 213.3           | 143.6            | 5,355             | 81.8 | 68.0 | 56.2             | 55.5 | 66.7 | Floor           | 3,060      |     |
| Aux Clg                          | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | Part            | 0          |     |
| Opt Vent                         | 0.0                   | 0.0             | 0.0              | 0                 | 0.0  | 0.0  | 0.0              | 0.0  | 0.0  | ExFlr           | 0          |     |
| Totals                           | 17.8                  | 213.3           |                  |                   |      |      |                  |      |      | Roof            | 3,060      | 0 0 |
|                                  |                       |                 |                  |                   |      |      |                  |      |      | Wall            | 0          | 0 0 |

| -----HEATING COIL SELECTION----- |                |                  |           |           | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)-- |      |      |
|----------------------------------|----------------|------------------|-----------|-----------|--------------------------|---------|---------|------------------------|--------|----------------------|------|------|
|                                  | Capacity (Mbh) | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type                     | Cooling | Heating | Clg % OA               |        | Type                 | Clg  | Htg  |
| Main Htg                         | -69.7          | 5,355            | 58.3      | 70.3      | Vent                     | 1,530   | 1,530   | Clg Cfm/Sqft           | 28.6   | SADB                 | 57.5 | 71.6 |
| Aux Htg                          | 0.0            | 0                | 0.0       | 0.0       | Infil                    | 51      | 51      | Clg Cfm/Ton            | 1.75   | Plenum               | 90.6 | 62.6 |
| Preheat                          | -0.0           | 5,355            | 58.3      | 56.2      | Supply                   | 5,355   | 5,355   | Clg Sqft/Ton           | 301.31 | Return               | 78.0 | 70.0 |
| Reheat                           | 0.0            | 0                | 0.0       | 0.0       | Mincfm                   | 1,874   | 1,874   | Clg Btuh/Sqft          | 172.18 | Ret/OA               | 81.8 | 58.3 |
| Humidif                          | 0.0            | 0                | 0.0       | 0.0       | Return                   | 5,355   | 5,355   | No. People             | 69.70  | Runarnd              | 78.0 | 70.0 |
| Opt Vent                         | 0.0            | 0                | 0.0       | 0.0       | Exhaust                  | 1,530   | 1,530   | Htg % OA               | 61     | Fn MtrTD             | 0.3  | 0.3  |
| Total                            | -69.7          |                  |           |           | Rm Exh                   | 0       | 0       | Htg Cfm/Sqft           | 28.6   | Fn BldTD             | 0.2  | 0.2  |
|                                  |                |                  |           |           | Auxil                    | 0       | 0       | Htg Btuh/SqFt          | 1.75   | Fn Frict             | 0.7  | 0.7  |
|                                  |                |                  |           |           |                          |         |         |                        | -22.78 |                      |      |      |

System 5 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/12 \* Mo/Hr: 7/13 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 91/ 76/117.0 \* OADB: 95 \* OADB: 29

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 9,457                          |                              | 9,457                  | 4.52                   | * | 0                           | 0.00                   | * | 0                                  | -6,315                          | 6.51                   |
| Glass Solar     | 17,940                        | 0                              |                              | 17,940                 | 8.57                   | * | 15,410                      | 13.49                  | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 2,758                         | 0                              |                              | 2,758                  | 1.32                   | * | 3,441                       | 3.01                   | * | -11,410                            | -11,410                         | 11.77                  |
| Wall Cond       | 3,888                         | 359                            |                              | 4,247                  | 2.03                   | * | 4,317                       | 3.78                   | * | -9,779                             | -13,125                         | 13.54                  |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | -5,970                             | -5,970                          | 6.16                   |
| Infiltration    | 2,283                         |                                |                              | 2,283                  | 1.09                   | * | 883                         | 0.77                   | * | -2,176                             | -2,176                          | 2.24                   |
| Sub Total==>    | 26,868                        | 9,816                          |                              | 36,684                 | 17.53                  | * | 24,051                      | 21.05                  | * | -29,335                            | -38,996                         | 40.22                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 13,153                        | 2,321                          |                              | 15,474                 | 7.39                   | * | 13,153                      | 11.51                  | * | 0                                  | 0                               | 0.00                   |
| People          | 27,261                        |                                |                              | 27,261                 | 13.03                  | * | 12,777                      | 11.18                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 20,096                        | 0                              | 0                            | 20,096                 | 9.60                   | * | 16,077                      | 14.07                  | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 60,510                        | 2,321                          | 0                            | 62,831                 | 30.02                  | * | 42,006                      | 36.77                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 12,137                        | -12,137                        |                              | 0                      | 0.00                   | * | 14,225                      | 12.45                  | * | -9,661                             | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 68,479                 | 32.72                  | * | 0                           | 0.00                   | * | 0                                  | -65,287                         | 67.34                  |
| Sup. Fan Heat   |                               |                                |                              | 7,327                  | 3.50                   | * |                             | 0.00                   | * |                                    | 7,327                           | -7.56                  |
| Ret. Fan Heat   |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat Pkup  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 33,971                        |                                |                              | 33,971                 | 16.23                  | * | 33,971                      | 29.73                  | * | 0                                  | 0                               | 0.00                   |
| Exhaust Heat    |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 133,486                       | 0                              | 0                            | 209,292                | 100.00                 | * | 114,252                     | 100.00                 | * | -38,996                            | -96,956                         | 100.00                 |

-----COOLING COIL SELECTION-----

|          | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        |      |
|----------|--------------------------|--------------------|---------------------|-------------------|-------|--------|------------------|-------|--------|------|
|          |                          |                    |                     | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains |      |
| Main Clg | 17.4                     | 209.3              | 141.3               | 5,152             | 81.8  | 67.9   | 83.5             | 56.2  | 55.0   | 64.9 |
| Aux Clg  | 0.0                      | 0.0                | 0.0                 | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0  |
| Opt Vent | 0.0                      | 0.0                | 0.0                 | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0  |
| Totals   | 17.4                     | 209.3              |                     |                   |       |        |                  |       |        |      |

-----AREAS-----

|       | Gross Total | Glass (sf) | (%) |
|-------|-------------|------------|-----|
| Floor | 2,944       |            |     |
| Part  | 0           |            |     |
| ExFlr | 182         |            |     |
| Roof  | 2,944       | 0          | 0   |
| Wall  | 2,548       | 230        | 9   |

-----HEATING COIL SELECTION-----

|          | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F |
|----------|-------------------|---------------------|--------------|--------------|
| Main Htg | -97.0             | 5,152               | 58.3         | 75.7         |
| Aux Htg  | 0.0               | 0                   | 0.0          | 0.0          |
| Preheat  | -0.0              | 5,152               | 58.3         | 56.2         |
| Reheat   | 0.0               | 0                   | 0.0          | 0.0          |
| Humidif  | 0.0               | 0                   | 0.0          | 0.0          |
| Opt Vent | 0.0               | 0                   | 0.0          | 0.0          |
| Total    | -97.0             |                     |              |              |

-----AIRFLOWS (cfm)-----

|         | Type | Cooling | Heating |
|---------|------|---------|---------|
| Vent    |      | 1,472   | 1,472   |
| Infil   |      | 49      | 49      |
| Supply  |      | 5,152   | 5,152   |
| Mincfm  |      | 1,803   | 1,803   |
| Return  |      | 5,152   | 5,152   |
| Exhaust |      | 1,472   | 1,472   |
| Rm Exh  |      | 0       | 0       |
| Auxil   |      | 0       | 0       |

-----ENGINEERING CHECKS-----

|               |        |
|---------------|--------|
| Clg % OA      | 28.6   |
| Clg Cfm/Sqft  | 1.75   |
| Clg Cfm/Ton   | 295.40 |
| Clg Sqft/Ton  | 168.80 |
| Clg Btuh/Sqft | 71.09  |
| No. People    | 59     |
| Htg % OA      | 28.6   |
| Htg Cfm/Sqft  | 1.75   |
| Htg Btuh/Sqft | -32.93 |

-----TEMPERATURES (F)-----

| Type     | Clg  | Htg  |
|----------|------|------|
| SADB     | 57.5 | 77.0 |
| Plenum   | 91.0 | 59.6 |
| Return   | 78.0 | 70.0 |
| Ret/OA   | 81.8 | 58.3 |
| Runarnd  | 78.0 | 70.0 |
| Fn MtrTD | 0.3  | 0.3  |
| Fn BldTD | 0.2  | 0.2  |
| Fn Frict | 0.7  | 0.7  |

System 6 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  |                  | CLG SPACE PEAK *****  |                  |                   | HEATING COIL PEAK ***** |                  |  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|------------------|-----------------------|------------------|-------------------|-------------------------|------------------|--|
| Peaked at Time ==> Mo/Hr: 8/12           |                         |                          |                        |                  |                  | Mo/Hr: 7/13           |                  |                   | Mo/Hr: 13/ 1            |                  |  |
| Outside Air ==> OADB/WB/HR: 91/ 76/117.0 |                         |                          |                        |                  |                  | OADB: 95              |                  |                   | OADB: 29                |                  |  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%) | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak (Btuh) | Coil Peak (Btuh)        | Perct Of Tot (%) |  |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00             | 0                     | 0.00             | 0                 | 0                       | 0.00             |  |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00             | 0                     | 0.00             | 0                 | 0                       | 0.00             |  |
| Roof Cond                                | 0                       | 3,355                    |                        | 3,355            | 4.73             | 0                     | 0.00             | 0                 | -2,126                  | 5.67             |  |
| Glass Solar                              | 3,120                   | 0                        |                        | 3,120            | 4.39             | 2,680                 | 6.91             | 0                 | 0                       | 0.00             |  |
| Glass Cond                               | 480                     | 0                        |                        | 480              | 0.68             | 598                   | 1.54             | -1,984            | -1,984                  | 5.29             |  |
| Wall Cond                                | 2,630                   | 226                      |                        | 2,856            | 4.02             | 2,709                 | 6.99             | -6,457            | -8,349                  | 22.27            |  |
| Partition                                | 0                       |                          |                        | 0                | 0.00             | 0                     | 0.00             | 0                 | 0                       | 0.00             |  |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00             | 0                     | 0.00             | -3,575            | -3,575                  | 9.54             |  |
| Infiltration                             | 801                     |                          |                        | 801              | 1.13             | 315                   | 0.81             | -776              | -776                    | 2.07             |  |
| Sub Total==>                             | 7,031                   | 3,581                    |                        | 10,612           | 14.95            | 6,302                 | 16.26            | -12,793           | -16,811                 | 44.85            |  |
| Internal Loads                           |                         |                          |                        |                  |                  |                       |                  |                   |                         |                  |  |
| Lights                                   | 4,691                   | 828                      |                        | 5,519            | 7.77             | 4,691                 | 12.10            | 0                 | 0                       | 0.00             |  |
| People                                   | 9,723                   |                          |                        | 9,723            | 13.70            | 4,557                 | 11.76            | 0                 | 0                       | 0.00             |  |
| Misc                                     | 1,792                   | 0                        | 0                      | 1,792            | 2.52             | 1,433                 | 3.70             | 0                 | 0                       | 0.00             |  |
| Sub Total==>                             | 16,206                  | 828                      | 0                      | 17,034           | 23.99            | 10,681                | 27.56            | 0                 | 0                       | 0.00             |  |
| Ceiling Load                             | 4,409                   | -4,409                   |                        | 0                | 0.00             | 5,085                 | 13.12            | -4,018            | 0                       | 0.00             |  |
| Outside Air                              | 0                       | 0                        | 0                      | 24,042           | 33.87            | 0                     | 0.00             | 0                 | -23,285                 | 62.12            |  |
| Sup. Fan Heat                            |                         |                          |                        | 2,613            | 3.68             |                       | 0.00             |                   | 2,613                   | -6.97            |  |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00             |                       | 0.00             |                   | 0                       | 0.00             |  |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00             |                       | 0.00             |                   | 0                       | 0.00             |  |
| OV/UNDR Sizing                           | 16,692                  |                          |                        | 16,692           | 23.51            | 16,692                | 43.06            | 0                 | 0                       | 0.00             |  |
| Must Heat                                |                         | 0                        | 0                      | 0                | 0.00             |                       | 0.00             |                   | 0                       | 0.00             |  |
| Minimal Bypass                           |                         | 0                        | 0                      | 0                | 0.00             |                       | 0.00             |                   | 0                       | 0.00             |  |
| Grand Total==>                           | 44,338                  | 0                        | 0                      | 70,994           | 100.00           | 38,761                | 100.00           | -16,811           | -37,483                 | 100.00           |  |

| -----COOLING COIL SELECTION----- |                 |                  |                   |       |      |                  |      |      |             | -----AREAS----- |       |       |
|----------------------------------|-----------------|------------------|-------------------|-------|------|------------------|------|------|-------------|-----------------|-------|-------|
| Total Capacity (Tons)            | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |       |      | Leaving DB/WB/HR |      |      | Gross Total | Glass (sf)      | (%)   |       |
| Main Clg                         | 5.9             | 71.0             | 48.2              | 1,837 | 81.8 | 68.1             | 84.2 | 57.2 | 55.9        | 67.0            | Floor | 1,050 |
| Aux Clg                          | 0.0             | 0.0              | 0.0               | 0     | 0.0  | 0.0              | 0.0  | 0.0  | 0.0         | 0.0             | Part  | 0     |
| Opt Vent                         | 0.0             | 0.0              | 0.0               | 0     | 0.0  | 0.0              | 0.0  | 0.0  | 0.0         | 0.0             | ExFlr | 109   |
| Totals                           | 5.9             | 71.0             |                   |       |      |                  |      |      |             |                 | Roof  | 1,050 |
|                                  |                 |                  |                   |       |      |                  |      |      |             |                 | Wall  | 1,526 |
|                                  |                 |                  |                   |       |      |                  |      |      |             |                 |       | 40    |
|                                  |                 |                  |                   |       |      |                  |      |      |             |                 |       | 3     |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |          | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|----------|------------------------|--------|-----------------------|------|------|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating | Clg % OA | 28.6                   | Type   | Clg                   | Htg  |      |
| Main Htg                         | -37.5            | 1,838     | 58.3      | 77.1 | Vent                     | 525     | 525      | Clg Cfm/Sqft           | 1.75   | SADB                  | 58.5 | 78.5 |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Infil                    | 18      | 18       | Clg Cfm/Ton            | 310.59 | Plenum                | 91.3 | 57.9 |
| Preheat                          | -0.0             | 1,837     | 58.3      | 57.2 | Supply                   | 1,837   | 1,838    | Clg Sqft/Ton           | 177.48 | Return                | 78.0 | 70.0 |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Mincfm                   | 643     | 643      | Clg Btuh/Sqft          | 67.61  | Ret/OA                | 81.8 | 58.3 |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Return                   | 1,837   | 1,838    | No. People             | 21     | Runarnd               | 78.0 | 70.0 |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 525     | 525      | Htg % OA               | 28.6   | Fn MtrTD              | 0.3  | 0.3  |
| Total                            | -37.5            |           |           |      | Rm Exh                   | 0       | 0        | Htg Cfm/Sqft           | 1.75   | Fn BldTD              | 0.2  | 0.2  |
|                                  |                  |           |           |      | Auxil                    | 0       | 0        | Htg Btuh/Sqft          | -35.70 | Fn Frict              | 0.7  | 0.7  |



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC<br>On Peak<br>(kWh) | DEMAND<br>On Peak<br>(kW) | GAS<br>On Peak<br>(Therm) | WATER<br>(1000 Gl) | GAS DMND<br>On Peak<br>(Thrm/hr) |
|-------|--------------------------|---------------------------|---------------------------|--------------------|----------------------------------|
| Jan   | 106,965                  | 245                       | 334                       | 6                  | 4                                |
| Feb   | 95,826                   | 226                       | 434                       | 5                  | 3                                |
| March | 125,903                  | 252                       | 79                        | 42                 | 1                                |
| April | 123,784                  | 279                       | 10                        | 79                 | 0                                |
| May   | 132,214                  | 308                       | 0                         | 112                | 0                                |
| June  | 133,504                  | 321                       | 0                         | 137                | 0                                |
| July  | 137,741                  | 332                       | 0                         | 158                | 0                                |
| Aug   | 143,418                  | 337                       | 0                         | 173                | 0                                |
| Sept  | 131,994                  | 329                       | 0                         | 135                | 0                                |
| Oct   | 126,957                  | 263                       | 51                        | 68                 | 1                                |
| Nov   | 116,934                  | 255                       | 115                       | 40                 | 1                                |
| Dec   | 113,849                  | 245                       | 474                       | 12                 | 3                                |
| Total | 1,489,086                | 337                       | 1,498                     | 965                | 4                                |

Building Energy Consumption = 160,719 (Btu/Sq Ft/Year)  
Source Energy Consumption = 473,244 (Btu/Sq Ft/Year)

Floor Area = 32,554 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3

| ----- EQUIPMENT ENERGY CONSUMPTION ----- |          |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|------------------------------------------|----------|---------------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Ref                                      | Equip    | ----- Monthly Consumption ----- |                           |       |       |       |       |       |       |       |       |       |       |         |
| Num                                      | Code     | Jan                             | Feb                       | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   | Total   |
| 0                                        | LIGHTS   |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 20835                           | 19168                     | 22501 | 20835 | 21668 | 21668 | 20835 | 22501 | 20835 | 21668 | 19168 | 20835 | 252,515 |
|                                          | PK       | 65.1                            | 65.1                      | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1  | 65.1    |
| 1                                        | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 45403                           | 41009                     | 45403 | 43938 | 45403 | 43938 | 45403 | 45403 | 43938 | 45403 | 43938 | 45403 | 534,579 |
|                                          | PK       | 61.0                            | 61.0                      | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0  | 61.0    |
| 2                                        | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | GAS      | 0                               | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                             | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3                                        | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | OIL      | 0                               | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                             | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4                                        | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P STEAM  | 0                               | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                             | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|                                          | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P HOTH2O | 0                               | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                             | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6                                        | MISC LD  |                                 |                           |       |       |       |       |       |       |       |       |       |       |         |
|                                          | P CHILL  | 0                               | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|                                          | PK       | 0.0                             | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1                                        | EQ1001S  |                                 | 2-STG CTV <555 TONS       |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 1380                            | 1183                      | 8631  | 13100 | 17985 | 21603 | 24995 | 27589 | 21576 | 11622 | 8013  | 2816  | 160,492 |
|                                          | PK       | 23.5                            | 23.5                      | 30.7  | 68.8  | 86.8  | 99.8  | 111.4 | 115.7 | 107.7 | 42.0  | 33.7  | 23.5  | 115.7   |
| 1                                        | EQ5100   |                                 | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 1658                            | 0                         | 6541  | 6104  | 6304  | 6304  | 6104  | 6541  | 6104  | 6304  | 5557  | 4100  | 61,620  |
|                                          | PK       | 18.2                            | 0.0                       | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2  | 18.2    |
| 1                                        | EQ5100   |                                 | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |         |
|                                          | WATER    | 6                               | 5                         | 42    | 79    | 112   | 137   | 158   | 173   | 135   | 68    | 40    | 12    | 965     |
|                                          | PK       | 0.0                             | 0.0                       | 0.2   | 0.5   | 0.6   | 0.7   | 0.7   | 0.7   | 0.7   | 0.3   | 0.2   | 0.1   | 0.7     |
| 1                                        | EQ5001   |                                 | CHILLED WATER PUMP C.V.   |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 4847                            | 4449                      | 8924  | 8327  | 8600  | 8600  | 8327  | 8924  | 8327  | 8600  | 7581  | 6388  | 91,895  |
|                                          | PK       | 24.9                            | 24.9                      | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9  | 24.9    |
| 1                                        | EQ5010   |                                 | CONDENSER WATER PUMP C.V. |       |       |       |       |       |       |       |       |       |       |         |
|                                          | ELEC     | 2908                            | 2670                      | 5354  | 4996  | 5160  | 5160  | 4996  | 5354  | 4996  | 5160  | 4549  | 3833  | 55,137  |
|                                          | PK       | 14.9                            | 14.9                      | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9  | 14.9    |
|                                          | EQ5300   |                                 | CONTROL PANEL & INTERLOCK |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3

|   |        |                            |       |       |       |       |       |       |       |       |       |       |       |         |
|---|--------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|   | ELEC   | 195                        | 179   | 359   | 335   | 346   | 346   | 335   | 359   | 335   | 346   | 305   | 257   | 3,697   |
|   | PK     | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 9679                       | 8743  | 9679  | 9367  | 9679  | 9367  | 9679  | 9679  | 9367  | 9679  | 9367  | 9679  | 113,968 |
|   | PK     | 13.0                       | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0  | 13.0    |
| 1 | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 0                          | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|   | PK     | 0.0                        | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2 | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 1406                       | 1270  | 1406  | 1361  | 1406  | 1361  | 1406  | 1406  | 1361  | 1406  | 1361  | 1406  | 16,556  |
|   | PK     | 1.9                        | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9   | 1.9     |
| 3 | EQ4001 | AIRFOIL CENTRIF. FAN C.V.  |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 12760                      | 11525 | 12760 | 12348 | 12760 | 12348 | 12760 | 12760 | 12348 | 12760 | 12348 | 12760 | 150,234 |
|   | PK     | 17.1                       | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1  | 17.1    |
| 4 | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
|   | PK     | 1.5                        | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.4   | 1.5     |
| 5 | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 1079                       | 974   | 1079  | 1044  | 1079  | 1044  | 1079  | 1079  | 1044  | 1079  | 1044  | 1079  | 12,702  |
|   | PK     | 1.5                        | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5     |
|   | EQ4003 | FC CENTRIF. FAN C.V.       |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 744                        | 672   | 744   | 720   | 744   | 720   | 744   | 744   | 720   | 744   | 720   | 744   | 8,760   |
|   | PK     | 1.0                        | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 | EQ2001 | GAS FIRE TUBE HOT WATER    |       |       |       |       |       |       |       |       |       |       |       |         |
|   | GAS    | 334                        | 434   | 79    | 10    | 0     | 0     | 0     | 0     | 0     | 51    | 115   | 474   | 1,498   |
|   | PK     | 3.5                        | 3.3   | 0.9   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 0.9   | 3.1   | 3.5     |
| 1 | EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 2520                       | 2535  | 1215  | 224   | 0     | 0     | 0     | 0     | 0     | 932   | 1633  | 2923  | 11,983  |
|   | PK     | 7.5                        | 7.5   | 7.5   | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.5   | 7.5   | 7.5   | 7.5     |
| 1 | EQ5240 | BOILER FORCED DRAFT FAN    |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 303                        | 305   | 146   | 27    | 0     | 0     | 0     | 0     | 0     | 112   | 196   | 352   | 1,442   |
|   | PK     | 0.9                        | 0.9   | 0.9   | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9   | 0.9   | 0.9   | 0.9     |
| 1 | EQ5307 | BOILER CONTROLS            |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 169                        | 170   | 81    | 15    | 0     | 0     | 0     | 0     | 0     | 63    | 109   | 196   | 804     |
|   | PK     | 0.5                        | 0.5   | 0.5   | 0.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5   | 0.5   | 0.5   | 0.5     |
| 2 | EQ2001 | GAS FIRE TUBE HOT WATER    |       |       |       |       |       |       |       |       |       |       |       |         |
|   | GAS    | 0                          | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|   | PK     | 0.0                        | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2 | EQ5020 | HEAT WATER CIRC. PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 0                          | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|   | PK     | 0.0                        | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
|   | EQ5240 | BOILER FORCED DRAFT FAN    |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3

|          |                 |     |     |     |     |     |     |     |     |     |     |     |     |
|----------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ELEC     | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|          | 0.0             | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PK       | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|          | 0.0             | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 EQS307 | BOILER CONTROLS |     |     |     |     |     |     |     |     |     |     |     |     |
| ELEC     | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|          | 0.0             | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PK       | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|          | 0.0             | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        336.7    (kW)  
Yearly Time of Peak   12 (hr)    8 (mo)

Hour 12   Month   8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|------------------------|
|----------------------|------------------------|-----------------------|---------------------------|------------------------|

Cooling Equipment

|           |         |                     |       |       |
|-----------|---------|---------------------|-------|-------|
| 1         | EQ1001S | 2-STG CTV <555 TONS | 174.7 | 51.87 |
| Sub Total |         |                     | 174.7 | 51.87 |
| Sub Total |         |                     | 0.0   | 0.00  |

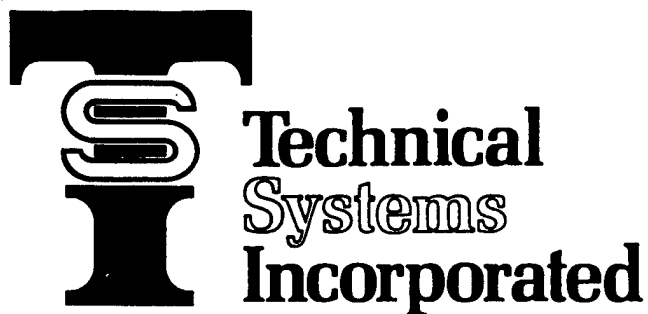
Air Moving Equipment

|           |                                    |  |      |       |
|-----------|------------------------------------|--|------|-------|
| 1         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 13.0 | 3.86  |
| 2         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 1.9  | 0.56  |
| 3         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 17.1 | 5.09  |
| 4         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 1.4  | 0.43  |
| 5         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 1.5  | 0.43  |
| 6         | SUMMATION OF FAN ELECTRICAL DEMAND |  | 1.0  | 0.30  |
| Sub Total |                                    |  | 36.0 | 10.68 |
| Sub Total |                                    |  | 0.0  | 0.00  |

Miscellaneous

|                |       |        |
|----------------|-------|--------|
| Lights         | 65.1  | 19.33  |
| Base Utilities | 0.0   | 0.00   |
| Misc Equipment | 61.0  | 18.12  |
| Sub Total      | 126.1 | 37.46  |
| Grand Total    | 336.7 | 100.00 |

[illegible]



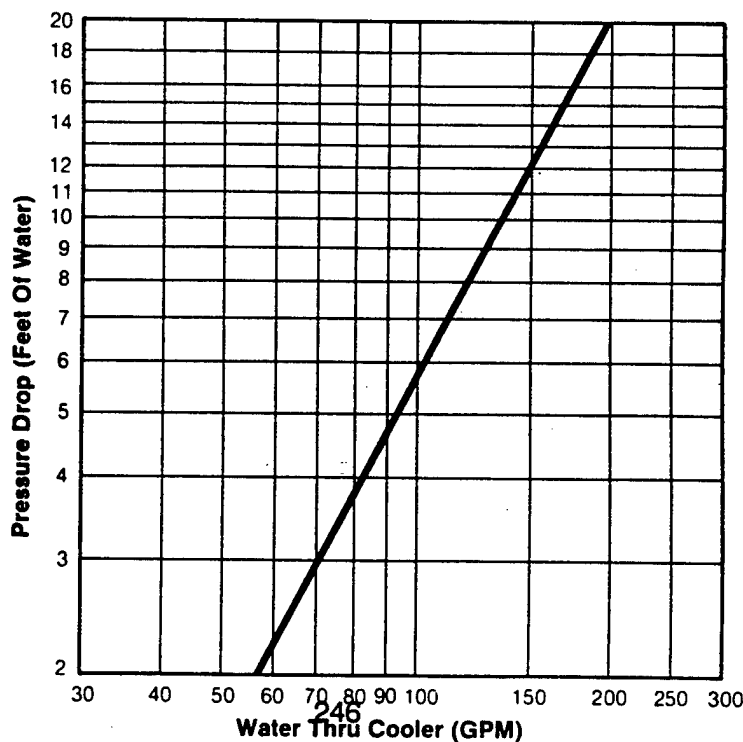
# CA-SC-SE Series Air Cooled Water Chillers CD 80

Air Cooled Water Chillers manufactured by TSI are designed to offer a complete family of units to fulfill the requirements of air conditioning through light industrial duty in sizes ranging from 3 to 135 tons. All units utilize a unique continuous tube condenser surface design which offers maximum heat transfer and minimum pressure drop. Fins are spiral wound under tension for complete metal to metal contact throughout the entire tube surface. Propellor fans are used for high reliability and minimum maintenance. These fans are aluminum bladed, selected for minimum noise and are direct driven by poly-phase motors. Compressors are both full hermetic and accessible hermetic, selected and matched to condensers and evaporators for optimum performance. Direct expansion, removable head coolers are used on CS, CD and CM Model Chillers.

## Performance

| Leaving<br>Water<br>Temperature<br>Degrees F | Total Unit Capacity and KW for Compressor |      |      |      |      |      |      |      |
|----------------------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|                                              | AMBIENT TEMPERATURE DEGREES F             |      |      |      |      |      |      |      |
|                                              | 85                                        |      | 95   |      | 105  |      | 115  |      |
|                                              | Tons                                      | KW   | Tons | KW   | Tons | KW   | Tons | KW   |
| 42                                           | 64.6                                      | 69.2 | 60.9 | 72.4 | 57.4 | 75.6 | 53.3 | 79.0 |
| 44                                           | 66.9                                      | 70.4 | 63.0 | 73.8 | 59.4 | 77.1 | 55.3 | 80.6 |
| 45                                           | 68.0                                      | 71.0 | 64.1 | 74.5 | 60.5 | 77.7 | 56.3 | 81.4 |
| 46                                           | 69.1                                      | 71.5 | 65.2 | 75.0 | 61.5 | 78.4 | 57.3 | 82.2 |
| 48                                           | 71.4                                      | 72.6 | 67.3 | 76.4 | 63.5 | 80.0 | 59.2 | 83.8 |
| 50                                           | 73.4                                      | 73.9 | 69.3 | 77.6 | 65.5 | 81.6 | —    | —    |

## Cooler Pressure Drop - CD 80 Chiller



## Construction Features

**Cabinet** is constructed entirely of mill galvanized sheet steel panels and formed structural members. All panels or louvers are removable for access and service.

**Motors** are three phase, 1140 RPM, specifically designed for vertical shaft, direct drive fan application and utilize permanently lubricated ball bearings. Corrosion resistant steel rod mounting brackets reduce air turbulence and eliminate vibration.

**Fans** are direct propellor type with steel hubs and aluminum blades. Vertical air discharge through a formed venturi minimizes noise generation and air recirculation.

**Condenser coils** are constructed with ½ inch O.D. seamless copper (drawn) tubing and formed to minimize return bends and brazed joints. Fins are spiral wound (aluminum) under tension and designed to be self spacing to completely eliminate exposed copper tubing in the finned area. Coil circuiting has been engineered to incorporate integral sub cooling.

**Compressors** for the "C" Models are accessible hermetic, direct drive by 4 pole motor, complete with overload protection, automatic reversing, oil pump, oil strainer, oil sight glass, suction and discharge service valves. All Compressors are mounted on shock mounts, and all have crankcase heaters.

**Coolers** for the "C" models are direct expansion thru tube design having removable heads. Tubes are seamless copper with aluminum inserts and roller expanded into steel tube sheets. Insulated with closed cell plastic foam insulation.

## Specifications

### CD 80 CHILLER

Copelametic-1750 RPM-Accessible Hermetic Compressor with Internal 3 Leg Protection

Dual Compressors with 2½" ODS Suction Connections

6 Cylinders 2-15/16" Bore X 2-3/16" Stroke Each

Dual Refrigerant Circuits.

6" X 36" Receivers with 1½" ODS Outlet Connections

241 lbs R-22 Refrigerant Operating Charge Above 55° F.

100-67-50-33-0% Capacity Modulation Standard

6-28" Diameter Fans.

### ELECTRICAL DATA — Amperage For Each Compressor

| Across The Line Start | 208/230/3/60 | 460/3/60   | Part Wind Start    | 208/230/3/60 | 460/3/60   |
|-----------------------|--------------|------------|--------------------|--------------|------------|
| Rated Load Amps.      | 142.0 Each   | 71.0 Each  | Rated Load Amps.   | 142.0 Each   | 71.0 Each  |
| Locked Rotor Amps.    | 594.0 Each   | 297.0 Each | Locked Rotor Amps. | 340.0 Each   | 225.0 Each |

### 1140 RPM FAN MOTORS - FLA and KW

24" Fans Have ½ HP

28" Fans Have 1 HP

All Fan Motors Have Inherent Thermal Protection - 3 Leg Line Break

| Voltage  | ½ HP FLA | ½ HP KW | 1 HP FLA | 1 HP KW |
|----------|----------|---------|----------|---------|
| 208/3/60 | 2.4 AMPS | .55 KW  | 4.8 AMPS | 1.1 KW  |
| 230/3/60 | 2.2 AMPS | .55 KW  | 4.6 AMPS | 1.1 KW  |
| 460/3/60 | 1.1 AMPS | .55 KW  | 2.3 AMPS | 1.1 KW  |

## Standard Features

Direct Drive Condenser Fans  
With Guards  
Liquid Receiver With  
Fusible Plug  
Liquid Line Shut Off Valve  
Liquid Line Drier  
(Replaceable Core)  
Liquid Line Sight Glass/  
Moisture Indicator  
Thermostatic Expansion Valve

Refrigerant Charging Valve  
High Pressure Safety Control  
Low Pressure Operating Control  
Oil Failure Control  
Compressor Service Valves  
Auto-Pumpdown Switch  
Integral Subcooling  
Crankcase Heater  
Vibration Isolation Under  
Compressor

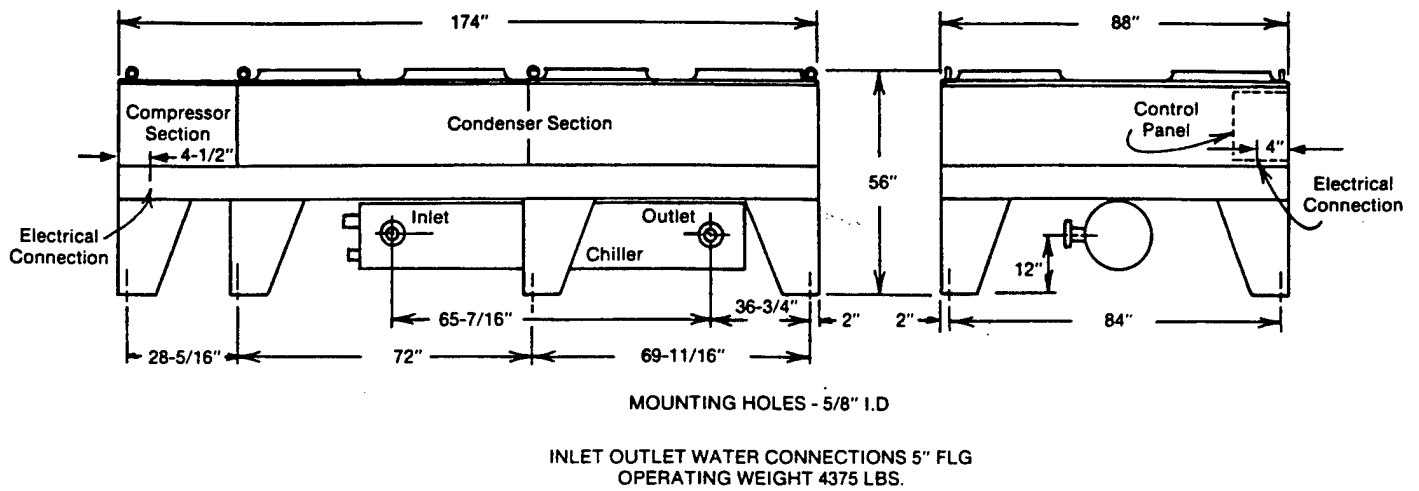
Removable Access Panels  
Hinged Control Panel Access  
Rigging Points  
Low Profile  
Compressor Overload Protection  
Fan Motor Overload Protection  
Fused Control Circuit 115V  
Compressor Contactor  
Fan Motor Contactor  
Prewired Controls

Freeze Control  
Return Water Temperature Control  
Insulated Evaporator  
Insulated Suction Lines  
Refrigerant Charge (CA Only)  
Time Delay Between Compressors  
F20 Fan Control  
Chiller Heater  
Manual Lead Lag Control  
Flow Switch (Loose)

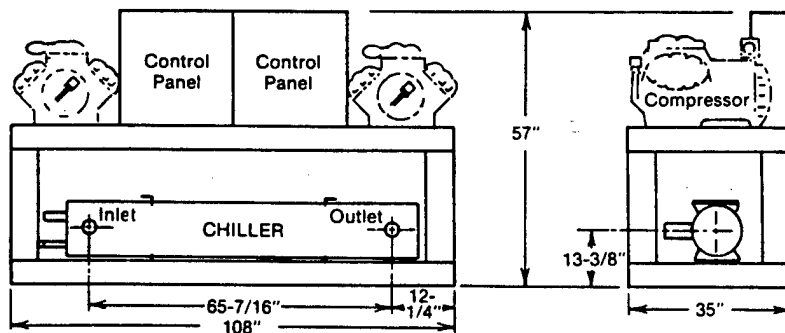
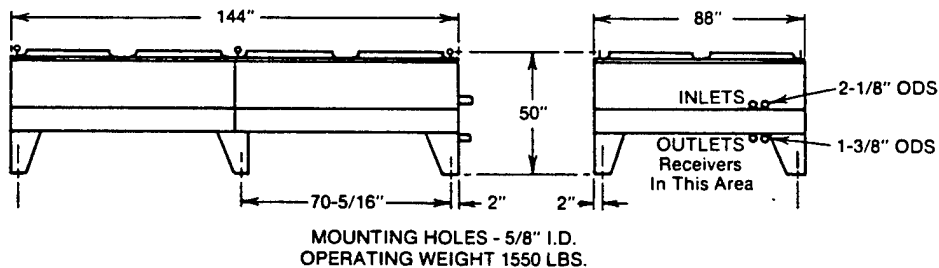


# Dimensions

## CA 2 CD 80

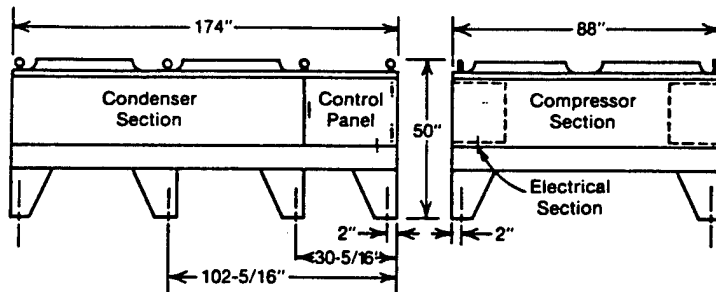


## SC 2 CD 80

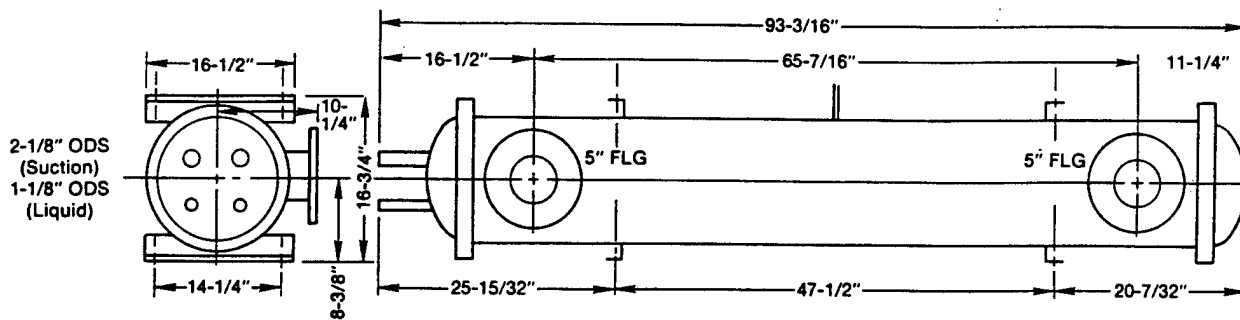


248  
INLET OUTLET WATER CONNECTIONS 5" FLG  
OPERATING WEIGHT 2920 LBS.

# SE 2 CD 80

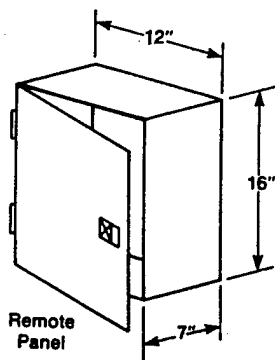


MOUNTING HOLES - 5/8" I.D.  
OPERATING WEIGHT 3100 LBS.



MOUNTING HOLES 5/8" I.D.

OPERATING WEIGHT 1357 LBS.



Remote Panel  
SE Model Only . . .  
Contains system run/  
pumpdown switch,  
return water thermostat  
and control interlocks.

NOTE: Liquid line kit shipped loose (solenoid, sight glass, drier, TXV).

Continual engineering and research for product improvement may result in design and specification changes. Consult factory for certified drawings.

## Technical Systems Incorporated

### Air Conditioning

249

Post Office Box 309  
Pryor, Oklahoma 74361

CarrierBuilding Systems & Services  
Division of Carrier Corporation4084 Sandshell Drive  
Fort Worth, TX 76137  
(817) 232-2229TOTAL NUMBER OF PAGES TO FOLLOW: 7 (INCLUDING COVER SHEET)

PLEASE CHECK ONE OF THE FOLLOWING:

☒ NO CONFIRMATION REQUIRED☐ CONFIRMATION NECESSARY

PHONE: (817) 847-0082

TO:

SCOTT CLARK

COMMENTS:

FT Sam Harris - 23XL CHILLER

FROM:

COB

DEPARTMENT:

DATE:

TIME:

WE ARE TRANSMITTING FROM FAX NUMBER (817) 847-8135

**Carrier Corporation**

4084 Sandshell Drive  
Fort Worth, TX 76137  
(817) 232-2228  
FAX: (817) 847-8135

SEPTEMBER 16, 1993

CARTER AND BURGESS  
FORT WORTH, TEXAS

ATTN: SCOTT CLARK

SUBJECT: FT. SAM HOUSTON  
154 TON CHILLER REPLACEMENT

DEAR MR. CLARK,

PLEASE FIND ATTACHED SELECTION RUNS FOR BOTH 154 TONS AND 234 TON  
RESPECTIVELY. AS REQUESTED THE FOLLOWING IS BUDGETARY PRICING WITH  
THE EQUIPMENT DESCRIPTION. PLEASE NOTE:

ITEM 1- REFRIGERATION MACHINE - ROTARY SCREW TYPE - 23XL SERIES  
QUANTITY-001, MARK FOR 154 TON

Carrier 23 series hermetic screw chiller each  
complete with compressor, motor, cooler, condenser,  
and control console ready for electrical connections.  
Microprocessor controls include manual/auto  
start, safety indicator and alarm, soft loading, under  
voltage protection, motor current indication, low load  
recycle, slide valve control, self-diagnostic check,  
start-counter, and running time indicator. This machine  
is tested and completely assembled at the factory.  
The standard control wiring is factory installed  
and wired to terminal strip for connection to starter and  
pipe mounted flow switches.

In addition, the following items are included:

- Initial charge of R-22 refrigerant, shipped in machine
- Across the line starter for oil pump, factory mounted
- Necessary labor for machine start up
- Complete set of machine drawings and wiring diagrams
- Bound operation and maintenance instructions
- Factory applied insulation of the cooler
- Neoprene isolation pads
- Flanged connections on all water nozzles
- Hot gas by-pass - automatic (electronic)
- Refrigerant isolation valves - for storage in condenser
- Star Delta closed transition starter - unit mounted
- Main power disconnect - circuit breaker
- Ammeter - 3 phase, mounted in starter door
- Voltmeter - 3 phase, mounted in starter door

## Page 2

- Control voltage transformer
- One year parts and labor warranty
- Freight to jobsite
- Flow switches

Among the items NOT included are:

- Rigging, carting or painting
- Labor to install
- Equipment base or pad
- Any piping or accessories except as noted above
- Refrigerant other than the initial charge
- Isolators
- Electrical work including power and control wiring

Our price for the above equipment FOB factory with freight allowed to jobsite is:(154 ton).....\$58,020.00

Our price for the above equipment FOB factory with freight allowed to jobsite is:(234 ton).....\$67,451.00

The price for equipment and materials as outlined is quoted FOB shipping point with freight allowed to jobsite. Terms of payment are net 30 days from date of invoice. We reserve the right to require payment in advance or COD or otherwise modify credit terms. In all other respects this quotation shall be subject to the terms and conditions of sale as outlined on the reverse side of page one of this quotation.

The price quoted does not include any sales, excise, or similar taxes, it being understood that any which apply are to be added at cost.

Work which is to be performed or materials which are to be furnished at Carrier's expense for completion of the proposed contract or fulfillment of warranty must be authorized by us and notice to proceed received prior to furnishing such service or material. Immediately upon completion of such work, the prenegotiated price would be invoiced through our office for immediate processing of a credit memo to be applied to your account. Inadvertent deductions from our invoices or backcharges for unauthorized work or materials will not be accepted.

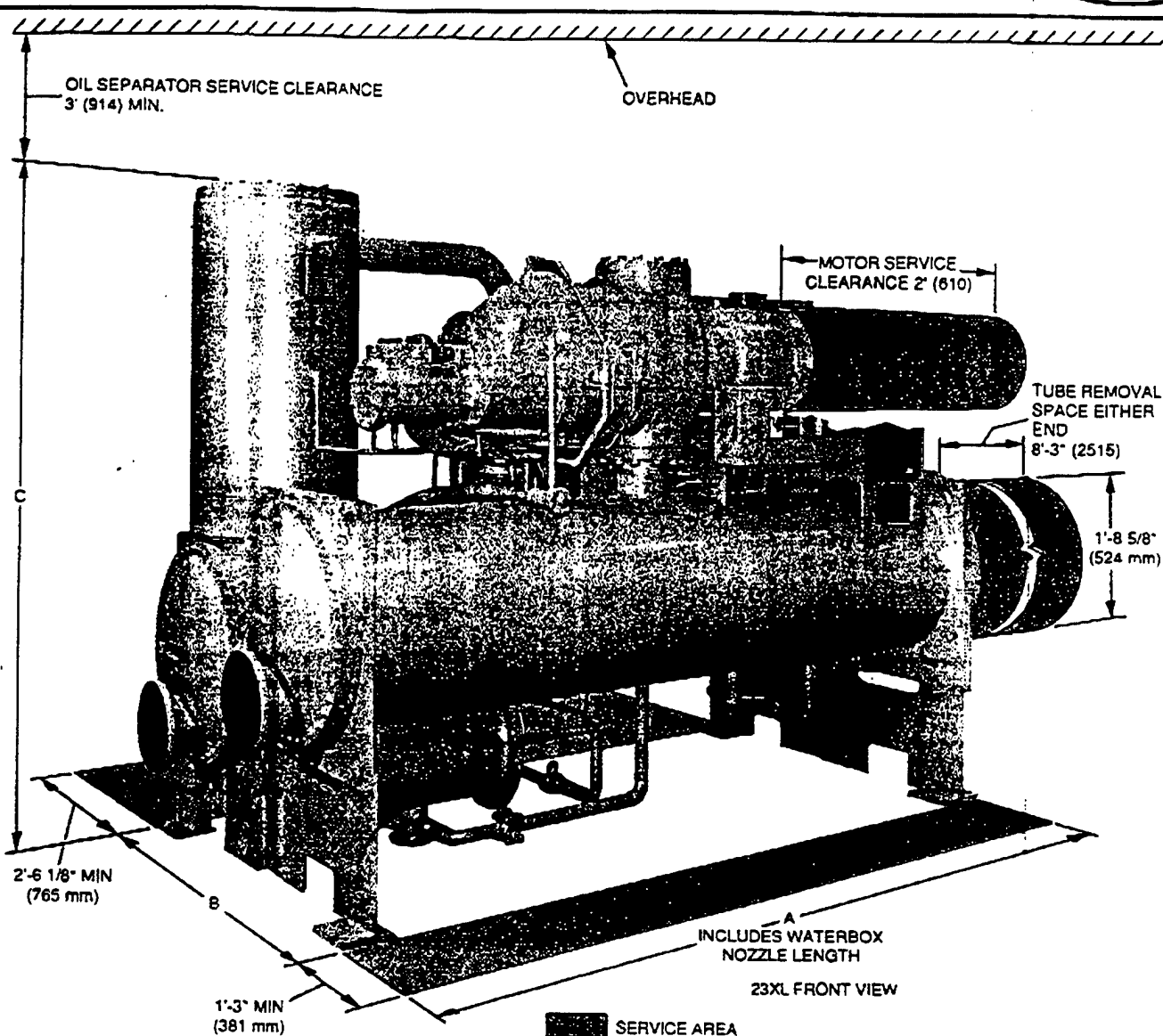
We appreciate your consideration of this quotation and would be pleased to discuss it in detail at your convenience.

Yours very truly,



Glen Brunkenhoefer  
Sales Engineer  
Carrier Corporation

# Dimensions



| HEAT EXCHANGER<br>SIZE | A (LENGTH) |      |               |      | B (WIDTH) |      | C (HEIGHT) |      | NOZZLE PIPE SIZE<br>(In.) |              |
|------------------------|------------|------|---------------|------|-----------|------|------------|------|---------------------------|--------------|
|                        | 1 Pass     |      | 2 and 3 Pass* |      |           |      |            |      | 1-Pass                    | 2 and 3-Pass |
|                        | ft-in.     | mm   | ft-in.        | mm   | ft-in.    | mm   | ft-in.     | mm   |                           |              |
| 10 or 11               |            |      |               |      | 4- 9½     | 1454 | 6- 9%      | 2073 | 8                         | 6            |
| 20 or 21               | 9-5        | 2870 | 9-6½          | 2908 | 4-11      | 1489 | 6-11%      | 2118 | 8                         | 6            |

\*2 and 3-pass length applies if either (or both) cooler or condenser is a 2 or 3-pass design.

## NOTES:

1. Service access should be provided per ASHRAE 15 (American Society of Heating Refrigeration and Air Conditioning Engineers), Latest Edition, NFPA 70 (National Fire Protection Association) and local safety codes.
2. Allow at least 2 ft (610 mm) overhead clearance for service rigging.
3. Certified drawings available upon request.

DATE

09/16/93

JOB ID : FT. SAM HOUSTON

| ANS PROBLEM<br>PLV %<br>ALTERNATES | CH-1<br>100%<br>FULLLOAD | CH-1<br>75%<br>PARTLOAD | CH-1<br>50%<br>PARTLOAD | CH-1<br>25%<br>PARTLOAD |
|------------------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| UNIT-CLR-CND                       | 23XL1011                 | 23XL1011                | 23XL1011                | 23XL1011                |
| COMPRESSOR                         | NC40                     | NC40                    | NC40                    | NC40                    |
| FLASC ORIFICE                      | 33                       | 33                      | 33                      | 33                      |
| CLR-CND PASS                       | 3-3                      | 3-3                     | 3-3                     | 3-3                     |
| CLR TUBING                         | TURBOBII                 | TURBOBII                | TURBOBII                | TURBOBII                |
| CND/SUBC.TBG                       | SPIKEFIN                 | SPIKEFIN                | SPIKEFIN                | SPIKEFIN                |
| VOLTS-HERTZ                        | 208-60                   | 208-60                  | 208-60                  | 208-60                  |
| REFR.NBR-LBS                       | 22- 600                  | 22- 600                 | 22- 600                 | 22- 600                 |
| COOLING TONS                       | 154.0                    | 115.5                   | 77.0                    | 38.5                    |
| CHILLER INPUT KW                   | 103.8                    | 71.7                    | 48.1                    | 29.0                    |
| IKW/TON                            | 0.674                    | 0.621                   | 0.625                   | 0.753                   |
| UNIT-MTD STARTER                   | Y-DELTA                  | Y-DELTA                 | Y-DELTA                 | Y-DELTA                 |
| TOTAL RIG.WT LB                    | 9319                     | 9319                    | 9319                    | 9319                    |
| TOTAL OP.WT LB                     | 10653                    | 10653                   | 10653                   | 10653                   |
| COOLER FLUID                       | FW                       | FW                      | FW                      | FW                      |
| ARI-550 FF                         | STD                      | STD                     | STD                     | STD                     |
| CLR ENT.TEMP F                     | 54.00                    | 51.49                   | 48.99                   | 46.50                   |
| CLR LVG.TEMP F                     | 44.00                    | 44.00                   | 44.00                   | 44.00                   |
| FLOW,U.S.GPM                       | 369                      | 369                     | 369                     | 369                     |
| PD, FT.W.G.                        | 18.0                     | 18.1                    | 18.2                    | 18.3                    |
| DNSR FLUID                         | FW                       | FW                      | FW                      | FW                      |
| .RJCTN MBH                         | 2201                     | 1630                    | 1088                    | 560                     |
| ARI-550 FF                         | STD                      | STD                     | STD                     | STD                     |
| CND LVG.TEMP F                     | 94.58                    | 85.84                   | 77.22                   | 68.68                   |
| CND ENT.TEMP F                     | 85.00                    | 78.75                   | 72.50                   | 66.25                   |
| FLOW,U.S.GPM                       | 462                      | 462                     | 462                     | 462                     |
| PD, FT.W.G.                        | 12.2                     | 12.4                    | 12.7                    | 12.9                    |
| MOTOR INPUT KW                     | 103                      | 71                      | 48                      | 29                      |
| RATED-L.AMPS                       | 326                      | 248                     | 195                     | 147                     |
| O.L.T.AMPS                         | 352                      |                         |                         |                         |
| L.R.Y.AMPS                         | 839                      | 839                     | 839                     | 839                     |
| L.R.D.AMPS                         | 2622                     | 2622                    | 2622                    | 2622                    |

IPLV 0.643

CERTIFIED IN ACCORDANCE WITH ARI 550-92

ON PROBLEM

CH-1

09/16/93

IPLV OR APLV CALCULATED PER ARI STANDARD 550-92

JOB ID : FT. SAM HOUSTON

DATE

09/16/93

| ANS PROBLEM<br>PLV %<br>ALTERNATES | CH-1<br>100%<br>FULLLOAD | CH-1<br>75%<br>PARTLOAD | CH-1<br>50%<br>PARTLOAD | CH-1<br>25%<br>PARTLOAD |
|------------------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| UNIT-CLR-CND                       | 23XL2020                 | 23XL2020                | 23XL2020                | 23XL2020                |
| COMPRESSOR                         | EC60                     | EC60                    | EC60                    | EC60                    |
| FLASC ORIFICE                      | 36                       | 36                      | 36                      | 36                      |
| CLR-CND PASS                       | 3-3                      | 3-3                     | 3-3                     | 3-3                     |
| CLR TUBING                         | TURBOBII                 | TURBOBII                | TURBOBII                | TURBOBII                |
| CND/SUBC.TBG                       | SPIKEFIN                 | SPIKEFIN                | SPIKEFIN                | SPIKEFIN                |
| VOLTS-HERTZ                        | 208-60                   | 208-60                  | 208-60                  | 208-60                  |
| REFR.NBR-LBS                       | 22- 750                  | 22- 750                 | 22- 750                 | 22- 750                 |
| COOLING TONS                       | 234.0                    | 175.5                   | 117.0                   | 58.5                    |
| CHILLER INPUT KW                   | 147.9                    | 95.2                    | 63.5                    | 35.6                    |
| IKW/TON                            | 0.632                    | 0.542                   | 0.543                   | 0.609                   |
| UNIT-MTD STARTER                   | Y-DELTA                  | Y-DELTA                 | Y-DELTA                 | Y-DELTA                 |
| TOTAL RIG.WT LB                    | 10329                    | 10329                   | 10329                   | 10329                   |
| TOTAL OP.WT LB                     | 11949                    | 11949                   | 11949                   | 11949                   |
| COOLER FLUID                       | FW                       | FW                      | FW                      | FW                      |
| ARI-550 FF                         | STD                      | STD                     | STD                     | STD                     |
| CLR ENT.TEMP F                     | 54.00                    | 51.49                   | 48.99                   | 46.50                   |
| CLR LVG.TEMP F                     | 44.00                    | 44.00                   | 44.00                   | 44.00                   |
| FLOW,U.S.GPM                       | 561                      | 561                     | 561                     | 561                     |
| PD, FT.W.G.                        | 22.9                     | 23.0                    | 23.1                    | 23.2                    |
| DNSR FLUID                         | FW                       | FW                      | FW                      | FW                      |
| .RJCTN MBH                         | 3313                     | 2431                    | 1620                    | 823                     |
| ARI-550 FF                         | STD                      | STD                     | STD                     | STD                     |
| CND LVG.TEMP F                     | 94.49                    | 85.71                   | 77.13                   | 68.60                   |
| CND ENT.TEMP F                     | 85.00                    | 78.75                   | 72.50                   | 66.25                   |
| FLOW,U.S.GPM                       | 702                      | 702                     | 702                     | 702                     |
| PD, FT.W.G.                        | 22.8                     | 23.2                    | 23.6                    | 24.1                    |
| MOTOR INPUT KW                     | 147                      | 95                      | 63                      | 35                      |
| RATED-L.AMPS                       | 449                      | 317                     | 247                     | 179                     |
| O.L.T.AMPS                         | 485                      |                         |                         |                         |
| L.R.Y.AMPS                         | 810                      | 810                     | 810                     | 810                     |
| L.R.D.AMPS                         | 2531                     | 2531                    | 2531                    | 2531                    |

IPLV 0.563

CERTIFIED IN ACCORDANCE WITH ARI 550-92

ON PROBLEM

CH-1

09/16/93

IPLV OR APLV CALCULATED PER ARI STANDARD 550-92





## CENTRIFUGAL MACHINE DATA

## MACHINE

 MODEL 19DA-160  
 S/N 82412763
Job Name FT. SAN HOUSTONJob No. 8660E6001Location SAN ANTONIO, TEXASApplication NON-COMMISSIONED OFFICERS MESS DARI-2092

## OPERATING DATA

|           | BRINE        | GPM        | °F IN     | °F OUT      | TONS       | SUCT. °F    | COND. °F     | REFRIG     |
|-----------|--------------|------------|-----------|-------------|------------|-------------|--------------|------------|
| COOLER    | <u>WATER</u> | <u>369</u> | <u>54</u> | <u>44</u>   | <u>154</u> | <u>35.7</u> | <u>—</u>     | <u>R-1</u> |
| CONDENSER | <u>WATER</u> | <u>462</u> | <u>85</u> | <u>94.7</u> | <u>—</u>   | <u>—</u>    | <u>102.5</u> | <u>—</u>   |

## COMPRESSOR

P/N

S/N

MODEL 235STATOR: 19DA23-1724F 269757S/N 23035ROTOR: 19D23-1224 269757IMPELLER NO. 19D23-1054SHAFT: 19DA21 38525

MOTOR

Size C-2-TVolts/FLA 208/433OIL PUMP 208-3-60

## HEAT EXCHANGERS

|        | SIZE      | PASS     | S/N          | PD         | WORKING PRESS. | TUBE SHEET MATL. | TUBE MATL. |
|--------|-----------|----------|--------------|------------|----------------|------------------|------------|
| COOLER | <u>21</u> | <u>2</u> | <u>27898</u> | <u>14'</u> | <u>150</u>     |                  |            |
| COND.  |           | <u>2</u> |              | <u>18'</u> | <u>150</u>     |                  |            |

## OTHER COMPONENTS

|          | TYPE              | MFG.      | RPM          | S/N          |
|----------|-------------------|-----------|--------------|--------------|
| CONSOLE  | <u>19DA11-504</u> |           | <u>XXXXX</u> | <u>28014</u> |
| PURGE    |                   |           | <u>XXXXX</u> |              |
| CONTROLS | <u>ELECTRIC</u>   | <u>BC</u> | <u>XXXXX</u> |              |
| STARTER  | <u>ADAOT.</u>     | <u>CH</u> | <u>XXXXX</u> |              |
| GEAR     |                   |           | <u>1</u>     |              |
| DRIVER   |                   |           |              |              |

|          | COMPRESSOR | SPACER | PINION | GEAR | DRIVER |
|----------|------------|--------|--------|------|--------|
| Size     |            |        |        |      |        |
| Part No. |            |        |        |      |        |

DATE SHIPPED: 6-18-68 "T"WARRANTY EXP: 1-1-70
 R-11; ~~9.1~~ 9.1 kW/TON @ 100%, 1.1 kW/TON @ 50%; DERATE @  
 .75%/YEAR OR 1.12 kW/TON @ 100%, 1.35 kW/TON @ 50%

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1395 - ECO IV. D. 1) - REPLACE CHILLER W/ HIGHER EFF/CFC FREE CHILLER  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |           |     |           |
|----------------------------------------|-----------|-----|-----------|
| A. CONSTRUCTION COST                   | \$142,836 |     |           |
| B. SIOH                                | \$7,856   |     |           |
| C. DESIGN COST                         | \$8,570   |     |           |
| D. TOTAL COST (1A+1B+1C)               | \$159,262 |     |           |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |           | \$0 |           |
| F. PUBLIC UTILITY COMPANY REBATE       |           | \$0 |           |
| G. TOTAL INVESTMENT (1D-1E-1F)         |           |     | \$159,262 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 419.87             | \$4,430              | 14.65              | \$64,894              |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 20.60              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$7,872              | 13.59              | \$106,980             |
| N. TOTAL          |                 | 419.87             | \$12,302             |                    | \$171,875             |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |     |  |     |
|---------------------------------------|-----|--|-----|
| A. ANNUAL RECURRING (+/-)             | \$0 |  |     |
| 1. DISCOUNT FACTOR (TABLE A)          |     |  |     |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |     |  | \$0 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM          | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|---------------|-----------------------|-------------------|--------------------|---------------------------------|
| a. WC Chiller | \$90,080              | 1                 | 0.96               | \$86,477                        |
| b. N/A        | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A        | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A        | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A        | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A        | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A        | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A        | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A        | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A        | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A        | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A        | \$0                   | 12                | 0.62               | \$0                             |
| m. AC Chiller | \$51,000              | 13                | 0.6                | \$30,600                        |
| n. N/A        | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A        | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL      | \$141,080             |                   |                    | \$117,077                       |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$117,077

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 8.2 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$288,951

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 1.81

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 7.1%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1395

ECO NO: VII D & IX A, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>42,637.0</u> | KWH/yr |
| Demand Savings:                        | <u>53.7</u>     | KW/yr  |
| Gas Savings:                           | <u>n/a</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 2,179</u> | /yr    |
| Implementation Cost:                   | <u>\$ 4,850</u> |        |
| Simple Payback:                        | <u>2.2</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>5.08</u>     |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE            | ACTION                                   |
|-----|-------------------------|------------------------------------------|
| 80  | 2-Lamp, 4' Fluor.       | Retrofit w/T8 lamps and elect. ballasts. |
| 9   | Incandescent chandelier | None.                                    |
| 45  | Incandescent chandelier | Retrofit w/compact fluor. lamps.         |
| 14  | Misc. incandescent      | None.                                    |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned} \text{Demand Savings} &= (14.053 \text{ KW} - 9.578 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (14.053 \text{ KW} - 9.578 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$358/\text{yr} \end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy kWh | Net Present Value \$ | Present Value Total LCC \$ | Annual Value Total LCC \$ | Annual Energy Savings kWh | Savings Invest. Ratio (SIR) | Levelized Energy Cost cnts/kWh | Total Initial Cost \$ | Present Value Maint LCC \$ | Present Value Energy LCC \$ | Annual Value Maint LCC \$ | Annual Value Energy LCC \$ |
|-------------------------|-------------------|----------------------|----------------------------|---------------------------|---------------------------|-----------------------------|--------------------------------|-----------------------|----------------------------|-----------------------------|---------------------------|----------------------------|
| BLD1395A                | 38599             | 42161                | 112787                     | 8299                      | 18035                     | 9.693                       | 0.187                          | 4350                  | 16853                      | 91585                       | 1240                      | 6739                       |
| *BLD1395B               | 56634             | 0                    | 154949                     | 11401                     | 0                         | 0.000                       | 0.000                          | 0                     | 20744                      | 134204                      | 1526                      | 9875                       |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD1395A   | POST RETROFIT CONDITIONS |
| BLD1395B   | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395A.WBR  
 Date: 10/16/1993

Lighting Annual : 38599 kWh  
 Lighting Capacity : 9.578 kW  
 Annual Cooling Effect : 52953 kWh  
 Annual Heating Effect : 5514 kWh  
 Total Surveyed Floor Area: 5984 SqFt  
 Percent Survey Completed : 598400 %  
 Lighting Power Density : 1.601 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| -----    | -----   | -----  | -----  | -----   | -----   | -----  |
| PVLCC \$ | 4350    | 40836  | 16853  | 51695   | -946    | 112787 |
| AVLCC \$ | 320     | 3005   | 1240   | 3804    | -70     | 8299   |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395A.LLR  
 Date: 10/16/1993

| Room<br>Foot Candles | MAX  | MIN | AVG  | SDEV  | MAX Room  | MIN Room    |
|----------------------|------|-----|------|-------|-----------|-------------|
| Calculated           | 73.2 | 5.4 | 25.4 | 27.56 | 1-kitchen | 2-dry stor  |
| Measured             | 56.2 | 3.9 | 16.1 | 22.51 | 1-kitchen | 3-scullyery |
| Required             | 50.0 | 5.0 | 24.0 | 23.76 | 1-kitchen | 2-dry stor  |

| Foot Candle<br>Comparison | MAX  | MIN   | AVG  | SDEV  | MAX Room  | MIN Room    |
|---------------------------|------|-------|------|-------|-----------|-------------|
| Calc - Req.               | 23.2 | -25.8 | 1.4  | 17.64 | 1-kitchen | 3-scullyery |
| Meas - Req.               | 6.2  | -46.1 | -7.9 | 21.53 | 1-kitchen | 3-scullyery |



Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395A.LSR  
Date: 10/16/1993

System Number: 1      Descr: open fluor.

Rooms Served: 1  
Floor Area: 2160 SqFt  
Possible kW: 3.831  
Working kW: 3.831  
Capacity kW: 3.831  
Lighting: 15438 Annual kWh  
Heating: 2205 Annual kWh  
Cooling: 21299 Annual kWh  
Op Hours/Year: 4030 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 90.2 Months  
Power Density: 1.774 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 61       | 122   | 61.0     |
| Working       | 61       | 122   | 61.0     |
| Capacity      | 61       | 122   | 61.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 16333  | 2146   | 20824   | -378    | 41426 |
| AVLCC \$ | 1202   | 158    | 1532    | -28     | 3048  |

System Number: 2      Descr: 4' fluor. surf. acrylic lens

Rooms Served: 1  
Floor Area: 2160 SqFt  
Possible kW: 0.942  
Working kW: 0.942  
Capacity kW: 0.942  
Lighting: 3796 Annual kWh  
Heating: 542 Annual kWh  
Cooling: 5238 Annual kWh  
Op Hours/Year: 4030 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 90.2 Months  
Power Density: 0.436 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 15       | 30    | 15.0     |
| Working       | 15       | 30    | 15.0     |
| Capacity      | 15       | 30    | 15.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4016   | 528    | 5121    | -93     | 10187 |
| AVLCC \$ | 296    | 39     | 377     | -7      | 750   |

System Number: 3      Descrip: incand. chandelier

Rooms Served: 1  
 Floor Area: 2640 SqFt  
 Possible kW: 1.200  
 Working kW: 1.075  
 Capacity kW: 1.200  
 Lighting: 4836 Annual kWh  
 Heating: 691 Annual kWh  
 Cooling: 6672 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 7.4 Months  
 Power Density: 0.407 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 48    | 0.0      |
| Working       | 6        | 43    | 0.0      |
| Capacity      | 6        | 48    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 5     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5116   | 3189   | 6523    | -119    | 14710 |
| AVLCC \$ | 376    | 235    | 480     | -9      | 1082  |

System Number: 4      Descrip: rec. incand.

Rooms Served: 2  
 Floor Area: 3680 SqFt  
 Possible kW: 2.340  
 Working kW: 1.980  
 Capacity kW: 2.340  
 Lighting: 9430 Annual kWh  
 Heating: 1347 Annual kWh  
 Cooling: 12657 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 3.0 Months  
 Power Density: 0.538 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 39       | 39    | 0.0      |
| Working       | 39       | 33    | 0.0      |
| Capacity      | 39       | 39    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 6     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 9977   | 6104   | 12284   | -231    | 28133 |
| AVLCC \$ | 734    | 449    | 904     | -17     | 2070  |

System Number: 5      Descrip: spotlight W/ PL

Rooms Served: 1  
 Floor Area: 2640 SqFt  
 Possible kW: 0.048  
 Working kW: 0.048  
 Capacity kW: 0.048  
 Lighting: 193 Annual kWh  
 Heating: 28 Annual kWh  
 Cooling: 260 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 40.6 Months  
 Power Density: 0.018 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 2.0      |
| Working       | 2        | 2     | 2.0      |
| Capacity      | 2        | 2     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 205    | 226    | 252     | -5      | 722   |
| AVLCC \$ | 15     | 17     | 19      | -0      | 53    |

System Number: 6      Descrip: incand. Chandelier

Rooms Served: 1  
 Floor Area: 1040 SqFt  
 Possible kW: 1.200  
 Working kW: 1.200  
 Capacity kW: 1.200  
 Lighting: 4836 Annual kWh  
 Heating: 691 Annual kWh  
 Cooling: 6672 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 6.0 Months  
 Power Density: 1.154 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 24    | 0.0      |
| Working       | 3        | 24    | 0.0      |
| Capacity      | 3        | 24    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5116   | 3008   | 6523    | -119    | 14651 |
| AVLCC \$ | 376    | 221    | 480     | -9      | 1078  |

System Number: 7      Descrip: decorative sconce

Rooms Served: 1  
 Floor Area: 1040 SqFt  
 Possible kW: 0.225  
 Working kW: 0.225  
 Capacity kW: 0.225  
 Lighting: 907 Annual kWh  
 Heating: 130 Annual kWh  
 Cooling: 1251 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 7.4 Months  
 Power Density: 0.216 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 9     | 0.0      |
| Working       | 3        | 9     | 0.0      |
| Capacity      | 3        | 9     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 959    | 598    | 1223    | -22     | 2776  |
| AVLCC \$ | 71     | 44     | 90      | -2      | 204   |

System Number: 8      Descrip: incand. gask hood

Rooms Served: 1  
 Floor Area: 2160 SqFt  
 Possible kW: 1.000  
 Working kW: 1.000  
 Capacity kW: 1.000  
 Lighting: 4030 Annual kWh  
 Heating: 576 Annual kWh  
 Cooling: 5409 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 2.2 Months  
 Power Density: 0.463 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 10    | 0.0      |
| Working       | 10       | 10    | 0.0      |
| Capacity      | 10       | 10    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4264   | 2087   | 5250    | -99     | 11518 |
| AVLCC \$ | 314    | 154    | 386     | -7      | 847   |

System Number: 9      Descrip: keyless incand.

Rooms Served: 1  
 Floor Area: 48 SqFt  
 Possible kW: 0.100  
 Working kW: 0.100  
 Capacity kW: 0.100  
 Lighting: 403 Annual kWh  
 Heating: 58 Annual kWh  
 Cooling: 556 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 2.2 Months  
 Power Density: 2.083 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 426    | 209    | 544     | -10     | 1170  |
| AVLCC \$ | 31     | 15     | 40      | -1      | 86    |

System Number: 10      Descrip: incand. down light W/ PL

Rooms Served: 1  
 Floor Area: 96 SqFt  
 Possible kW: 0.096  
 Working kW: 0.096  
 Capacity kW: 0.096  
 Lighting: 387 Annual kWh  
 Heating: 55 Annual kWh  
 Cooling: 534 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 40.6 Months  
 Power Density: 1.000 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 4     | 4.0      |
| Working       | 4        | 4     | 4.0      |
| Capacity      | 4        | 4     | 4.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 409    | 452    | 522     | -9      | 1461  |
| AVLCC \$ | 30     | 33     | 38      | -1      | 108   |

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Room-By-Room Summary Report

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395A.RRR  
 Date: 10/16/1993

| Room Name  | Floor | # | Total Area | * #Pr | SYSTEM1 Name | Work Watts | Pot. Watts | Watt sqft | SYSTEM2 Name | Work Watts | Pot. Watts | Watt sqft | SYSTEM3 Name | Work Watts | Pot. Watts | Watt sqft | Work Watts | Pot. Watts | Watt sqft | Watt Meas. FootC | Calc. FootC | Req. FootC |
|------------|-------|---|------------|-------|--------------|------------|------------|-----------|--------------|------------|------------|-----------|--------------|------------|------------|-----------|------------|------------|-----------|------------------|-------------|------------|
| 1-kitchen  | 1     | 1 | 2160       | 4     | open fluor   | 3831       | 3831       | 1.77      | 4' fluor.    | 942        | 942        | 0.44      | incand.      | 1000       | 1000       | 0.46      | 5773       | 5773       | 2.67      | 56.2             | 73.2        | 50.0       |
| 2-dry stor | 1     | 1 | 48         | 0     | keyless in   | 100        | 100        | 2.08      |              |            |            |           |              |            |            |           | 100        | 100        | 2.08      | 4.8              | 5.4         | 5.0        |
| 3-scultery | 1     | 1 | 96         | 0     | incand. do   | 96         | 96         | 1.00      |              |            |            |           |              |            |            |           | 96         | 96         | 1.00      | 3.9              | 24.2        | 50.0       |
| 4-dining   | 1     | 1 | 2640       | 300   | PL DOWNLIG   | 672        | 672        | 0.25      | incand. ch   | 1200       | 1200       | 0.45      | spotlight    | 48         | 48         | 0.02      | 1920       | 1920       | 0.73      | 7.9              | 10.3        | 7.5        |
| 5-dining   | 1     | 1 | 1040       | 100   | PL DOWNLIG   | 264        | 264        | 0.25      | incand. ch   | 1200       | 1200       | 1.15      | decorative   | 225        | 225        | 0.22      | 1689       | 1689       | 1.62      | 7.6              | 14.2        | 7.5        |

Total Rooms : 5  
 Total Area Sqft : 5984  
 Total People : 404  
 Total Working kW : 9.578  
 Total Potential kW : 9.578  
 Power Density W/sqft : 1.601

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|                               |
|-------------------------------|
| Whole Building Summary Report |
|-------------------------------|

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395B.WBR  
 Date: 10/16/1993

Lighting Annual : 56634 kWh  
 Lighting Capacity : 14.053 kW  
 Annual Cooling Effect : 77555 kWh  
 Annual Heating Effect : 8091 kWh  
 Total Surveyed Floor Area: 5984 SqFt  
 Percent Survey Completed : 598400 %  
 Lighting Power Density : 2.348 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| PVLCC \$ | 0       | 59916  | 20744  | 75677   | -1388   | 154949 |
| AVLCC \$ | 0       | 4409   | 1526   | 5568    | -102    | 11401  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1395\BLD1395B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: open fluor.

Rooms Served: 1  
Floor Area: 2160 SqFt  
Possible kW: 6.048  
Working kW: 5.520  
Capacity kW: 6.048  
Lighting: 24373 Annual kWh  
Heating: 3482 Annual kWh  
Cooling: 33627 Annual kWh  
Op Hours/Year: 4030 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 90.2 Months  
Power Density: 2.556 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 63       | 126   | 63.0     |
| Working       | 61       | 115   | 57.0     |
| Capacity      | 63       | 126   | 63.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 2        | 7     | 5.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 25786  | 3606   | 32877   | -597    | 61672 |
| AVLCC \$ | 1897   | 265    | 2419    | -44     | 4538  |

System Number: 2      Descrip: 4' fluor. surf. acrylic lens

Rooms Served: 1  
Floor Area: 2160 SqFt  
Possible kW: 1.440  
Working kW: 1.248  
Capacity kW: 1.632  
Lighting: 5803 Annual kWh  
Heating: 829 Annual kWh  
Cooling: 8006 Annual kWh  
Op Hours/Year: 4030 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 90.2 Months  
Power Density: 0.578 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 15       | 30    | 15.0     |
| Working       | 15       | 26    | 13.0     |
| Capacity      | 17       | 34    | 17.0     |
| Disconnected  | 2        | 0     | 2.0      |
| Broken/Burned | 0        | 4     | 2.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 6140   | 859    | 7828    | -142    | 14684 |
| AVLCC \$ | 452    | 63     | 576     | -10     | 1080  |



System Number: 3      Descrip: incand. chandelier

Rooms Served: 1  
 Floor Area: 2640 SqFt  
 Possible kW: 1.200  
 Working kW: 1.200  
 Capacity kW: 1.200  
 Lighting: 4836 Annual kWh  
 Heating: 691 Annual kWh  
 Cooling: 6672 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 7.4 Months  
 Power Density: 0.455 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 48    | 0.0      |
| Working       | 6        | 48    | 0.0      |
| Capacity      | 6        | 48    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5116   | 3189   | 6523    | -119    | 14806 |
| AVLCC \$ | 376    | 235    | 480     | -9      | 1089  |

System Number: 4      Descrip: PL DOWNLIGHT

Rooms Served: 2  
 Floor Area: 3680 SqFt  
 Possible kW: 0.936  
 Working kW: 0.936  
 Capacity kW: 0.936  
 Lighting: 3772 Annual kWh  
 Heating: 539 Annual kWh  
 Cooling: 5063 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 40.6 Months  
 Power Density: 0.254 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 39       | 39    | 39.0     |
| Working       | 39       | 39    | 39.0     |
| Capacity      | 39       | 39    | 39.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3991   | 4410   | 4914    | -92     | 14071 |
| AVLCC \$ | 294    | 325    | 362     | -7      | 1035  |

System Number: 5      Descrip: spotlight

Rooms Served: 1  
 Floor Area: 2640 SqFt  
 Possible kW: 0.100  
 Working kW: 0.100  
 Capacity kW: 0.100  
 Lighting: 403 Annual kWh  
 Heating: 58 Annual kWh  
 Cooling: 541 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 6.0 Months  
 Power Density: 0.038 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 0.0      |
| Working       | 2        | 2     | 0.0      |
| Capacity      | 2        | 2     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 426    | 251    | 525     | -10     | 1192  |
| AVLCC \$ | 31     | 18     | 39      | -1      | 88    |

System Number: 6      Descrip: incand. Chandelier

Rooms Served: 1  
 Floor Area: 1040 SqFt  
 Possible kW: 1.200  
 Working kW: 1.000  
 Capacity kW: 1.200  
 Lighting: 4836 Annual kWh  
 Heating: 691 Annual kWh  
 Cooling: 6672 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 6.0 Months  
 Power Density: 0.962 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 24    | 0.0      |
| Working       | 3        | 20    | 0.0      |
| Capacity      | 3        | 24    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 4     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5116   | 3008   | 6523    | -119    | 14529 |
| AVLCC \$ | 376    | 221    | 480     | -9      | 1069  |

System Number: 7      Descrip: decorative sconce

Rooms Served: 1  
 Floor Area: 1040 SqFt  
 Possible kW: 0.225  
 Working kW: 0.200  
 Capacity kW: 0.225  
 Lighting: 907 Annual kWh  
 Heating: 130 Annual kWh  
 Cooling: 1251 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 7.4 Months  
 Power Density: 0.192 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 3        | 9     | 0.0      |
| Working       | 3        | 8     | 0.0      |
| Capacity      | 3        | 9     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 1     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 959    | 598    | 1223    | -22     | 2758  |
| AVLCC \$ | 71     | 44     | 90      | -2      | 203   |

System Number: 8      Descrip: incand. gask hood

Rooms Served: 1  
 Floor Area: 2160 SqFt  
 Possible kW: 1.000  
 Working kW: 1.000  
 Capacity kW: 1.000  
 Lighting: 4030 Annual kWh  
 Heating: 576 Annual kWh  
 Cooling: 5409 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 2.2 Months  
 Power Density: 0.463 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 10    | 0.0      |
| Working       | 10       | 10    | 0.0      |
| Capacity      | 10       | 10    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 4264   | 2087   | 5250    | -99     | 11501 |
| AVLCC \$ | 314    | 154    | 386     | -7      | 846   |

System Number: 9      Descrip: keyless incand.

Rooms Served: 1  
 Floor Area: 48 SqFt  
 Possible kW: 0.100  
 Working kW: 0.100  
 Capacity kW: 0.100  
 Lighting: 403 Annual kWh  
 Heating: 58 Annual kWh  
 Cooling: 556 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 2.2 Months  
 Power Density: 2.083 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 426    | 209    | 544     | -10     | 1169  |
| AVLCC \$ | 31     | 15     | 40      | -1      | 86    |

System Number: 10      Descrip: incand. down light

Rooms Served: 1  
 Floor Area: 96 SqFt  
 Possible kW: 0.400  
 Working kW: 0.400  
 Capacity kW: 0.400  
 Lighting: 1612 Annual kWh  
 Heating: 230 Annual kWh  
 Cooling: 2164 Annual kWh  
 Op Hours/Year: 4030 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 2.2 Months  
 Power Density: 4.167 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 4     | 0.0      |
| Working       | 4        | 4     | 0.0      |
| Capacity      | 4        | 4     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1705   | 835    | 2100    | -40     | 4600  |
| AVLCC \$ | 125    | 61     | 155     | -3      | 339   |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1395 - ECO VII D. & IX A., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |     |         |
|----------------------------------------|---------|-----|---------|
| A. CONSTRUCTION COST                   | \$4,350 |     |         |
| B. SIOH                                | \$239   |     |         |
| C. DESIGN COST                         | \$261   |     |         |
| D. TOTAL COST (1A+1B+1C)               | \$4,850 |     |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |         |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     | \$4,850 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 61.55              | \$649                | 11.77              | \$7,643               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 83.97              | \$886                | 11.12              | \$9,851               |
| M. DEMAND SAVINGS |                 |                    | \$358                | 11.12              | \$3,981               |
| N. TOTAL          |                 | 145.52             | \$1,893              |                    | \$21,475              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |      |         |
|---------------------------------------|-------|------|---------|
| A. ANNUAL RECURRING (+/-)             | \$286 |      |         |
| 1. DISCOUNT FACTOR (TABLE A)          |       | 11.1 |         |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       |      | \$3,175 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                             |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                             |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL | \$0                   |                   |                    | \$0                             |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$3,175

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bp1/ECONOMIC LIFE)): 2.2 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$24,649

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 5.08

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 15.9%

## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 1462 - SNACK BAR**

Building 1462 is a two story block wall facility consisting of 16,000 square feet. This facility contains a 1,300 square feet snack bar area.

The operating hours for this facility are from 9:00 am to 8:30 pm, Sunday thru Thursday and 9:00 am to 10:30 pm, Friday and Saturday.

The lighting system is primarily fluorescent.

The mechanical system consists of an single zone air handling unit served by an air cooled chiller. Heating is provided by a gas fired boiler.

Hot water is provided to the kitchen by a gas fired water heater. Dishwashing is done by hand using a rinse sink with an electric hot water booster heater.

The following ECO's are recommended for Building 1462:

1. VII. D - Reduce indoor/outdoor lighting to AEI levels
2. IX. B - Replace incandescent exit fixtures with LED
3. IX. C - Replace standard lamps with energy saving lamps
4. IX. D - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1462

ECO NO: VII D & IX B, C, D

ECO NAME: Improve lighting efficiency

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>8.760</u>    | KWH/yr |
| Demand Savings:                        | <u>15.38</u>    | KW/yr  |
| Gas Savings:                           | <u>n/a</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 455</u>   | /yr    |
| Implementation Cost:                   | <u>\$ 1,037</u> |        |
| Simple Payback:                        | <u>2.3</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>4.96</u>     |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                       |
|-----|-------------------|----------------------------------------------|
| 2   | 2-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 16  | 4-Lamp, 4" Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 2   | Incand. Exit      | Replace w/LED exit fixture.                  |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)



$$\begin{aligned}\text{Demand Savings} &= (3.264 \text{ KW} - 1.982 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (3.264 \text{ KW} - 1.982 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$102.56/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy kWh | Net Present Value \$ | Present Value LCC \$ | Annual Value Total LCC \$ | Annual Energy Savings kWh | Savings Invest. Ratio (SIR) | Levelized Energy Cost cts/kWh | Total Initial Cost \$ | Present Value Maint LCC \$ | Present Value Energy LCC \$ | Annual Value Maint LCC \$ | Annual Value Energy LCC \$ |
|-------------------------|-------------------|----------------------|----------------------|---------------------------|---------------------------|-----------------------------|-------------------------------|-----------------------|----------------------------|-----------------------------|---------------------------|----------------------------|
| BLD1462A                | 5697              | 9627                 | 17071                | 1256                      | 3687                      | 10.351                      | 0.828                         | 930                   | 620                        | 15522                       | 46                        | 1142                       |
| *BLD1462B               | 9384              | 0                    | 26698                | 1964                      | 0                         | 0.000                       | 0.000                         | 0                     | 1135                       | 25563                       | 83                        | 1881                       |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD1462A   | POST RETROFIT CONDITIONS |
| BLD1462B   | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462A.WBR  
 Date: 10/16/1993

Lighting Annual : 5697 kWh  
 Lighting Capacity : 1.982 kW  
 Annual Cooling Effect : 7843 kWh  
 Annual Heating Effect : 814 kWh  
 Total Surveyed Floor Area: 1344 SqFt  
 Percent Survey Completed : 134400 %  
 Lighting Power Density : 1.474 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| -----    | -----   | -----  | -----  | -----   | -----   | ----- |
| PVLCC \$ | 930     | 6664   | 620    | 8998    | -140    | 17071 |
| AVLCC \$ | 68      | 490    | 46     | 662     | -10     | 1256  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462A.LLR  
 Date: 10/16/1993

| Room         |      |      |      |       |           |          |
|--------------|------|------|------|-------|-----------|----------|
| Foot Candles | MAX  | MIN  | AVG  | SDEV  | MAX Room  | MIN Room |
| Calculated   | 49.2 | 25.0 | 35.8 | 12.27 | 2-kitchen | 3-stor   |
| Measured     | 79.1 | 8.2  | 42.6 | 35.49 | 1-dining  | 3-stor   |
| Required     | 50.0 | 5.0  | 20.0 | 25.98 | 2-kitchen | 1-dining |

| Foot Candle Comparison | MAX  | MIN  | AVG  | SDEV  | MAX Room | MIN Room  |
|------------------------|------|------|------|-------|----------|-----------|
| Calc - Req.            | 28.4 | -0.8 | 15.8 | 15.06 | 1-dining | 2-kitchen |
| Meas - Req.            | 74.1 | -9.5 | 22.6 | 45.03 | 1-dining | 2-kitchen |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462A.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 2x4 lay in 4 lamp

Rooms Served: 2  
Floor Area: 1260 SqFt  
Possible kW: 1.856  
Working kW: 1.856  
Capacity kW: 1.856  
Lighting: 5336 Annual kWh  
Heating: 762 Annual kWh  
Cooling: 7335 Annual kWh  
Op Hours/Year: 2875 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 120.1 Months  
Power Density: 1.473 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 16       | 64    | 16.0     |
| Working       | 16       | 64    | 16.0     |
| Capacity      | 16       | 64    | 16.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 6241   | 572    | 8402    | -131    | 15933 |
| AVLCC \$ | 459    | 42     | 618     | -10     | 1172  |

System Number: 2      Descrip: 4' strip

Rooms Served: 1  
Floor Area: 84 SqFt  
Possible kW: 0.126  
Working kW: 0.126  
Capacity kW: 0.126  
Lighting: 361 Annual kWh  
Heating: 52 Annual kWh  
Cooling: 508 Annual kWh  
Op Hours/Year: 2875 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 120.1 Months  
Power Density: 1.495 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 422    | 47     | 596     | -9      | 1138  |
| AVLCC \$ | 31     | 3      | 44      | -1      | 84    |

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| Room-By-Room Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462A.RRR  
 Date: 10/16/1993

| Room Name | Floor | # | Total Area | #Pr | SYSTEM1 Name | Work Watts | Pot. Watts | Watt SYSTEM2 Name | Work Watts | Pot. Watts | Watt SYSTEM3 Name | Work Watts | Pot. Watts | Watt Work sqft | Pot. Watts | Watt Meas. FootC | Calc. Req. FootC |
|-----------|-------|---|------------|-----|--------------|------------|------------|-------------------|------------|------------|-------------------|------------|------------|----------------|------------|------------------|------------------|
| 1-dining  | 1     | 1 | *          | 756 | 20           | 2x4 lay in | 928        | 928               | 1.23       |            |                   | 928        | 928        | 1.23           | 79.1       | 33.4             | 5.0              |
| 2-kitchen | 1     | 1 |            | 504 | 3            | 2x4 lay in | 928        | 928               | 1.84       |            |                   | 928        | 928        | 1.84           | 40.5       | 49.2             | 50.0             |
| 3-stor    | 10    | 1 |            | 84  | 0            | 4' strip   | 126        | 126               | 1.50       |            |                   | 126        | 126        | 1.50           | 8.2        | 25.0             | 5.0              |

Total Rooms : 3  
 Total Area Sqft : 1344  
 Total People : 23  
 Total Working kW : 1.982  
 Total Potential kW : 1.982  
 Power Density W/sqft : 1.474

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462B.WBR  
 Date: 10/16/1993

Lighting Annual : 9384 kWh  
 Lighting Capacity : 3.264 kW  
 Annual Cooling Effect : 12917 kWh  
 Annual Heating Effect : 1341 kWh  
 Total Surveyed Floor Area: 1344 SqFt  
 Percent Survey Completed : 134400 %  
 Lighting Power Density : 2.429 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| -----    | -----   | -----  | -----  | -----   | -----   | ----- |
| PVLCC \$ | 0       | 10976  | 1135   | 14817   | -230    | 26698 |
| AVLCC \$ | 0       | 808    | 83     | 1090    | -17     | 1964  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1462\BLD1462B.LSR  
Date: 10/16/1993

System Number: 1      Descr: 2x4 lay in 4 lamp

Rooms Served: 2  
Floor Area: 1260 SqFt  
Possible kW: 3.072  
Working kW: 3.072  
Capacity kW: 3.072  
Lighting: 8832 Annual kWh  
Heating: 1262 Annual kWh  
Cooling: 12141 Annual kWh  
Op Hours/Year: 2875 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 120.1 Months  
Power Density: 2.438 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 16       | 64    | 16.0     |
| Working       | 16       | 64    | 16.0     |
| Capacity      | 16       | 64    | 16.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 10331  | 1056   | 13907   | -217    | 25077 |
| AVLCC \$ | 760    | 78     | 1023    | -16     | 1845  |

System Number: 2      Descr: 4' strip

Rooms Served: 1  
Floor Area: 84 SqFt  
Possible kW: 0.192  
Working kW: 0.192  
Capacity kW: 0.192  
Lighting: 552 Annual kWh  
Heating: 79 Annual kWh  
Cooling: 776 Annual kWh  
Op Hours/Year: 2875 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 120.1 Months  
Power Density: 2.286 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 646    | 79     | 911     | -14     | 1621  |
| AVLCC \$ | 48     | 6      | 67      | -1      | 119   |



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1462 - ECO VII D. & IX B., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |     |         |
|----------------------------------------|---------|-----|---------|
| A. CONSTRUCTION COST                   | \$930   |     |         |
| B. SIOH                                | \$51    |     |         |
| C. DESIGN COST                         | \$56    |     |         |
| D. TOTAL COST (1A+1B+1C)               | \$1,037 |     |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |         |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     | \$1,037 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: 'NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 12.58              | \$133                | 11.77              | \$1,562               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 17.32              | \$183                | 11.12              | \$2,032               |
| M. DEMAND SAVINGS |                 |                    | \$103                | 11.12              | \$1,140               |
| N. TOTAL          |                 | 29.9               | \$418                |                    | \$4,734               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |      |      |       |
|---------------------------------------|------|------|-------|
| A. ANNUAL RECURRING (+/-)             | \$37 |      |       |
| 1. DISCOUNT FACTOR (TABLE A)          |      | 11.1 |       |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |      |      | \$411 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                             |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                             |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL | \$0                   |                   |                    | \$0                             |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$411

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 2.3 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$5,145

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 4.96

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 15.7%

## ENERGY CONSERVATION ANALYSIS

### BUILDING 1520 - RESERVE CENTER

Building 1520 is a two story brick facility consisting of reserve unit offices. This facility contains a full service kitchen and large dining area which consists of 4,300 square feet.

The operating hours for the dining and kitchen facility are very sporadic due to the fact that it is used only for mobilization. However, the dining area is used as a break room and from 8:00 am to 4:00 pm the lights are on.

The lighting system is primarily fluorescent.

The mechanical system consists of a packaged DX rooftop air handling unit with gas heating.

Hot water is provided to the kitchen by a gas fired water heater.

Due to the operating conditions for this facility are as follows:

1. VII.D - Reduce indoor/outdoor lighting to AEI levels.
2. IX.A - Replace incandescent lamps with compact fluorescents.
3. IX.B. - Replace incandescent exit fixtures with LED.
4. IX.C. - Replace standard lamps with energy saving lamps.
5. IX.D. - Replace standard ballast with energy saving ballast.

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 1520

ECO NO: VII D & IX A, B, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>12,030</u>   | KWH/yr |
| Demand Savings:                        | <u>26.76</u>    | KW/yr  |
| Gas Savings:                           | <u>n/a</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 664</u>   | /yr    |
| Implementation Cost:                   | <u>\$ 2,447</u> |        |
| Simple Payback:                        | <u>3.7</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>3.06</u>     |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                       |
|-----|-------------------|----------------------------------------------|
| 15  | 2-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 30  | 3-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 4   | Incand. Exit      | Replace w/LED exit fixture.                  |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (5.91 \text{ KW} - 3.68 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (5.91 \text{ KW} - 3.68 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$178.40/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest. Ratio<br>(SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD1520A                | 8275                 | 13373                   | 27685                   | 2037                         | 5022                         | 6.093                          | 2.176                              | 2195                     | 977                           | 24512                          | 72                           | 1804                          |
| *BLD1520B               | 13297                | 0                       | 41058                   | 3021                         | 0                            | 0.000                          | 0.000                              | 0                        | 1687                          | 39371                          | 124                          | 2897                          |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD1520A   | POST RETROFIT CONDITIONS |
| BLD1520B   | EXISTING CONDITIONS      |

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1520\BLD1520A.WBR

Date: 10/16/1993

Lighting Annual : 8275 kWh  
 Lighting Capacity : 3.678 kW  
 Annual Cooling Effect : 11556 kWh  
 Annual Heating Effect : 1182 kWh  
 Total Surveyed Floor Area: 4268 SqFt  
 Percent Survey Completed : 426800 %  
 Lighting Power Density : 0.862 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2195    | 10576  | 977    | 14139   | -203    | 27685 |
| AVLCC \$ | 162     | 778    | 72     | 1040    | -15     | 2037  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1520\BLD1520A.LLR

Date: 10/16/1993

| Room         | MAX   | MIN   | AVG   | SDEV  | MAX Room    | MIN Room          |
|--------------|-------|-------|-------|-------|-------------|-------------------|
| Foot Candles |       |       |       |       |             |                   |
| -----        | ----- | ----- | ----- | ----- | -----       | -----             |
| Calculated   | 53.3  | 15.4  | 35.0  | 15.59 | 4-scullyery | 1-multi use/dinig |
| Measured     | 44.8  | 30.6  | 36.8  | 6.09  | 4-scullyery | 1-multi use/dinig |
| Required     | 50.0  | 5.0   | 27.5  | 25.98 | 3-kitchen   | 1-multi use/dinig |

| Foot Candle | MAX   | MIN   | AVG   | SDEV  | MAX Room | MIN Room  |
|-------------|-------|-------|-------|-------|----------|-----------|
| Comparison  |       |       |       |       |          |           |
| -----       | ----- | ----- | ----- | ----- | -----    | -----     |
| Calc - Req. | 28.2  | -12.0 | 7.5   | 16.71 | 2-stor   | 3-kitchen |
| Meas - Req. | 29.1  | -12.2 | 9.3   | 21.06 | 2-stor   | 3-kitchen |



Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1520\BLD1520A.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 4 lamp, 2x4 lay-in

Rooms Served: 1  
Floor Area: 3500 SqFt  
Possible kW: 2.736  
Working kW: 2.736  
Capacity kW: 2.736  
Lighting: 6156 Annual kWh  
Heating: 879 Annual kWh  
Cooling: 8556 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.782 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 30       | 90    | 30.0     |
| Working       | 30       | 90    | 30.0     |
| Capacity      | 30       | 90    | 30.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 7867   | 698    | 10358   | -151    | 20242 |
| AVLCC \$ | 579    | 51     | 762     | -11     | 1489  |

System Number: 2      Descrip: 4' industrual

Rooms Served: 1  
Floor Area: 144 SqFt  
Possible kW: 0.126  
Working kW: 0.126  
Capacity kW: 0.126  
Lighting: 283 Annual kWh  
Heating: 40 Annual kWh  
Cooling: 400 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.872 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 361    | 35     | 504     | -7      | 976   |
| AVLCC \$ | 27     | 3      | 37      | -1      | 72    |

System Number: 3      Descrip: fluor wrap

Rooms Served: 1  
 Floor Area: 336 SqFt  
 Possible kW: 0.440  
 Working kW: 0.440  
 Capacity kW: 0.440  
 Lighting: 989 Annual kWh  
 Heating: 141 Annual kWh  
 Cooling: 1400 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 1.308 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 7        | 14    | 7.0      |
| Working       | 7        | 14    | 7.0      |
| Capacity      | 7        | 14    | 7.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1264   | 124    | 1765    | -24     | 3416  |
| AVLCC \$ | 93     | 9      | 130     | -2      | 251   |

System Number: 4      Descrip: 1x4 surface w/acrylic lens

Rooms Served: 2  
 Floor Area: 3788 SqFt  
 Possible kW: 0.377  
 Working kW: 0.377  
 Capacity kW: 0.377  
 Lighting: 848 Annual kWh  
 Heating: 121 Annual kWh  
 Cooling: 1200 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 0.099 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 12    | 6.0      |
| Working       | 6        | 12    | 6.0      |
| Capacity      | 6        | 12    | 6.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1083   | 120    | 1513    | -21     | 3051  |
| AVLCC \$ | 80     | 9      | 111     | -2      | 225   |

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| Room-By-Room Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\SELECT\FLEX\OUT\1520\BLD1520A.RRR  
 Date: 10/16/1993

| Room Name   | Floor | # | Total Area | #Pr | SYSTEM1 Name | Work Watts | Pot. Watts | Watt SYSTEM2 Name | Work Watts | Pot. Watts | Watt SYSTEM3 Name | Work Watts | Pot. Watts | Watt Work Watts | Pot. Watts | Watt Meas. FootC | Calc. Req. FootC |
|-------------|-------|---|------------|-----|--------------|------------|------------|-------------------|------------|------------|-------------------|------------|------------|-----------------|------------|------------------|------------------|
| 1-multi use | 1     | 1 | 3500       | 100 | 4 lamp, 2x   | 2736       | 2736       | 0.78 1x4 surfac   | 63         | 63         | 0.02              | 2799       | 2799       | 0.80            | 30.6       | 15.4             | 5.0              |
| 2-stor      | 1     | 1 | 144        | 0   | 4' industr   | 126        | 126        | 0.87              |            |            |                   | 126        | 126        | 0.87            | 34.1       | 33.2             | 5.0              |
| 3-kitchen   | 1     | 1 | 288        | 2   | 1x4 surfac   | 314        | 314        | 1.09              |            |            |                   | 314        | 314        | 1.09            | 37.8       | 38.0             | 50.0             |
| 4-scultery  | 1     | 1 | 336        | 2   | fluor wrap   | 440        | 440        | 1.31              |            |            |                   | 440        | 440        | 1.31            | 44.8       | 53.3             | 50.0             |

Total Rooms : 4  
 Total Area Sqft : 4268  
 Total People : 104  
 Total Working kW : 3.678  
 Total Potential kW : 3.678  
 Power Density W/sqft : 0.862

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1520\BLD1520B.WBR  
 Date: 10/16/1993

Lighting Annual : 13297 kWh  
 Lighting Capacity : 5.910 kW  
 Annual Cooling Effect : 18565 kWh  
 Annual Heating Effect : 1900 kWh  
 Total Surveyed Floor Area: 4268 SqFt  
 Percent Survey Completed : 426800 %  
 Lighting Power Density : 1.385 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 0       | 16994  | 1687   | 22703   | -326    | 41058 |
| AVLCC \$ | 0       | 1250   | 124    | 1671    | -24     | 3021  |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1520\BLD1520B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 3 lamp, 2x4 lay-in

Rooms Served: 1  
Floor Area: 3500 SqFt  
Possible kW: 4.470  
Working kW: 2.682  
Capacity kW: 4.470  
Lighting: 10058 Annual kWh  
Heating: 1437 Annual kWh  
Cooling: 13978 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 0.766 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 30       | 90    | 30.0     |
| Working       | 20       | 54    | 18.0     |
| Capacity      | 30       | 90    | 30.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 10       | 6     | 12.0     |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 12853  | 1240   | 16923   | -247    | 30769 |
| AVLCC \$ | 946    | 91     | 1245    | -18     | 2264  |

System Number: 2      Descrip: 4' industrual

Rooms Served: 1  
Floor Area: 144 SqFt  
Possible kW: 0.192  
Working kW: 0.192  
Capacity kW: 0.192  
Lighting: 432 Annual kWh  
Heating: 62 Annual kWh  
Cooling: 612 Annual kWh  
Op Hours/Year: 2250 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 142.1 Months  
Power Density: 1.333 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 552    | 60     | 771     | -11     | 1372  |
| AVLCC \$ | 41     | 4      | 57      | -1      | 101   |

System Number: 3      Descrip: fluor wrap

Rooms Served: 1  
 Floor Area: 336 SqFt  
 Possible kW: 0.672  
 Working kW: 0.624  
 Capacity kW: 0.672  
 Lighting: 1512 Annual kWh  
 Heating: 216 Annual kWh  
 Cooling: 2141 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 1.857 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 7        | 14    | 7.0      |
| Working       | 7        | 13    | 6.0      |
| Capacity      | 7        | 14    | 7.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 1     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1932   | 209    | 2698    | -37     | 4802  |
| AVLCC \$ | 142    | 15     | 198     | -3      | 353   |

System Number: 4      Descrip: 1x4 surface w/acrylic lens

Rooms Served: 2  
 Floor Area: 3788 SqFt  
 Possible kW: 0.576  
 Working kW: 0.576  
 Capacity kW: 0.576  
 Lighting: 1296 Annual kWh  
 Heating: 185 Annual kWh  
 Cooling: 1835 Annual kWh  
 Op Hours/Year: 2250 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 142.1 Months  
 Power Density: 0.152 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 12    | 6.0      |
| Working       | 6        | 12    | 6.0      |
| Capacity      | 6        | 12    | 6.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1656   | 179    | 2312    | -32     | 4116  |
| AVLCC \$ | 122    | 13     | 170     | -2      | 303   |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1520 - ECO VI/FSI D. & IX B., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |         |
|----------------------------------------|---------|---------|
| A. CONSTRUCTION COST                   | \$2,195 |         |
| B. SIOH                                | \$121   |         |
| C. DESIGN COST                         | \$132   |         |
| D. TOTAL COST (1A+1B+1C)               | \$2,447 |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0     |         |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0     |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         | \$2,447 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 17.14              | \$181                | 11.77              | \$2,128               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 23.92              | \$252                | 11.12              | \$2,806               |
| M. DEMAND SAVINGS |                 |                    | \$178                | 11.12              | \$1,984               |
| N. TOTAL          |                 | 41.06              | \$612                |                    | \$6,918               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |      |       |
|---------------------------------------|------|-------|
| A. ANNUAL RECURRING (+/-)             | \$52 |       |
| 1. DISCOUNT FACTOR (TABLE A)          |      | 11.1  |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |      | \$577 |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)**

\$577

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :**

3.7 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):**

\$7,496

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :**

3.06

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):**

12.1%



## **ENERGY CONSERVATION ANALYSIS**

### **BUILDING 1630 - YOUTH CENTER**

Building 1630 is a one story stucco recreational facility. This facility contains a small snack bar which consists of 480 square feet.

The operating hours for this facility are from 4:00 pm to 10:00 pm, Monday thru Friday and 7:00 am to 10:00 pm on Saturdays.

The lighting system is primarily fluorescent.

The mechanical system consists of multizone air handling units with DX cooling coils and an air cooled condensing units. Heating is provided by gas fired boiler.

Hot water is provided to the kitchen by a gas fired water heater.

The only recommended ECO's for this facility are as follows;

1. VII.D - Reduce Indoor/Outdoor Lighting to AEI Levels
2. IX.A - Replace Incandescent Lamps with Compact Fluorescents
3. IX.C - Replace Standard Lamps with Energy Saving Lamps
4. IX.D - Replace Standard Ballast with Energy Saving Ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO 1630

ECO NO: VII D & IX A, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                |        |
|----------------------------------------|----------------|--------|
| KWH Savings:                           | <u>2,396.7</u> | KWH/yr |
| Demand Savings:                        | <u>5.47</u>    | KW/yr  |
| Gas Savings:                           | <u>n/a</u>     | MCF/yr |
| Cost Savings:                          | <u>\$ 133</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 357</u>  |        |
| Simple Payback:                        | <u>2.7</u>     | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>4.21</u>    |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current lighting levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                       |
|-----|-------------------|----------------------------------------------|
| 6   | 4-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts. |
| 1   | Bare incandescent | None.                                        |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (1.252 \text{ KW} - .796 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (1.252 \text{ KW} - .796 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$36.48/\text{yr}\end{aligned}$$

**IMPLEMENTATION COSTS:**

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>LCC \$ | Annual Value<br>Total<br>LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint<br>LCC \$ | Present Value<br>Energy<br>LCC \$ | Annual Value<br>Maint<br>LCC \$ | Annual Value<br>Energy<br>LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------|---------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|----------------------------------|-----------------------------------|---------------------------------|----------------------------------|
| BLD1630A                | 1815                 | 2627                    | 5507                    | 405                             | 1040                         | 8.219                          | 1.278                              | 320                      | 286                              | 4901                              | 21                              | 361                              |
| *BLD1630B               | 2855                 | 0                       | 8135                    | 599                             | 0                            | 0.000                          | 0.000                              | 0                        | 425                              | 7709                              | 31                              | 567                              |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD1630A   | POST RETROFIT CONDITIONS |
| BLD1630B   | EXISTING CONDITIONS      |

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|                               |
|-------------------------------|
| Whole Building Summary Report |
|-------------------------------|

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\8LD1630A.WBR

Date: 10/16/1993

Lighting Annual : 1815 kWh  
 Lighting Capacity : 0.796 kW  
 Annual Cooling Effect : 2367 kWh  
 Annual Heating Effect : 259 kWh  
 Total Surveyed Floor Area: 480 SqFt  
 Percent Survey Completed : 48000 %  
 Lighting Power Density : 1.658 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 320     | 2307   | 286    | 2638    | -44     | 5507  |
| AVLCC \$ | 24      | 170    | 21     | 194     | -3      | 405   |

=====

| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\BLD1630A.LLR

Date: 10/16/1993

| Room         |       |       |       |       |           |           |
|--------------|-------|-------|-------|-------|-----------|-----------|
| Foot Candles | MAX   | MIN   | AVG   | SDEV  | MAX Room  | MIN Room  |
| -----        | ----- | ----- | ----- | ----- | -----     | -----     |
| Calculated   | 50.5  | 7.1   | 30.7  | 21.97 | 3-entry   | 2-stor    |
| Measured     | 51.5  | 2.7   | 23.4  | 25.23 | 1-kitchen | 2-stor    |
| Required     | 50.0  | 5.0   | 28.3  | 22.55 | 1-kitchen | 2-stor    |
| Foot Candle  |       |       |       |       |           |           |
| Comparison   | MAX   | MIN   | AVG   | SDEV  | MAX Room  | MIN Room  |
| -----        | ----- | ----- | ----- | ----- | -----     | -----     |
| Calc - Req.  | 20.5  | -15.4 | 2.4   | 17.98 | 3-entry   | 1-kitchen |
| Meas - Req.  | 1.5   | -14.0 | -4.9  | 8.10  | 1-kitchen | 3-entry   |

=====

Lighting System Survey Summary

One Page for Each Defined System

=====

Subject: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\BLD1630A.LSR  
 Date: 10/16/1993

System Number: 1      Descrip: 4 lamp, 2x4 lay-in w/acrylic

=====

Rooms Served: 2  
 Floor Area: 400 SqFt  
 Possible kW: 0.696  
 Working kW: 0.696  
 Capacity kW: 0.696  
 Lighting: 1587 Annual kWh  
 Heating: 227 Annual kWh  
 Cooling: 2069 Annual kWh  
 Op Hours/Year: 2280 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 140.6 Months  
 Power Density: 1.740 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 24    | 6.0      |
| Working       | 6        | 24    | 6.0      |
| Capacity      | 6        | 24    | 6.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2018   | 168    | 2307    | -39     | 4772  |
| AVLCC \$ | 148    | 12     | 170     | -3      | 351   |

System Number: 2      Descrip: bare incand.

=====

Rooms Served: 1  
 Floor Area: 80 SqFt  
 Possible kW: 0.100  
 Working kW: 0.100  
 Capacity kW: 0.100  
 Lighting: 228 Annual kWh  
 Heating: 33 Annual kWh  
 Cooling: 297 Annual kWh  
 Op Hours/Year: 2280 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 3.9 Months  
 Power Density: 1.250 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 290    | 118    | 331     | -6      | 735   |
| AVLCC \$ | 21     | 9      | 24      | -0      | 54    |

=====  
 | Room-By-Room Summary Report |  
 =====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\BLD1630A.RRR  
 Date: 10/16/1993

| Room Name | Floor | # | * | Total Area | #Pr | SYSTEM1 Name | Work Watts | Pot. Watts | Watt SYSTEM2 Name | Work Watts | Pot. Watts | Watt SYSTEM3 Name | Work Watts | Pot. Watts | Watt Work | Pot. Watts | Watt Meas. | Calc. Req. |
|-----------|-------|---|---|------------|-----|--------------|------------|------------|-------------------|------------|------------|-------------------|------------|------------|-----------|------------|------------|------------|
| 1-kitchen | 1     | 1 | * | 320        | 2   | 4 lamp, 2x   | 464        | 464        | 1.45              | 100        | 100        | 1.25              | 464        | 464        | 1.45      | 51.5       | 34.6       | 50.0       |
| 2-stor    | 1     | 1 |   | 80         | 0   | bare incan   | 100        | 100        | 1.25              |            |            |                   | 100        | 100        | 1.25      | 2.7        | 7.1        | 5.0        |
| 3-entry   | 1     | 1 |   | 80         | 0   | 4 lamp, 2x   | 232        | 232        | 2.90              |            |            |                   | 232        | 232        | 2.90      | 16.0       | 50.5       | 30.0       |

Total Rooms : 3  
 Total Area Sqft : 480  
 Total People : 2  
 Total Working kW : 0.796  
 Total Potential kW : 0.796  
 Power Density W/sqft : 1.658



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| Whole Building Summary Report |

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\BLD1630B.WBR  
 Date: 10/16/1993

Lighting Annual : 2855 kWh  
 Lighting Capacity : 1.252 kW  
 Annual Cooling Effect : 3723 kWh  
 Annual Heating Effect : 408 kWh  
 Total Surveyed Floor Area: 480 Sqft  
 Percent Survey Completed : 48000 %  
 Lighting Power Density : 2.608 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| -----    | -----   | -----  | -----  | -----   | -----   | ----- |
| PVLCC \$ | 0       | 3629   | 425    | 4150    | -70     | 8135  |
| AVLCC \$ | 0       | 267    | 31     | 305     | -5      | 599   |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\1630\BLD1630B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 4 lamp, 2x4 lay-in w/acrylic

Rooms Served: 2  
Floor Area: 400 SqFt  
Possible kW: 1.152  
Working kW: 1.152  
Capacity kW: 1.152  
Lighting: 2627 Annual kWh  
Heating: 375 Annual kWh  
Cooling: 3425 Annual kWh  
Op Hours/Year: 2280 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 140.6 Months  
Power Density: 2.880 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 24    | 6.0      |
| Working       | 6        | 24    | 6.0      |
| Capacity      | 6        | 24    | 6.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3339   | 307    | 3818    | -64     | 7401  |
| AVLCC \$ | 246    | 23     | 281     | -5      | 545   |

System Number: 2      Descrip: bare incand.

Rooms Served: 1  
Floor Area: 80 SqFt  
Possible kW: 0.100  
Working kW: 0.100  
Capacity kW: 0.100  
Lighting: 228 Annual kWh  
Heating: 33 Annual kWh  
Cooling: 297 Annual kWh  
Op Hours/Year: 2280 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 3.9 Months  
Power Density: 1.250 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 1        | 1     | 0.0      |
| Working       | 1        | 1     | 0.0      |
| Capacity      | 1        | 1     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 290    | 118    | 331     | -6      | 734   |
| AVLCC \$ | 21     | 9      | 24      | -0      | 54    |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 1630 - ECO VII D. & IX A., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |       |       |
|----------------------------------------|-------|-------|
| A. CONSTRUCTION COST                   | \$320 |       |
| B. SIOH                                | \$18  |       |
| C. DESIGN COST                         | \$19  |       |
| D. TOTAL COST (1A+1B+1C)               | \$357 |       |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0   |       |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0   |       |
| G. TOTAL INVESTMENT (1D-1E-1F)         |       | \$357 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 3.55               | \$37                 | 11.77              | \$441                 |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 4.63               | \$49                 | 11.12              | \$543                 |
| M. DEMAND SAVINGS |                 |                    | \$36                 | 11.12              | \$406                 |
| N. TOTAL          |                 | 8.18               | \$123                |                    | \$1,390               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |      |       |
|---------------------------------------|------|-------|
| A. ANNUAL RECURRING (+/-)             | \$10 |       |
| 1. DISCOUNT FACTOR (TABLE A)          |      | 11.1  |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |      | \$111 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                             |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                             |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL | \$0                   |                   |                    | \$0                             |

## **C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)**

\$111

## **4. SIMPLE PAYBACK $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :**

2.7 YEARS

## **5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):**

\$1,501

## **6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G:**

4.21

## **7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):**

14.5%

## ENERGY CONSERVATION ANALYSIS

### BUILDING 2265 - MESS HALL IN BARRACKS

Building 2265 is a three story barracks consisting of 106,000 square feet. This facility contains a large full service kitchen and dining area which consists of 4,100 square feet.

The operating hours for this facility are from 5:00 am to 8:00 pm, Monday to Friday and 7:00 am to 8:00 pm Saturday and Sunday.

The lighting system is primarily fluorescent.

The mechanical system consists of single zone air handling units served by a water cooled centrifugal chiller located in the basement. Heating is provided by gas fired boilers.

Hot water is provided to the kitchen by a gas fired water heater. Dishwashing is accomplished using an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 2265:

1. IV. D.1) - Replace chiller with higher EFF/CFC free chiller
2. VII. C. - Remove unneeded lamps or fixtures
3. VII. D. - Reduce indoor/outdoor lighting to AEI levels
4. IX. B. - Replace incandescent exit fixtures with LED
5. IX. C. - Replace standard lamps with energy saving lamps
6. IX. D. - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2265

ECO NO: IV. D 1)

ECO NAME: Replace chiller with higher efficiency CFC free chiller.

#### SUMMARY DATA (DEPENDENT):

|                                        |                   |        |
|----------------------------------------|-------------------|--------|
| KWH Savings:                           | <u>424,595</u>    | KWH/yr |
| Demand Savings:                        | <u>1,740</u>      | KW/yr  |
| Gas Savings:                           | <u>n/a</u>        | MCF/yr |
| Cost Savings:                          | <u>\$ 26,888</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 338,516</u> |        |
| Simple Payback:                        | <u>7.7</u>        | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>2.02</u>       |        |

#### ECO DESCRIPTION:

Currently, a 657 ton water cooled centrifugal chiller is in use. This chiller was installed in 1973 and operates at an efficiency of approximately .871 KW/ton. This ECO analyzes replacing this unit with a new high efficiency, CFC free chiller. The new chillers will operate with an efficiency of approximately .540 KW/ton (see following selection). This ECO analysis accounts for the interdependencies related to operating hours and the proposed lighting retrofit.

#### COST SAVINGS CALCULATIONS:

(Refer to following Trace Output)

$$\begin{aligned}\text{Demand Savings} &= (907 \text{ KW} - 792 \text{ KW}) \times 4 \text{ mo.} \times \$7.50/\text{KW} + (907 \text{ KW} - 792 \text{ KW}) \times 8 \text{ mo.} \times \$6.25/\text{KW} \\ &= \$9,200/\text{yr}\end{aligned}$$

**IMPLEMENTATION COSTS:**

(Refer to following Cost Estimate)

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

LINE # -----

1 JOB - 1  
 2 01/FORT SAM HOUSTON EEAP  
 3 01/SAN ANTONIO  
 4 01/FWD-COE  
 5 01/SCOTT CLARK  
 6 01/HVAC IMPROVEMENTS  
 7 08/SANANTON  
 8 09/JAN/DEC  
 9 10/CLTD-CLF  
 10 11/JAN/DEC  
 11 LOAD - 1  
 12 19/1/ENERGY CONSERVATION SIMULATION  
 13 20/1/1/FIRST FLOOR/500/185//4//14  
 14 20/2/2/SECOND FLOOR/500/185//4//14  
 15 20/3/3/THIRD FLOOR/500/185//4//14  
 16 21/M/78/50/78//70/70  
 17 22/3/1/YES///.07  
 18 24/1/1/500/14/.15//0  
 19 24/1/2/185/14/.15//90  
 20 24/1/3/500/14/.15//180  
 21 24/1/4/185/14/.15//270  
 22 24/2/1/500/14/.15//0  
 23 24/2/2/185/14/.15//90  
 24 24/2/3/500/14/.15//180  
 25 24/2/4/185/14/.15//270  
 26 24/3/1/500/14/.15//0  
 27 24/3/2/185/14/.15//90  
 28 24/3/3/500/14/.15//180  
 29 24/3/4/185/14/.15//270  
 30 25/1/1//20/1.07/.7  
 31 25/1/2//20/1.07/.7  
 32 25/1/3//20/1.07/.7  
 33 25/1/4//20/1.07/.7  
 34 25/2/1//20/1.07/.7  
 35 25/2/2//20/1.07/.7  
 36 25/2/3//20/1.07/.7  
 37 25/2/4//20/1.07/.7  
 38 25/3/1//20/1.07/.7  
 39 25/3/2//20/1.07/.7  
 40 25/3/3//20/1.07/.7  
 41 25/3/4//20/1.07/.7  
 42 26/M/2265PLP/2265LT  
 43 27/M/100/SF-PERS/255/255/2.0/WATT-SF///30  
 44 28/M/1//1.5/WATT-SF/2265LT  
 45 29/M/15/CFM-P/15/CFM-P  
 46 30/M/.75/CFM-SF  
 47 SYSTEM - 1  
 48 39/1/EXISTING CONDITIONS  
 49 40/1/VTCV  
 50 41/1/1/3  
 51 42/1/2.5  
 52 43/1/54/62  
 53 44/1/NONE  
 54 45/1/AVAIL  
 55 EQUIPMENT - 1  
 56 60/1/1/PKPLANT/1/1  
 57 61/1/1  
 58 62/1/EQ1001L/1/657/TONS/.871/KW-TON



CONTENTS OF : H:\JOB\911099\12F\TRACE\EQUIPECO\2265.TM

LINE # -----

59 63/1/75/HP/35/HP  
60 64/1//NO/NO/NONE  
69/1/EQ4003  
62 70/1/100  
63 EQUIPMENT - 2  
64 60/1/1/PKPLANT/1/1  
65 61/1/1  
66 62/1/EQ1001L/1/657/TONS/.540/KW-TON  
67 63/1/75/HP/35/HP  
68 64/1//NO/NO/NONE  
69 69/1/EQ4003  
70 70/1/100

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TRACE 600 ANALYSIS  
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by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 9:59:34 4/18/94  
Dataset Name: 2265 .TM

AIRFLOW - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | ----- Main -----            |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 41,625                      | 208,125                     | 208,125                     | 208,125                    | 41,625                      | 0                                    | 0                                   |
| Totals           |                | 41,625                      | 208,125                     | 208,125                     | 208,125                    | 41,625                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

| ----- Cooling ----- |        |           |           |           |         |            |           |          |          |          |           |            | ----- Heating ----- |  |  |  |  |
|---------------------|--------|-----------|-----------|-----------|---------|------------|-----------|----------|----------|----------|-----------|------------|---------------------|--|--|--|--|
|                     |        | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys.  | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |                     |  |  |  |  |
| System              | System | Capacity  | Capacity  | Capacity  | Totals  | Capacity   | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |                     |  |  |  |  |
| Number              | Type   | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)     | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |                     |  |  |  |  |
| 1                   | VTCV   | 562.6     | 0.0       | 0.0       | 562.6   | -2,816,967 | 0         | 0        | 0        | 0        | 0         | -2,816,967 |                     |  |  |  |  |
| Totals              |        | 562.6     | 0.0       | 0.0       | 562.6   | -2,816,967 | 0         | 0        | 0        | 0        | 0         | -2,816,967 |                     |  |  |  |  |

The building peaked at hour 14 month 8 with a capacity of 562.6 tons

ENGINEERING CHECKS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | ----- Cooling ----- |             |               |                | ----- Heating ----- |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------------|-------------|---------------|----------------|---------------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft       | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft       | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 20.00                     | 0.75                | 369.9       | 493.2         | 24.33          | 0.75                | -10.15         | 277,500             |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | CLG SPACE PEAK ***** |                       |                  | ***** HEATING COIL PEAK ***** |                           |                  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------|-----------------------|------------------|-------------------------------|---------------------------|------------------|
| Peak at Time ==> Mo/Hr: 8/14             |                         |                          |                        |                  | Mo/Hr: 8/16          |                       |                  | Mo/Hr: 13/ 1                  |                           |                  |
| Outside Air ==> OADB/WB/HR: 96/ 79/126.0 |                         |                          |                        |                  | OADB: 96             |                       |                  | OADB: 30                      |                           |                  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)     | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Sens (Btuh)        | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%) |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Roof Cond                                | 0                       | 335,369                  |                        | 335,369          | 4.97                 | 0                     | 0.00             | 0                             | -251,809                  | 8.94             |
| Glass Solar                              | 375,928                 | 0                        |                        | 375,928          | 5.57                 | 410,452               | 11.39            | 0                             | 0                         | 0.00             |
| Glass Cond                               | 181,830                 | 0                        |                        | 181,830          | 2.69                 | 194,965               | 5.41             | -540,565                      | -540,565                  | 19.19            |
| Wall Cond                                | 148,848                 | 77,994                   |                        | 226,842          | 3.36                 | 167,787               | 4.66             | -177,552                      | -273,453                  | 9.71             |
| Partition                                | 0                       |                          |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Infiltration                             | 0                       |                          |                        | 0                | 0.00                 | 0                     | 0.00             | 0                             | 0                         | 0.00             |
| Sub Total==>                             | 706,606                 | 413,363                  |                        | 1,119,969        | 16.59                | 773,203               | 21.46            | -718,117                      | -1,065,827                | 37.84            |
| Internal Loads                           |                         |                          |                        |                  |                      |                       |                  |                               |                           |                  |
| Lights                                   | 427,486                 | 183,208                  |                        | 610,695          | 9.05                 | 446,448               | 12.39            | 0                             | 0                         | 0.00             |
| People                                   | 724,136                 |                          |                        | 724,136          | 10.73                | 363,247               | 10.08            | 0                             | 0                         | 0.00             |
| Misc                                     | 1,245,446               | 0                        | 0                      | 1,245,446        | 18.45                | 1,273,860             | 35.36            | 0                             | 0                         | 0.00             |
| Sub Total==>                             | 2,397,069               | 183,208                  | 0                      | 2,580,278        | 38.22                | 2,083,555             | 57.84            | 0                             | 0                         | 0.00             |
| Ceiling Load                             | 167,550                 | -167,550                 |                        | 0                | 0.00                 | 201,461               | 5.59             | -97,656                       | 0                         | 0.00             |
| Outside Air                              | 0                       | 0                        | 0                      | 2,222,663        | 32.92                | 0                     | 0.00             | 0                             | -1,801,151                | 63.94            |
| Sup. Fan Heat                            |                         |                          |                        | 370,000          | 5.48                 |                       | 0.00             |                               | 0                         | 0.00             |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| OV/UNDR Sizing                           | 544,082                 |                          |                        | 544,082          | 8.06                 | 544,082               | 15.10            | 0                             | 0                         | 0.00             |
| Exhaust Heat                             |                         | -85,804                  | 0                      | -85,804          | -1.27                |                       | 0.00             |                               | 50,011                    | -1.78            |
| Minimal Bypass                           |                         | 0                        | 0                      | 0                | 0.00                 |                       | 0.00             |                               | 0                         | 0.00             |
| Grand Total==>                           | 3,815,307               | 343,218                  | 0                      | 6,751,188        | 100.00               | 3,602,301             | 100.00           | -815,774                      | -2,816,967                | 100.00           |

| -----COOLING COIL SELECTION----- |       |           |            |                   |       |        |                  |       |        | -----AREAS----- |            |           |
|----------------------------------|-------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|-----------|
| Total Capacity                   |       | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)       |
| (Tons)                           | (Mbh) | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |            |           |
| Main Clg                         | 562.6 | 6,751.2   | 4,962.7    | 208,125           | 83.0  | 68.7   | 85.5             | 60.4  | 58.8   | 74.1            | 277,500    |           |
| Aux Clg                          | 0.0   | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |           |
| Opt Vent                         | 0.0   | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |           |
| Totals                           | 562.6 | 6,751.2   |            |                   |       |        |                  |       |        | Roof            | 92,500     | 0 0       |
|                                  |       |           |            |                   |       |        |                  |       |        | Wall            | 57,540     | 11,508 20 |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        | --TEMPERATURES (F)--- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------|--------|-----------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA               | 20.0   | Type                  | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     | 41,625  | 41,625  | Clg Cfm/Sqft           | 0.75   | SADB                  | 62.0 | 73.6 |
| Main Htg                         | -2,817.0 | 208,125    | 61.1  | 73.6  | Infil                    | 0       | 0       | Clg Cfm/Ton            | 369.93 | Plenum                | 79.9 | 68.9 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 208,125 | 208,125 | Clg Sqft/Ton           | 493.25 | Return                | 79.9 | 68.9 |
| Preheat                          | -0.0     | 208,125    | 61.1  | 60.4  | Mincfm                   | 0       | 0       | Clg Btuh/Sqft          | 24.33  | Ret/OA                | 83.0 | 61.1 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 208,125 | 208,125 | No. People             | 2,775  | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 41,625  | 41,625  | Htg % OA               | 20.0   | Fn MtrTD              | 0.4  | 0.0  |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 0       | 0       | Htg Cfm/Sqft           | 0.75   | Fn BldTD              | 0.3  | 0.0  |
| Total                            | -2,817.0 |            |       |       | Auxil                    | 0       | 0       | Htg Btuh/Sqft          | -10.15 | Fn Frict              | 0.9  | 0.0  |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC             | DEMAND          | WATER |
|-------|------------------|-----------------|-------|
|       | On Peak<br>(kWh) | On Peak<br>(kW) |       |
| Jan   | 247,328          | 610             | 160   |
| Feb   | 204,913          | 579             | 119   |
| March | 295,463          | 659             | 262   |
| April | 337,897          | 695             | 368   |
| May   | 389,877          | 735             | 506   |
| June  | 392,642          | 763             | 568   |
| July  | 420,851          | 802             | 664   |
| Aug   | 426,188          | 841             | 685   |
| Sept  | 397,514          | 814             | 586   |
| Oct   | 323,823          | 713             | 346   |
| Nov   | 289,579          | 672             | 256   |
| Dec   | 243,931          | 630             | 151   |
| Total | 3,970,007        | 841             | 4,672 |

Building Energy Consumption = 48,828 (Btu/Sq Ft/Year)  
Source Energy Consumption = 146,497 (Btu/Sq Ft/Year)

Floor Area = 277,500 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION -----

| Ref<br>Num | Equip<br>Code | ----- Monthly Consumption ----- |       |       |       |        |        |        |        |        |       |       |       | Total     |
|------------|---------------|---------------------------------|-------|-------|-------|--------|--------|--------|--------|--------|-------|-------|-------|-----------|
|            |               | Jan                             | Feb   | Mar   | Apr   | May    | June   | July   | Aug    | Sep    | Oct   | Nov   | Dec   |           |
| 0          | LIGHTS        |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 78171                           | 70606 | 78171 | 75649 | 78171  | 75649  | 78171  | 78171  | 75649  | 78171 | 75649 | 78171 | 920,399   |
|            | PK            | 205.6                           | 205.6 | 205.6 | 205.6 | 205.6  | 205.6  | 205.6  | 205.6  | 205.6  | 205.6 | 205.6 | 205.6 | 205.6     |
| 1          | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
| 2          | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | GAS           | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
| 3          | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | OIL           | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
| 4          | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | P STEAM       | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
|            | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | P HOTH2O      | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
| 6          | MISC LD       |                                 |       |       |       |        |        |        |        |        |       |       |       |           |
|            | P CHILL       | 0                               | 0     | 0     | 0     | 0      | 0      | 0      | 0      | 0      | 0     | 0     | 0     | 0         |
|            | PK            | 0.0                             | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0       |
| 1          | EQ1001L       | 2-STG CTV >555 TONS             |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 38537                           | 29747 | 59569 | 81695 | 114938 | 126572 | 145912 | 151249 | 131443 | 74377 | 58049 | 36863 | 1,048,951 |
|            | PK            | 139.6                           | 149.7 | 188.5 | 225.1 | 264.4  | 293.2  | 332.2  | 370.4  | 343.9  | 242.6 | 202.4 | 160.3 | 370.4     |
| 1          | EQ5100        | COOLING TOWER                   |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 11741                           | 276   | 25158 | 35709 | 40253  | 38955  | 40253  | 40253  | 38955  | 31867 | 27593 | 13440 | 344,454   |
|            | PK            | 54.1                            | 14.3  | 54.1  | 54.1  | 54.1   | 54.1   | 54.1   | 54.1   | 54.1   | 54.1  | 54.1  | 54.1  | 54.1      |
| 1          | EQ5100        | COOLING TOWER                   |       |       |       |        |        |        |        |        |       |       |       |           |
|            | WATER         | 160                             | 119   | 262   | 368   | 506    | 568    | 664    | 685    | 586    | 346   | 256   | 151   | 4,672     |
|            | PK            | 0.7                             | 0.8   | 1.0   | 1.2   | 1.3    | 1.5    | 1.6    | 1.8    | 1.7    | 1.3   | 1.1   | 0.8   | 1.8       |
| 1          | EQ5001        | CHILLED WATER PUMP C.V.         |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 30052                           | 25056 | 39299 | 49216 | 55480  | 53691  | 55480  | 55480  | 53691  | 43922 | 38031 | 27740 | 527,137   |
|            | PK            | 74.6                            | 74.6  | 74.6  | 74.6  | 74.6   | 74.6   | 74.6   | 74.6   | 74.6   | 74.6  | 74.6  | 74.6  | 74.6      |
| 1          | EQ5010        | CONDENSER WATER PUMP C.V.       |       |       |       |        |        |        |        |        |       |       |       |           |
|            | ELEC          | 14024                           | 11693 | 18339 | 22968 | 25891  | 25056  | 25891  | 25891  | 25056  | 20497 | 17748 | 12945 | 245,997   |
|            | PK            | 34.8                            | 34.8  | 34.8  | 34.8  | 34.8   | 34.8   | 34.8   | 34.8   | 34.8   | 34.8  | 34.8  | 34.8  | 34.8      |
|            | EQ5300        | CONTROL PANEL & INTERLOCK       |       |       |       |        |        |        |        |        |       |       |       |           |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|   |        |                      |       |       |       |       |       |       |       |       |       |       |       |         |
|---|--------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|   | ELEC   | 403                  | 336   | 527   | 660   | 744   | 720   | 744   | 744   | 720   | 589   | 510   | 372   | 7,069   |
|   | PK     | 1.0                  | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 | EQ4003 | FC CENTRIF. FAN C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 74400                | 67200 | 74400 | 72000 | 74400 | 72000 | 74400 | 74400 | 72000 | 74400 | 72000 | 74400 | 876,000 |
|   | PK     | 100.0                | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        840.5    (kW)  
Yearly Time of Peak 15 (hr)    8 (mo)

Hour 15    Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Percnt<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|
|----------------------|------------------------|-----------------------|---------------------------|-------------------------|

Cooling Equipment

|   |         |                     |       |       |
|---|---------|---------------------|-------|-------|
| 1 | EQ1001L | 2-STG CTV >555 TONS | 534.9 | 63.64 |
|---|---------|---------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 534.9 | 63.64 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |       |       |
|---|--|------------------------------------|-------|-------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 100.0 | 11.90 |
|---|--|------------------------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 100.0 | 11.90 |
|-----------|--|--|-------|-------|

|       |  |  |     |      |
|-------|--|--|-----|------|
| Total |  |  | 0.0 | 0.00 |
|-------|--|--|-----|------|

Miscellaneous

|        |       |       |
|--------|-------|-------|
| Lights | 205.6 | 24.46 |
|--------|-------|-------|

|                |     |      |
|----------------|-----|------|
| Base Utilities | 0.0 | 0.00 |
|----------------|-----|------|

|                |     |      |
|----------------|-----|------|
| Misc Equipment | 0.0 | 0.00 |
|----------------|-----|------|

|           |       |       |
|-----------|-------|-------|
| Sub Total | 205.6 | 24.46 |
|-----------|-------|-------|

|             |       |        |
|-------------|-------|--------|
| Grand Total | 840.5 | 100.00 |
|-------------|-------|--------|



AIRFLOW - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- S Y S T E M S U M M A R Y -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply | Room<br>Exhaust  |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|------------------|------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) | Airflow<br>(Cfm) | Airflow<br>(Cfm) |
| 1                | VTCV           | 41,625                      | 208,125                     | 208,125                     | 208,125                    | 41,625                      | 0                | 0                |
| Totals           |                | 41,625                      | 208,125                     | 208,125                     | 208,125                    | 41,625                      | 0                | 0                |

CAPACITY - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- S Y S T E M S U M M A R Y -----  
(Design Capacity Quantities)

| ----- Cooling ----- Heating ----- |        |           |           |           |         |            |           |          |          |          |           |            |
|-----------------------------------|--------|-----------|-----------|-----------|---------|------------|-----------|----------|----------|----------|-----------|------------|
|                                   |        | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys.  | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |
| System                            | System | Capacity  | Capacity  | Capacity  | Totals  | Capacity   | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |
| Number                            | Type   | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)     | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |
| 1                                 | VTCV   | 562.6     | 0.0       | 0.0       | 562.6   | -2,816,967 | 0         | 0        | 0        | 0        | 0         | -2,816,967 |
| Totals                            |        | 562.6     | 0.0       | 0.0       | 562.6   | -2,816,967 | 0         | 0        | 0        | 0        | 0         | -2,816,967 |

The building peaked at hour 14 month 8 with a capacity of 562.6 tons

ENGINEERING CHECKS - ALTERNATIVE 2  
ENERGY CONSERVATION SIMULATION

----- E N G I N E E R I N G C H E C K S -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 20.00                     | 0.75          | 369.9       | 493.2         | 24.33          | 0.75          | -10.15         | 277,500             |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

| ***** COOLING COIL PEAK *****            |                         |                          |                        |                  | ***** CLG SPACE PEAK ***** |                       |                  |                        |                           | ***** HEATING COIL PEAK ***** |  |  |  |  |
|------------------------------------------|-------------------------|--------------------------|------------------------|------------------|----------------------------|-----------------------|------------------|------------------------|---------------------------|-------------------------------|--|--|--|--|
| Peak at Time ==> Mo/Hr: 8/14             |                         |                          |                        |                  | Mo/Hr: 8/16                |                       |                  |                        |                           | Mo/Hr: 13/ 1                  |  |  |  |  |
| Outside Air ==> OADB/WB/HR: 96/ 79/126.0 |                         |                          |                        |                  | OADB: 96                   |                       |                  |                        |                           | OADB: 30                      |  |  |  |  |
| Envelope Loads                           | Space Sens.+Lat. (Btuh) | Ret. Air Sensible (Btuh) | Ret. Air Latent (Btuh) | Net Total (Btuh) | Perct Of Tot (%)           | Space Sensible (Btuh) | Perct Of Tot (%) | Space Peak Sens (Btuh) | Coil Peak Tot Sens (Btuh) | Perct Of Tot (%)              |  |  |  |  |
| Skylite Solr                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                      | 0                         | 0.00                          |  |  |  |  |
| Skylite Cond                             | 0                       | 0                        |                        | 0                | 0.00                       | 0                     | 0.00             | 0                      | 0                         | 0.00                          |  |  |  |  |
| Roof Cond                                | 0                       | 335,369                  |                        | 335,369          | 4.97                       | 0                     | 0.00             | 0                      | -251,809                  | 8.94                          |  |  |  |  |
| Glass Solar                              | 375,928                 | 0                        |                        | 375,928          | 5.57                       | 410,452               | 11.39            | 0                      | 0                         | 0.00                          |  |  |  |  |
| Glass Cond                               | 181,830                 | 0                        |                        | 181,830          | 2.69                       | 194,965               | 5.41             | -540,565               | -540,565                  | 19.19                         |  |  |  |  |
| Wall Cond                                | 148,848                 | 77,994                   |                        | 226,842          | 3.36                       | 167,787               | 4.66             | -177,552               | -273,453                  | 9.71                          |  |  |  |  |
| Partition                                | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                      | 0                         | 0.00                          |  |  |  |  |
| Exposed Floor                            | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                      | 0                         | 0.00                          |  |  |  |  |
| Infiltration                             | 0                       |                          |                        | 0                | 0.00                       | 0                     | 0.00             | 0                      | 0                         | 0.00                          |  |  |  |  |
| Sub Total==>                             | 706,606                 | 413,363                  |                        | 1,119,969        | 16.59                      | 773,203               | 21.46            | -718,117               | -1,065,827                | 37.84                         |  |  |  |  |
| Internal Loads                           |                         |                          |                        |                  |                            |                       |                  |                        |                           |                               |  |  |  |  |
| Lights                                   | 427,486                 | 183,208                  |                        | 610,695          | 9.05                       | 446,448               | 12.39            | 0                      | 0                         | 0.00                          |  |  |  |  |
| People                                   | 724,136                 |                          |                        | 724,136          | 10.73                      | 363,247               | 10.08            | 0                      | 0                         | 0.00                          |  |  |  |  |
| Misc                                     | 1,245,446               | 0                        | 0                      | 1,245,446        | 18.45                      | 1,273,860             | 35.36            | 0                      | 0                         | 0.00                          |  |  |  |  |
| Sub Total==>                             | 2,397,069               | 183,208                  | 0                      | 2,580,278        | 38.22                      | 2,083,555             | 57.84            | 0                      | 0                         | 0.00                          |  |  |  |  |
| Ceiling Load                             | 167,550                 | -167,550                 |                        | 0                | 0.00                       | 201,461               | 5.59             | -97,656                | 0                         | 0.00                          |  |  |  |  |
| Outside Air                              | 0                       | 0                        | 0                      | 2,222,663        | 32.92                      | 0                     | 0.00             | 0                      | -1,801,151                | 63.94                         |  |  |  |  |
| Sup. Fan Heat                            |                         |                          |                        | 370,000          | 5.48                       |                       | 0.00             |                        | 0                         | 0.00                          |  |  |  |  |
| Ret. Fan Heat                            |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                        | 0                         | 0.00                          |  |  |  |  |
| Duct Heat Pkup                           |                         | 0                        |                        | 0                | 0.00                       |                       | 0.00             |                        | 0                         | 0.00                          |  |  |  |  |
| OV/UNDR Sizing                           | 544,082                 |                          |                        | 544,082          | 8.06                       | 544,082               | 15.10            | 0                      | 0                         | 0.00                          |  |  |  |  |
| Exhaust Heat                             |                         | -85,804                  | 0                      | -85,804          | -1.27                      |                       | 0.00             |                        | 50,011                    | -1.78                         |  |  |  |  |
| Terminal Bypass                          |                         | 0                        | 0                      | 0                | 0.00                       |                       | 0.00             |                        | 0                         | 0.00                          |  |  |  |  |
| Grand Total==>                           | 3,815,307               | 343,218                  | 0                      | 6,751,188        | 100.00                     | 3,602,301             | 100.00           | -815,774               | -2,816,967                | 100.00                        |  |  |  |  |

| -----COOLING COIL SELECTION----- |                       |                 |                  |                   |       |        |                  |       |        | -----AREAS----- |            |        |
|----------------------------------|-----------------------|-----------------|------------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|--------|
|                                  | Total Capacity (Tons) | Sens Cap. (Mbh) | Coil Airfl (cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)    |
|                                  |                       |                 |                  | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           | 277,500    |        |
| Main Clg                         | 562.6                 | 6,751.2         | 4,962.7          | 208,125           | 83.0  | 68.7   | 85.5             | 60.4  | 58.8   | 74.1            | Part       | 0      |
| Aux Clg                          | 0.0                   | 0.0             | 0.0              | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | ExFlr      | 0      |
| Opt Vent                         | 0.0                   | 0.0             | 0.0              | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | Roof       | 92,500 |
| Totals                           | 562.6                 | 6,751.2         |                  |                   |       |        |                  |       |        |                 | Wall       | 57,540 |

| -----HEATING COIL SELECTION----- |                  |           |           |      | -----AIRFLOWS (cfm)----- |         |               | -----ENGINEERING CHECKS----- |          |      | -----TEMPERATURES (F)----- |  |  |
|----------------------------------|------------------|-----------|-----------|------|--------------------------|---------|---------------|------------------------------|----------|------|----------------------------|--|--|
| Capacity (Mbh)                   | Coil Airfl (cfm) | Ent Deg F | Lvg Deg F | Type | Cooling                  | Heating | Clg % OA      | 20.0                         | Type     | Clg  | Htg                        |  |  |
|                                  |                  |           |           | Vent | 41,625                   | 41,625  | Clg Cfm/Sqft  | 0.75                         | SADB     | 62.0 | 73.6                       |  |  |
| Main Htg                         | -2,817.0         | 208,125   | 61.1      | 73.6 | Infil                    | 0       | Clg Cfm/Ton   | 369.93                       | Plenum   | 79.9 | 68.9                       |  |  |
| Aux Htg                          | 0.0              | 0         | 0.0       | 0.0  | Supply                   | 208,125 | Clg Sqft/Ton  | 493.25                       | Return   | 79.9 | 68.9                       |  |  |
| Preheat                          | -0.0             | 208,125   | 61.1      | 60.4 | Mincfm                   | 0       | Clg Btuh/Sqft | 24.33                        | Ret/OA   | 83.0 | 61.1                       |  |  |
| Reheat                           | 0.0              | 0         | 0.0       | 0.0  | Return                   | 208,125 | No. People    | 2,775                        | Runarnd  | 78.0 | 70.0                       |  |  |
| Humidif                          | 0.0              | 0         | 0.0       | 0.0  | Exhaust                  | 41,625  | Htg % OA      | 20.0                         | Fn MtrTD | 0.4  | 0.0                        |  |  |
| Opt Vent                         | 0.0              | 0         | 0.0       | 0.0  | Rm Exh                   | 0       | Htg Cfm/Sqft  | 0.75                         | Fn BldTD | 0.3  | 0.0                        |  |  |
| Total                            | -2,817.0         |           |           |      | Auxil                    | 0       | Htg Btuh/Sqft | -10.15                       | Fn Frict | 0.9  | 0.0                        |  |  |

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TRACE 600 ANALYSIS \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FMD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)  
  
Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20  
  
Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)  
  
Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)  
  
Time/Date Program was Run: 10: 5:53 4/18/94  
Dataset Name: 2265 .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC             | DEMAND          | WATER |
|-------|------------------|-----------------|-------|
|       | On Peak<br>(kWh) | On Peak<br>(kW) |       |
| Jan   | 231,797          | 553             | 147   |
| Feb   | 193,587          | 521             | 109   |
| March | 270,928          | 583             | 241   |
| April | 304,160          | 606             | 340   |
| May   | 343,169          | 630             | 467   |
| June  | 341,607          | 648             | 524   |
| July  | 362,364          | 672             | 613   |
| Aug   | 365,673          | 696             | 633   |
| Sept  | 344,629          | 679             | 541   |
| Oct   | 293,154          | 616             | 321   |
| Nov   | 265,440          | 591             | 236   |
| Dec   | 228,903          | 565             | 138   |
| Total | 3,545,412        | 696             | 4,309 |

Building Energy Consumption = 43,605 (Btu/Sq Ft/Year)  
Source Energy Consumption = 130,829 (Btu/Sq Ft/Year)

Floor Area = 277,500 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

----- EQUIPMENT ENERGY CONSUMPTION -----

| Ref<br>Num | Equip<br>Code             | Monthly Consumption       |       |       |       |       |       |       |       |       |       |       |       | Total   |
|------------|---------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|            |                           | Jan                       | Feb   | Mar   | Apr   | May   | June  | July  | Aug   | Sep   | Oct   | Nov   | Dec   |         |
| 0          | LIGHTS                    |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 78171                     | 70606 | 78171 | 75649 | 78171 | 75649 | 78171 | 78171 | 75649 | 78171 | 75649 | 78171 | 920,399 |
|            | PK                        | 205.6                     | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6 | 205.6   |
| 1          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 2          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | GAS                       | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 3          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | OIL                       | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 4          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P STEAM                   | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 5          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P HOTH2O                  | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 6          | MISC LD                   |                           |       |       |       |       |       |       |       |       |       |       |       |         |
|            | P CHILL                   | 0                         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0       |
|            | PK                        | 0.0                       | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| 1          | EQ1001L                   | 2-STG CTV >555 TONS       |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 23892                     | 18442 | 36932 | 50652 | 71267 | 78476 | 90462 | 93771 | 81498 | 46112 | 35992 | 22854 | 650,352 |
|            | PK                        | 86.6                      | 92.8  | 116.9 | 139.6 | 163.9 | 181.8 | 206.0 | 229.7 | 213.2 | 150.4 | 125.5 | 99.4  | 229.7   |
| 1          | EQ5100                    | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 10855                     | 254   | 23260 | 33014 | 37216 | 36016 | 37216 | 37216 | 36016 | 29463 | 25511 | 12421 | 318,458 |
|            | PK                        | 50.0                      | 13.4  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0  | 50.0    |
| 1          | EQ5100                    | COOLING TOWER             |       |       |       |       |       |       |       |       |       |       |       |         |
|            | WATER                     | 147                       | 109   | 241   | 340   | 467   | 524   | 613   | 633   | 541   | 321   | 236   | 138   | 4,309   |
|            | PK                        | 0.6                       | 0.7   | 1.0   | 1.1   | 1.2   | 1.4   | 1.5   | 1.7   | 1.6   | 1.2   | 1.0   | 0.8   | 1.7     |
| 1          | EQ5001                    | CHILLED WATER PUMP C.V.   |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 30052                     | 25056 | 39299 | 49216 | 55480 | 53691 | 55480 | 55480 | 53691 | 43922 | 38031 | 27740 | 527,137 |
|            | PK                        | 74.6                      | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6  | 74.6    |
| 1          | EQ5010                    | CONDENSER WATER PUMP C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|            | ELEC                      | 14024                     | 11693 | 18339 | 22968 | 25891 | 25056 | 25891 | 25891 | 25056 | 20497 | 17748 | 12945 | 245,997 |
|            | PK                        | 34.8                      | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8  | 34.8    |
| EQ5300     | CONTROL PANEL & INTERLOCK |                           |       |       |       |       |       |       |       |       |       |       |       |         |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|   |        |                      |       |       |       |       |       |       |       |       |       |       |       |         |
|---|--------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|   | ELEC   | 403                  | 336   | 527   | 660   | 744   | 720   | 744   | 744   | 720   | 589   | 510   | 372   | 7,069   |
|   | PK     | 1.0                  | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0   | 1.0     |
| 1 | EQ4003 | FC CENTRIF. FAN C.V. |       |       |       |       |       |       |       |       |       |       |       |         |
|   | ELEC   | 74400                | 67200 | 74400 | 72000 | 74400 | 72000 | 74400 | 74400 | 72000 | 74400 | 72000 | 74400 | 876,000 |
|   | PK     | 100.0                | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value        695.7    (kW)  
Yearly Time of Peak   15 (hr)    8 (mo)

Hour 15    Month    8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description              | Utility<br>Demand<br>(kW) | Percnt<br>Of Tot<br>(%) |
|----------------------|------------------------|------------------------------------|---------------------------|-------------------------|
| Cooling Equipment    |                        |                                    |                           |                         |
| 1                    | EQ1001L                | 2-STG CTV >555 TONS                | 390.1                     | 56.07                   |
| Sub Total            |                        |                                    | 390.1                     | 56.07                   |
| Sub Total            |                        |                                    | 0.0                       | 0.00                    |
| Air Moving Equipment |                        |                                    |                           |                         |
| 1                    |                        | SUMMATION OF FAN ELECTRICAL DEMAND | 100.0                     | 14.37                   |
| Sub Total            |                        |                                    | 100.0                     | 14.37                   |
| Total                |                        |                                    | 0.0                       | 0.00                    |
| Miscellaneous        |                        |                                    |                           |                         |
|                      | Lights                 |                                    | 205.6                     | 29.56                   |
|                      | Base Utilities         |                                    | 0.0                       | 0.00                    |
|                      | Misc Equipment         |                                    | 0.0                       | 0.00                    |
| Sub Total            |                        |                                    | 205.6                     | 29.56                   |
| Grand Total          |                        |                                    | 695.7                     | 100.00                  |

[illegible]



BUILDING 2265 - CHILLER INFORMATION

Chrysler Airtemp Chiller

Model # C2MN 779-2

S/N 4C104272

4160V/3 $\phi$ /515 KW

Capacity: 657 tons

Efficiency = .784 KW/ton (new)

Derate Efficiency .05%/yr

Existing Efficiency = .871 KW/ton

TRANE FT. WORTH --- CARTER BURGESS 001/013

---

# Texas Trane - Fort Worth Facsimile Cover Sheet

**To:** Scott Clark  
**Company:** Carter & Burgess  
**Phone:** 817-735-6038  
**Fax:** 817-735-6064

**From:** Arthur Murnan  
**Company:** Texas Trane  
**Phone:** 817-838-1301  
**Fax:** 817-831-8135

**Date:** October 11, 1993  
**Pages including this  
cover page:** 13

**Comments:**

Here is the information you requested. The Trane Centravac will  
cost about \$235,000.

*\$217,500.00 F&L 657 TON.*

PROJECT : HOSPITAL CHILLER REPLACEMENT  
LOCATION : FORT SAM HOUSTON - SAN ANTONIO  
BLDG. OWNER : U.S. ARMY  
PROGRAM USER : MURNAN  
COMMENTS : SCOTT CLARK - CARTER & BURGESS  
MACHINE : CVHF

TECU 28

TECU 28

\*\*\*\*\* INPUT CONDITIONS \*\*\*\*\*

|                        |         |                        |       |
|------------------------|---------|------------------------|-------|
| DESIGN DUTY            | 710-657 |                        |       |
| EXITING EVAP TEMP      | 44      | ENTERING COND TEMP     | 85    |
| EVAP FLOW RATE         | 2260    | COND FLOW RATE         | 2830  |
| EVAPORATOR PASSES      | 2       | CONDENSER PASSES       | 2     |
| MAX EVAP PRESSURE DROP | 33      | MAX COND PRESSURE DROP | 24    |
| FLUID TYPE             | WATER   | FLUID TYPE             | WATER |
| FLUID %                | 0       | FLUID %                | 0     |
| VOLTAGE                | 4160    |                        |       |
| FREQUENCY              | 60      |                        |       |
| REFRIGERANT            | 123     |                        |       |

\*\*\*\*\* OUTPUT DATA \*\*\*\*\*  
NOTE - PERFORMANCE CERTIFIED IN ACCORDANCE WITH ARI STANDARD 550-92  
NOTE - EXTENDED SHELL SELECTION.

|                       |      |         |       |       |       |
|-----------------------|------|---------|-------|-------|-------|
| %LOAD                 |      | 100%    | 75%   | 50%   | 25%   |
| DESIGN DUTY           | TONS | 710-657 | 533   | 355   | 178   |
| POWER CONSUMED        | KW   | 383     | 256   | 171   | 100   |
| KW PER DESIGN DUTY    |      | 0.539   | 0.481 | 0.482 | 0.563 |
| APLV                  |      | 0.498   |       |       |       |
| EXIT EVAP TEMP        | F    | 44.00   | 44.00 | 44.00 | 44.00 |
| EVAP FLOW RATE        | GPM  | 2260.0  |       |       |       |
| ENTERING EVAP TEMP    | F    | 51.54   |       |       |       |
| EVAP PD (NON-MAR)     | FEET | 29.67   |       |       |       |
| EVAP PD (MARINE)      | FEET | 30.33   |       |       |       |
| EVAP FOULING FACTOR   |      | 0.00025 |       |       |       |
| FLUID TYPE AND %      |      | WATER 0 |       |       |       |
| ENTERING COND TEMP    | F    | 85.00   | 78.75 | 72.50 | 66.25 |
| COND FLOW RATE        | GPM  | 2830.0  |       |       |       |
| EXIT COND TEMP        | F    | 91.97   |       |       |       |
| COND PD (NON-MAR)     | FEET | 20.60   |       |       |       |
| COND PD (MARINE)      | FEET | 21.64   |       |       |       |
| COND FOULING FACTOR   |      | 0.00025 |       |       |       |
| FLUID TYPE AND %      |      | WATER 0 |       |       |       |
| MAX LRA AT MOTOR KW   | AMPS | 405     |       |       |       |
| RLA AT MOTOR KW       | AMPS | 62      |       |       |       |
| RLA AT SELECTION KW   | AMPS | 59      |       |       |       |
| REFRIGERANT CHARGE    | LBS  | 1600    |       |       |       |
| SHIP WT. (W/NMAR WB.) | LBS  | 30721   |       |       |       |
| OPER WT. (W/NMAR WB.) | LBS  | 35397   |       |       |       |

|           |          |           |           |           |          |          |
|-----------|----------|-----------|-----------|-----------|----------|----------|
| mod1-CVHF | nton-650 | volt-4160 | hrtz-60   | type-SNGL | cpkw-403 | cpim-275 |
| evtm-TECU | evth-28  | evsz-142M | evbs-980  | evwp-2    | orsz-880 | refg-123 |
| cdtm-TECU | cdth-28  | cdsz-142S | cdbS-1220 | cdwp-2    | cdty-STD |          |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2265 - ECO IV. D. 1) - REPLACE CHILLER W/ HIGHER EFF/CFC FREE CHILLER  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |           |           |
|----------------------------------------|-----------|-----------|
| A. CONSTRUCTION COST                   | \$536,040 |           |
| B. SIOH                                | \$29,482  |           |
| C. DESIGN COST                         | \$32,162  |           |
| D. TOTAL COST (1A+1B+1C)               | \$597,685 |           |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0       |           |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0       |           |
| G. TOTAL INVESTMENT (1D-1E-1F)         |           | \$597,685 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 1449.1             | \$15,288             | 14.65              | \$223,969             |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 20.60              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$11,600             | 13.59              | \$157,644             |
| N. TOTAL          |                 | 1449.1             | \$26,888             |                    | \$381,613             |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) \$0  
 1. DISCOUNT FACTOR (TABLE A) \_\_\_\_\_  
 2. DISCOUNTED SAVINGS/COST (3A X 3A1) \_\_\_\_\_ \$0

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM       | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|------------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A     | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A     | \$0                   | 2                 | 0.92               | \$0                              |
| c. Chiller | \$338,516             | 3                 | 0.89               | \$301,279                        |
| d. N/A     | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A     | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A     | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A     | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A     | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A     | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A     | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A     | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A     | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A     | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A     | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A     | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL   | \$338,516             |                   |                    | \$301,279                        |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$301,279

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 13.6 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$682,893

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 1.14

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 4.7%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2265

ECO NO: VII C, D & IX B, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>49,856.4</u> | KWH/yr |
| Demand Savings:                        | <u>46.7</u>     | KW/yr  |
| Gas Savings:                           | <u>n/a</u>      | MCF/yr |
| Cost Savings:                          | <u>\$ 2,349</u> | /yr    |
| Implementation Cost:                   | <u>\$ 2,723</u> |        |
| Simple Payback:                        | <u>1.2</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>9.77</u>     |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE      | ACTION                                                                                             |
|-----|-------------------|----------------------------------------------------------------------------------------------------|
| 2   | 2-Lamp, 2' Fluor. | Retrofit w/T8 lamps and electronic ballasts.                                                       |
| 58  | 2-Lamp, 4' Fluor. | Remove 16 fixtures along window area and retrofit remaining with T8 lamps and electronic ballasts. |
| 12  | 4-Lamp, 4' Fluor. | Retrofit w/T8 lamps and electronic ballasts.                                                       |
| 4   | Incand. Exit      | Replace /LED exit fixtures.                                                                        |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (8.065 \text{ KW} - 4.171 \text{ KW})(4 \text{ mo.} \times \$17.50/\text{KW} + 8 \text{ mo.} \times \$6.25/\text{KW}) \\ &= \$311.52/\text{yr}\end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy<br>kWh | Net Present Value<br>\$ | Present Value<br>Total LCC \$ | Annual Value<br>Total LCC \$ | Annual Energy Savings<br>kWh | Savings Invest.<br>Ratio (SIR) | Levelized Energy Cost<br>cents/kWh | Total Initial Cost<br>\$ | Present Value<br>Maint LCC \$ | Present Value<br>Energy LCC \$ | Annual Value<br>Maint LCC \$ | Annual Value<br>Energy LCC \$ |
|-------------------------|----------------------|-------------------------|-------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------------|--------------------------|-------------------------------|--------------------------------|------------------------------|-------------------------------|
| BLD2265A                | 2354                 | 49738                   | 57821                         | 4255                         | 20874                        | 20.372                         | -0.298                             | 2442                     | 3020                          | 52360                          | 222                          | 3853                          |
| *BLD2265B               | 43228                | 0                       | 107560                        | 7914                         | 0                            | 0.000                          | 0.000                              | 0                        | 6307                          | 101253                         | 464                          | 7450                          |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description         |
|------------|--------------------------|
| BLD2265A   | POST RETROFIT CONDITIONS |
| BLD2265B   | EXISTING CONDITIONS      |



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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265A.WBR  
 Date: 10/17/1993

Lighting Annual : 22354 kWh  
 Lighting Capacity : 4.171 kW  
 Annual Cooling Effect : 31039 kWh  
 Annual Heating Effect : 3193 kWh  
 Total Surveyed Floor Area: 5320 SqFt  
 Percent Survey Completed : 532000 %  
 Lighting Power Density : 0.784 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total |
|----------|---------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2442    | 22107  | 3020   | 30801   | -548    | 57821 |
| AVLCC \$ | 180     | 1627   | 222    | 2266    | -40     | 4255  |

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| Lighting Level Comparison Report |

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265A.LLR  
 Date: 10/17/1993

| Room         |      |       |      |       |             |            |
|--------------|------|-------|------|-------|-------------|------------|
| Foot Candles | MAX  | MIN   | AVG  | SDEV  | MAX Room    | MIN Room   |
| Calculated   | 63.8 | 7.4   | 34.0 | 24.78 | 5-scullyery | 4-dry stor |
| Measured     | 23.4 | 4.8   | 15.8 | 7.74  | 1-dining    | 3-stor     |
| Required     | 50.0 | 5.0   | 25.0 | 23.18 | 2-kitchen   | 1-dining   |
| Foot Candle  |      |       |      |       |             |            |
| Comparison   | MAX  | MIN   | AVG  | SDEV  | MAX Room    | MIN Room   |
| Calc - Req.  | 25.1 | -7.6  | 9.0  | 12.00 | 1-dining    | 4-dry stor |
| Meas - Req.  | 18.4 | -34.3 | -9.2 | 21.46 | 1-dining    | 2-kitchen  |

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Lighting System Survey Summary

One Page for Each Defined System

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Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265A.LSR  
 Date: 10/17/1993

System Number: 1      Descrip: 2 lamp, 2x2 lay-in w/crylic lens

=====

Rooms Served: 1  
 Floor Area: 3200 SqFt  
 Possible kW: 0.141  
 Working kW: 0.141  
 Capacity kW: 0.141  
 Lighting: 756 Annual kWh  
 Heating: 108 Annual kWh  
 Cooling: 1049 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 42.0 Months  
 Power Density: 0.044 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 747    | 121    | 1041    | -19     | 1975  |
| AVLCC \$ | 55     | 9      | 77      | -1      | 145   |

System Number: 2      Descrip: 2x4 fluor. w/acrylic lens

=====

Rooms Served: 1  
 Floor Area: 3200 SqFt  
 Possible kW: 1.392  
 Working kW: 1.392  
 Capacity kW: 1.392  
 Lighting: 7461 Annual kWh  
 Heating: 1066 Annual kWh  
 Cooling: 10360 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 70.0 Months  
 Power Density: 0.435 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 12       | 48    | 12.0     |
| Working       | 12       | 48    | 12.0     |
| Capacity      | 12       | 48    | 12.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 7379   | 853    | 10280   | -183    | 18965 |
| AVLCC \$ | 543    | 63     | 756     | -13     | 1395  |

System Number: 3      Descrip: 1x4 recess fluor.w/acrylic

Rooms Served: 3  
 Floor Area: 4588 SqFt  
 Possible kW: 2.386  
 Working kW: 2.386  
 Capacity kW: 2.386  
 Lighting: 12791 Annual kWh  
 Heating: 1827 Annual kWh  
 Cooling: 17760 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 70.0 Months  
 Power Density: 0.520 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 38       | 76    | 38.0     |
| Working       | 38       | 76    | 38.0     |
| Capacity      | 38       | 76    | 38.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 12650  | 1850   | 17624   | -314    | 33369 |
| AVLCC \$ | 931    | 136    | 1297    | -23     | 2455  |

System Number: 4      Descrip: fluor. wrap

Rooms Served: 2  
 Floor Area: 732 SqFt  
 Possible kW: 0.251  
 Working kW: 0.251  
 Capacity kW: 0.251  
 Lighting: 1346 Annual kWh  
 Heating: 192 Annual kWh  
 Cooling: 1869 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 70.0 Months  
 Power Density: 0.343 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 8     | 4.0      |
| Working       | 4        | 8     | 4.0      |
| Capacity      | 4        | 8     | 4.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1332   | 195    | 1855    | -33     | 3513  |
| AVLCC \$ | 98     | 14     | 137     | -2      | 258   |

Room-By-Room Summary Report

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265A.RRR  
 Date: 10/17/1993

| Room Name  | Floor | # | Total # | Area | Pr  | SYSTEM1 Name | Work Watts | Pot. Watts | Watt sqft | SYSTEM2 Name | Work Watts | Pot. Watts | Watt sqft | SYSTEM3 Name | Work Watts | Pot. Watts | Watt sqft | Watt Meas. FootC | Calc. Req. FootC |
|------------|-------|---|---------|------|-----|--------------|------------|------------|-----------|--------------|------------|------------|-----------|--------------|------------|------------|-----------|------------------|------------------|
| 1-dining   | 1     | 1 | *       | 3200 | 100 | 2x4 fluor.   | 1392       | 1392       | 0.44      | 1x4 recess   | 942        | 942        | 0.29      | 2 lamp, 2x   | 141        | 141        | 0.04      | 2475             | 30.1             |
| 2-kitchen  | 1     | 1 |         | 812  | 6   | 1x4 recess   | 754        | 754        | 0.93      |              |            |            |           |              |            |            |           | 754              | 50.0             |
| 3-stor     | 1     | 1 |         | 84   | 0   | fluor. wra   | 63         | 63         | 0.75      |              |            |            |           |              |            |            |           | 63               | 5.0              |
| 4-dry stor | 1     | 1 |         | 648  | 1   | fluor. wra   | 188        | 188        | 0.29      |              |            |            |           |              |            |            |           | 188              | 15.0             |
| 5-sculley  | 1     | 1 |         | 576  | 2   | 1x4 recess   | 691        | 691        | 1.20      |              |            |            |           |              |            |            |           | 691              | 50.0             |

Total Rooms : 5  
 Total Area Sqft : 5320  
 Total People : 109  
 Total Working kW : 4.171  
 Total Potential kW : 4.171  
 Power Density W/sqft : 0.784

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| Whole Building Summary Report |

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265B.WBR  
 Date: 10/16/1993

Lighting Annual : 43228 kWh  
 Lighting Capacity : 8.065 kW  
 Annual Cooling Effect : 60022 kWh  
 Annual Heating Effect : 6175 kWh  
 Total Surveyed Floor Area: 5320 SqFt  
 Percent Survey Completed : 532000 %  
 Lighting Power Density : 1.516 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| -----    | -----   | -----  | -----  | -----   | -----   | -----  |
| PVLCC \$ | 0       | 42751  | 6307   | 59562   | -1060   | 107560 |
| AVLCC \$ | 0       | 3146   | 464    | 4383    | -78     | 7914   |

Lighting System Survey Summary  
One Page for Each Defined System

Project: FT SAM HOUSTON EEAP  
File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2265\BLD2265B.LSR  
Date: 10/16/1993

System Number: 1      Descrip: 2 lamp, 2x2 lay-in w/crylic lens

Rooms Served: 1  
Floor Area: 3200 SqFt  
Possible kW: 0.193  
Working kW: 0.193  
Capacity kW: 0.193  
Lighting: 1034 Annual kWh  
Heating: 148 Annual kWh  
Cooling: 1436 Annual kWh  
Op Hours/Year: 5360 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 42.0 Months  
Power Density: 0.060 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 4     | 2.0      |
| Working       | 2        | 4     | 2.0      |
| Capacity      | 2        | 4     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1023   | 220    | 1425    | -25     | 2643  |
| AVLCC \$ | 75     | 16     | 105     | -2      | 194   |

System Number: 3      Descrip: 2x4 fluor. w/acrylic lens

Rooms Served: 1  
Floor Area: 3200 SqFt  
Possible kW: 2.304  
Working kW: 2.160  
Capacity kW: 2.304  
Lighting: 12349 Annual kWh  
Heating: 1764 Annual kWh  
Cooling: 17147 Annual kWh  
Op Hours/Year: 5360 Annual Hrs  
Relamp Method: Spot  
Relamp Time : 70.0 Months  
Power Density: 0.675 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 12       | 48    | 12.0     |
| Working       | 12       | 45    | 11.0     |
| Capacity      | 12       | 48    | 12.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 3     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 12213  | 1562   | 17016   | -303    | 30488 |
| AVLCC \$ | 899    | 115    | 1252    | -22     | 2243  |

System Number: 4      Descrip: 1x4 recess fluor.w/acrylic

Rooms Served: 3  
 Floor Area: 4588 SqFt  
 Possible kW: 5.184  
 Working kW: 4.992  
 Capacity kW: 5.184  
 Lighting: 27786 Annual kWh  
 Heating: 3969 Annual kWh  
 Cooling: 38581 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 70.0 Months  
 Power Density: 1.088 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 54       | 108   | 54.0     |
| Working       | 54       | 104   | 51.0     |
| Capacity      | 54       | 108   | 54.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 4     | 1.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 27479  | 4213   | 38285   | -681    | 69296 |
| AVLCC \$ | 2022   | 310    | 2817    | -50     | 5099  |

System Number: 6      Descrip: fluor. wrap

Rooms Served: 2  
 Floor Area: 732 SqFt  
 Possible kW: 0.384  
 Working kW: 0.384  
 Capacity kW: 0.384  
 Lighting: 2058 Annual kWh  
 Heating: 294 Annual kWh  
 Cooling: 2858 Annual kWh  
 Op Hours/Year: 5360 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 70.0 Months  
 Power Density: 0.525 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 4        | 8     | 4.0      |
| Working       | 4        | 8     | 4.0      |
| Capacity      | 4        | 8     | 4.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2035   | 312    | 2836    | -50     | 5133  |
| AVLCC \$ | 150    | 23     | 209     | -4      | 378   |



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2265 - ECO VII C., D. & IX A., B., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |         |
|----------------------------------------|---------|---------|
| A. CONSTRUCTION COST                   | \$2,442 |         |
| B. SIOH                                | \$134   |         |
| C. DESIGN COST                         | \$147   |         |
| D. TOTAL COST (1A+1B+1C)               | \$2,723 |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0     |         |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0     |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         | \$2,723 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 71.24              | \$752                | 11.77              | \$8,846               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 98.92              | \$1,044              | 11.12              | \$11,605              |
| M. DEMAND SAVINGS |                 |                    | \$312                | 11.12              | \$3,469               |
| N. TOTAL          |                 | 170.16             | \$2,107              |                    | \$23,920              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |         |
|---------------------------------------|-------|---------|
| A. ANNUAL RECURRING (+/-)             | \$242 |         |
| 1. DISCOUNT FACTOR (TABLE A)          |       | 11.1    |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       | \$2,686 |

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+)COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|---------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                             |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                             |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                             |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                             |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                             |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                             |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                             |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                             |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                             |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                             |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                             |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                             |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                             |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                             |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                             |
| p. TOTAL | \$0                   |                   |                    | \$0                             |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$2,686

4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ : 1.2 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$26,607

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 9.77

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 21.1%

## ENERGY CONSERVATION ANALYSIS

### BUILDING 2399 - HOSPITAL MESS HALL

Building 2399 is a single story stucco building consisting of a total area of 26,000 square feet. This facility contains a full service kitchen and a large dining area which consists of 14,700 square feet.

The operating hours are from 5:00 am to 8:00 pm, seven days per week.

The lighting system is primarily fluorescent.

The mechanical system consists of fan coil units above the ceiling served by the central hospital water cooled chillers. Heating is provided by three central gas fired, steam boilers.

Hot water is provided to the kitchen by a steam to hot water heat exchanger and a 300 gallon storage tank. Dishwashing is accomplished using an automatic dishwasher with an electric hot water booster heater.

The following ECO's are recommended for Building 2399:

1. IV. A. - Night setback/setup thermostat
2. IV. D.1) - Replace chiller with higher EFF/CFC free chiller
3. IV. F. - Install make-up air supply for kitchen areas
4. VII. D. - Reduce indoor/outdoor lighting to AEI levels
5. IX. A. - Replace incandescent lamps with compact fluorescents
6. IX. B. - Replace incandescent exit fixtures with LED
7. IX. C. - Replace standard lamps with energy saving lamps
8. IX. D. - Replace standard ballast with energy saving ballast

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2399

ECO NO: IV. A.

ECO NAME: Night setback/setup thermostat.

#### SUMMARY DATA (DEPENDENT):

|                                        |               |        |
|----------------------------------------|---------------|--------|
| KWH Savings:                           | <u>7,528</u>  | KWH/yr |
| Demand Savings:                        | <u>0</u>      | KW/yr  |
| Gas Savings:                           | <u>89.1</u>   | MCF/yr |
| Cost Savings:                          | <u>\$ 575</u> | /yr    |
| Implementation Cost:                   | <u>\$ 363</u> |        |
| Simple Payback:                        | <u>.6</u>     | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>21.61</u>  |        |

#### ECO DESCRIPTION:

Currently, manual thermostats are used to control the existing fan coil units that serve the dining and office areas. Each fan coil unit is controlled by a separate thermostat. This ECO analyzes the installation of a programmable night setback/setup thermostats to reduce energy consumption during unoccupied periods.

#### COST SAVINGS CALCULATIONS:

(Refer to following SimpCalc)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### MAINTENANCE COSTS:

Maintenance costs of \$5.00/year is included in the LCCA for programming, battery replacement and failures.

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

TEXAS LoanSTAR Program - ECRM Simplified Calculation Ver 2.0

11/08/93

SimpCalc 2.0 SUMMARY (by FORM) - FORT SAM HOUSTON

Page 1

| Form              | Facility                  | ECRM Desc.      | Page | KWH/Yr | KW  | MCF/yr | mmBtu/Yr | \$/Yr | Imp.Cost | PayBack |
|-------------------|---------------------------|-----------------|------|--------|-----|--------|----------|-------|----------|---------|
| C7-01             | BLDG 2399 HOSPITAL DINING | Prog Thermostat | 1    | 7528   | .00 | 89.1   | 117.5    | 575   | 363      | .6      |
| *** SUB-TOTAL *** |                           |                 |      | 7528   | .00 | 89.1   | 117.5    | 575   | 363      | .6      |
| ** GRAND TOTAL ** |                           |                 |      | 7528   | .00 | 89.1   | 117.5    | 575   | 363      | .6      |

11/08/93

Consolidated ECRM Detail - FORT SAM HOUSTON

Page 1

C7-001 Programmable Thermostats - BLDG 2399 HOSPITAL DINING

(G)

Cost Source: means cost data

Description: Install night setback/setup thermostats.

A) .15 BTU/hr-ft-F U-Value of Walls  
 B) 9072 Sq.Ft. Wall Area (includes windows and doors)  
 C) .07 BTU/hr-ft-F U-Value of Roof  
 D) 25922 Sq.Ft. Roof Area  
 E) 70 Degree/F Heating Season Thermostat Setpoint  
 F) 55 Degree/F Heating Season Thermostat Setback Setpoint  
 G) 1350 Hours/yr Heating Season Setback Hours  
     = 9 Hrs/day x 150 Days/yr  
 H) 74 Degree/F Cooling Season Thermostat Setpoint  
 I) 90 Degree/F Cooling Season Thermostat Setback Setpoint  
 J) 1800 Hours/yr Cooling Season Setback Hours  
     = 9 Hrs/day x 200 Days/yr  
 K) .7000 Heating Equipment Efficiency (Table 2)  
 L) \$ 3.41 /MCF Cost per MCF  
 M) 12.12 BTUH/Watt EER of Air Conditioning Unit (Table 1)  
 N) \$ .0360 /KWH Cost per KWH - Summer  
 O) \$ 363 Installed Cost = 3 Thermostats x \$ 121/stat  
  
 P) 3175 BTU/hf-F Total Envelope UA-Value  
 Q) 64.3 mmBTU/yr Heating Load Reduction  
 R) \$ 304 Heating Cost Reduction  
 S) 91.4 mmBTU/yr Cooling Load Reduction  
 T) \$ 271 /year Cooling Cost Reduction  
 U) \$ 575 /year Annual Cost Savings  
 V) .6 years Simple Payback

|                                      |                       |
|--------------------------------------|-----------------------|
| PROJECT NAME: FORT SAM HOUSTON EEAP  | PROJECT NO: 91109912F |
| PROJECT LOCATION: SAN ANTONIO, TEXAS | ESTIMATOR: S.P. CLARK |
| SUBMITTAL: 35.0%                     | DATE: 26-Oct-93       |
| ECO NO/ BUILDING: IV. A. / BLDG 2399 | CHECKED BY: DJY       |

**26-Oct-93**



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2399 - ECO IV. A. - NIGHT SETBACK/SETUP THERMOSTAT  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |       |       |
|----------------------------------------|-------|-------|
| A. CONSTRUCTION COST                   | \$326 |       |
| B. SIOH                                | \$18  |       |
| C. DESIGN COST                         | \$20  |       |
| D. TOTAL COST (1A+1B+1C)               | \$363 |       |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0   |       |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0   |       |
| G. TOTAL INVESTMENT (1D-1E-1F)         |       | \$363 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: 'NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 25.69              | \$271                | 11.77              | \$3,190               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 91.86              | \$304                | 15.34              | \$4,664               |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 11.12              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$0                  | 11.12              | \$0                   |
| N. TOTAL          |                 | 117.55             | \$575                |                    | \$7,854               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |        |         |
|---------------------------------------|--------|---------|
| A. ANNUAL RECURRING (+/-)             | (\$15) |         |
| 1. DISCOUNT FACTOR (TABLE A)          |        | 11.1    |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |        | (\$167) |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** (\$167)

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 0.6 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$7,688

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 21.15

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 27.5%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's)- BUILDING 2399

ECO NO: IV.D.1)

ECO NAME: Replace chiller with higher efficiency, CFC free chiller.

#### SUMMARY DATA (DEPENDENT):

|                                        |                   |        |
|----------------------------------------|-------------------|--------|
| KWH Savings:                           | <u>926.098</u>    | KWH/yr |
| Demand Savings:                        | <u>3.192</u>      | KW/yr  |
| Gas Savings:                           | <u>n/a</u>        | MCF/yr |
| Cost Savings:                          | <u>\$ 54,626</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 365,824</u> |        |
| Simple Payback:                        | <u>5.1</u>        | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>3.02</u>       |        |

#### ECO DESCRIPTION:

Currently, two 436 ton water cooled centrifugal chillers are in use. These chillers serve Building 2399 and 2376 (hospital) and were installed in 1968. These chillers operate at an efficiency of 1.084 KW/ton and have 80% demand limiting setpoints. This ECO analyzes replacement of the two, 436 ton chillers with one 710 ton high efficiency, CFC free chiller. This would allow one of the 436 ton chillers to remain as back-up and the refrigerant from the demolition chiller could be recovered for future use. The new chiller will operate at an efficiency of approximately .539 KW/ton. This ECO analysis accounts for the operating hours and for the proposed lighting retrofit.

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned}\text{Demand Savings} &= (1,939 \text{ KW} - 1,842 \text{ KW})(4 \text{ mo.} \times \$7.50/\text{KW} + 8 \text{ mo.} \times \$6.25/\text{KW}) \\ &= \$7,760/\text{yr}\end{aligned}$$

**IMPLEMENTATION COSTS:**

(Refer to following Cost Estimate)

**LIFE CYCLE COST ANALYSIS:**

(Refer to following ECIP Life Cycle Cost Summary)

LINE # -----

1 JOB - 1

2 01/FORT SAM HOUSTON EEAP

3 01/SAN ANTONIO

4 01/FWD-COE

5 01/SCOTT CLARK

6 01/HVAC IMPROVEMENTS

7 08/SANANTON

8 09/JAN/DEC

9 10/CLTD-CLF

10 11/JAN/DEC

11 LOAD - 1

12 19/1/ENERGY CONSERVATION SIMULATION

13 20/1/1/FIRST FLOOR/600/200//4//14

14 20/2/2/FIRST FLOOR/600/200//4//14

15 20/3/3/FIRST FLOOR/600/200//4//14

16 21/M/78/50/78//70/70

17 22/3/1/YES///.07

18 24/1/1/200/14/.15

19 24/1/2/600/14/.15//90

20 24/1/3/200/14/.15//180

21 24/1/4/600/14/.15//270

22 24/2/1/200/14/.15

23 24/2/2/600/14/.15//90

24 24/2/3/200/14/.15//180

25 24/2/4/600/14/.15//270

26 24/3/1/200/14/.15

27 24/3/2/600/14/.15//90

28 24/3/3/200/14/.15//180

29 24/3/4/600/14/.15//270

30 25/1/1///15/1.07/.7

31 25/1/2///15/1.07/.7

32 25/1/3///15/1.07/.7

33 25/1/4///15/1.07/.7

34 25/2/1///15/1.07/.7

35 25/2/2///15/1.07/.7

36 25/2/3///15/1.07/.7

37 25/2/4///15/1.07/.7

38 25/3/1///15/1.07/.7

39 25/3/2///15/1.07/.7

40 25/3/3///15/1.07/.7

41 25/3/4///15/1.07/.7

42 26/M/2399PLP/2399LT

43 27/M/150/SF-PERS/255/255/2.5/WATT-SF///30

44 28/M/1//1.0/WATT-SF/2399LT

45 29/M/15/CFM-P/15/CFM-P

46 30/M/.75/CFM-SF

47 SYSTEM - 1

48 39/1/EXISTING EQUIPMENT

49 40/1/VTCV

50 41/1/1/3

51 42/1/2.5

52 43/1/54/62

53 44/1/NONE

54 45/1/AVAIL

55 EQUIPMENT - 1

56 60/1/1/PKPLANT/1/1

57 61/1/1

58 62/1/EQ1001S/2/436/TONS/1.084/KW-TON/////SER

CONTENTS OF : H:\JOB\911099\12F\TRACE\EQUIPECO\2399.TM

LINE # -----

59 63/1/142/HP/50/HP  
60 64/1//NO/NO/NONE  
69/1/EQ4003  
62 70/1/380  
63 EQUIPMENT - 2  
64 60/1/1/PKPLANT/1/1  
65 61/1/1  
66 62/1/EQ1001S/1/710/TONS/.539/KW-TON  
67 63/1/142/HP/50/HP  
68 64/1//NO/NO/NONE  
69 69/1/EQ4003  
70 70/1/380

\*\*\*\*\*  
\*\*\*\*\*  
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\*\* TRACE 600 ANALYSIS \*\*  
\*\*  
\*\* by \*\*  
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\*\*\*\*\*  
\*\*\*\*\*

FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 16:39: 0 4/17/94  
Dataset Name: 2399 .TM

AIRFLOW - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System<br>Number | System<br>Type | Main                        |                             |                             |                            |                             | Auxil.<br>Supply<br>Airflow<br>(Cfm) | Room<br>Exhaust<br>Airflow<br>(Cfm) |
|------------------|----------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------------|--------------------------------------|-------------------------------------|
|                  |                | Outside<br>Airflow<br>(Cfm) | Cooling<br>Airflow<br>(Cfm) | Heating<br>Airflow<br>(Cfm) | Return<br>Airflow<br>(Cfm) | Exhaust<br>Airflow<br>(Cfm) |                                      |                                     |
| 1                | VTCV           | 36,000                      | 270,000                     | 270,000                     | 270,000                    | 36,000                      | 0                                    | 0                                   |
| Totals           |                | 36,000                      | 270,000                     | 270,000                     | 270,000                    | 36,000                      | 0                                    | 0                                   |

CAPACITY - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

|        |        | Cooling   |           |           |         |            | Heating   |          |          |          |           |            |  |
|--------|--------|-----------|-----------|-----------|---------|------------|-----------|----------|----------|----------|-----------|------------|--|
| System | System | Main Sys. | Aux. Sys. | Opt. Vent | Cooling | Main Sys.  | Aux. Sys. | Preheat  | Reheat   | Humidif. | Opt. Vent | Heating    |  |
| Number | Type   | Capacity  | Capacity  | Capacity  | Totals  | Capacity   | Capacity  | Capacity | Capacity | Capacity | Capacity  | Totals     |  |
|        |        | (Tons)    | (Tons)    | (Tons)    | (Tons)  | (Btuh)     | (Btuh)    | (Btuh)   | (Btuh)   | (Btuh)   | (Btuh)    | (Btuh)     |  |
| 1      | VTCV   | 670.9     | 0.0       | 0.0       | 670.9   | -2,655,673 | 0         | 0        | 0        | 0        | 0         | -2,655,673 |  |
| Totals |        | 670.9     | 0.0       | 0.0       | 670.9   | -2,655,673 | 0         | 0        | 0        | 0        | 0         | -2,655,673 |  |

The building peaked at hour 15 month 8 with a capacity of 664.0 tons

ENGINEERING CHECKS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- ENGINEERING CHECKS -----

| System<br>Number | Main/<br>Auxiliary | System<br>Type | Percent<br>Outside<br>Air | Cooling       |             |               |                | Heating       |                | Floor Area<br>Sq Ft |
|------------------|--------------------|----------------|---------------------------|---------------|-------------|---------------|----------------|---------------|----------------|---------------------|
|                  |                    |                |                           | Cfm/<br>Sq Ft | Cfm/<br>Ton | Sq Ft<br>/Ton | Btuh/<br>Sq Ft | Cfm/<br>Sq Ft | Btuh/<br>Sq Ft |                     |
| 1                | Main               | VTCV           | 13.33                     | 0.75          | 402.5       | 536.6         | 22.36          | 0.75          | -7.38          | 360,000             |



System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/14 \* Mo/Hr: 7/16 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 96/ 79/126.0 \* OADB: 96 \* OADB: 30

|                 | Space      | Ret. Air | Ret. Air | Net       | Percnt |   | Space     | Percnt |   | Space Peak | Coil Peak  | Percnt |
|-----------------|------------|----------|----------|-----------|--------|---|-----------|--------|---|------------|------------|--------|
|                 | Sens.+Lat. | Sensible | Latent   | Total     | Of Tot |   | Sensible  | Of Tot |   | Space Sens | Tot Sens   | Of Tot |
|                 | (Btuh)     | (Btuh)   | (Btuh)   | (Btuh)    | (%)    |   | (Btuh)    | (%)    |   | (Btuh)     | (Btuh)     | (%)    |
| Envelope Loads  |            |          |          |           |        |   |           |        |   |            |            |        |
| Skylite Solr    | 0          | 0        |          | 0         | 0.00   | * | 0         | 0.00   | * | 0          | 0          | 0.00   |
| Skylite Cond    | 0          | 0        |          | 0         | 0.00   | * | 0         | 0.00   | * | 0          | 0          | 0.00   |
| Roof Cond       | 0          | 512,805  |          | 512,805   | 6.37   | * | 0         | 0.00   | * | 0          | -326,920   | 12.31  |
| Glass Solar     | 386,400    | 0        |          | 386,400   | 4.80   | * | 467,040   | 9.99   | * | 0          | 0          | 0.00   |
| Glass Cond      | 162,863    | 0        |          | 162,863   | 2.02   | * | 173,648   | 3.72   | * | -473,488   | -473,488   | 17.83  |
| Wall Cond       | 197,374    | 92,875   |          | 290,248   | 3.61   | * | 232,450   | 4.97   | * | -227,520   | -339,607   | 12.79  |
| Partition       | 0          |          |          | 0         | 0.00   | * | 0         | 0.00   | * | 0          | 0          | 0.00   |
| Exposed Floor   | 0          |          |          | 0         | 0.00   | * | 0         | 0.00   | * | 0          | 0          | 0.00   |
| Infiltration    | 0          |          |          | 0         | 0.00   | * | 0         | 0.00   | * | 0          | 0          | 0.00   |
| Sub Total==>    | 746,636    | 605,679  |          | 1,352,315 | 16.80  | * | 873,138   | 18.68  | * | -701,008   | -1,140,015 | 42.93  |
| Internal Loads  |            |          |          |           |        |   |           |        |   |            |            |        |
| Lights          | 910,304    | 390,130  |          | 1,300,435 | 16.15  | * | 935,591   | 20.02  | * | 0          | 0          | 0.00   |
| People          | 1,195,440  |          |          | 1,195,440 | 14.85  | * | 591,600   | 12.66  | * | 0          | 0          | 0.00   |
| Misc            | 1,085,334  | 0        | 0        | 1,085,334 | 13.48  | * | 1,105,812 | 23.66  | * | 0          | 0          | 0.00   |
| Sub Total==>    | 3,191,079  | 390,130  | 0        | 3,581,209 | 44.48  | * | 2,633,003 | 56.34  | * | 0          | 0          | 0.00   |
| Ceiling Load    | 279,678    | -279,678 |          | 0         | 0.00   | * | 309,070   | 6.61   | * | -123,298   | 0          | 0.00   |
| Outside Air     | 0          | 0        | 0        | 1,874,371 | 23.28  | * | 0         | 0.00   | * | 0          | -1,557,752 | 58.66  |
| Sup. Fan Heat   |            |          |          | 480,000   | 5.96   | * |           | 0.00   | * |            | 0          | 0.00   |
| Ret. Fan Heat   |            | 0        |          | 0         | 0.00   | * |           | 0.00   | * |            | 0          | 0.00   |
| Duct Heat Pkup  |            | 0        |          | 0         | 0.00   | * |           | 0.00   | * |            | 0          | 0.00   |
| OV/UNDR Sizing  | 858,046    |          |          | 858,046   | 10.66  | * | 858,046   | 18.36  | * | 0          | 0          | 0.00   |
| Exhaust Heat    |            | -95,484  | 0        | -95,484   | -1.19  | * |           | 0.00   | * |            | 42,095     | -1.59  |
| Terminal Bypass |            | 0        | 0        | 0         | 0.00   | * |           | 0.00   | * |            | 0          | 0.00   |
| Grand Total==>  | 5,075,438  | 620,648  | 0        | 8,050,457 | 100.00 | * | 4,673,256 | 100.00 | * | -824,306   | -2,655,673 | 100.00 |

| -----COOLING COIL SELECTION----- |                |           |            |                   |       |        |                  |       |        | -----AREAS----- |            |           |
|----------------------------------|----------------|-----------|------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|-----------|
|                                  | Total Capacity | Sens Cap. | Coil Airfl | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)       |
|                                  | (Tons)         | (Mbh)     | (cfm)      | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |            |           |
| Main Clg                         | 670.9          | 8,050.5   | 6,253.4    | 270,000           | 82.5  | 67.8   | 81.7             | 60.4  | 58.6   | 73.3            | 360,000    |           |
| Aux Clg                          | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0               | 0          |           |
| Opt Vent                         | 0.0            | 0.0       | 0.0        | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0               | 0          |           |
| Totals                           | 670.9          | 8,050.5   |            |                   |       |        |                  |       |        | Roof            | 120,000    | 0 0       |
|                                  |                |           |            |                   |       |        |                  |       |        | Wall            | 67,200     | 10,080 15 |

| -----HEATING COIL SELECTION----- |          |            |       |       | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |        |  | --TEMPERATURES (F)--- |      |      |
|----------------------------------|----------|------------|-------|-------|--------------------------|---------|---------|------------------------|--------|--|-----------------------|------|------|
|                                  | Capacity | Coil Airfl | Ent   | Lvg   | Type                     | Cooling | Heating | Clg % OA               |        |  | Type                  | Clg  | Htg  |
|                                  | (Mbh)    | (cfm)      | Deg F | Deg F | Vent                     | 36,000  | 36,000  | Clg Cfm/Sqft           | 13.3   |  | SADB                  | 62.0 | 72.8 |
| Main Htg                         | -2,655.7 | 270,000    | 63.7  | 72.8  | Infil                    | 0       | 0       | Clg Cfm/Ton            | 0.75   |  | Plenum                | 80.5 | 68.9 |
| Aux Htg                          | 0.0      | 0          | 0.0   | 0.0   | Supply                   | 270,000 | 270,000 | Clg Sqft/Ton           | 402.46 |  | Return                | 80.5 | 68.9 |
| Preheat                          | -0.0     | 270,000    | 63.7  | 60.4  | Minclm                   | 0       | 0       | Clg Btuh/Sqft          | 536.62 |  | Ret/OA                | 82.5 | 63.7 |
| Reheat                           | 0.0      | 0          | 0.0   | 0.0   | Return                   | 270,000 | 270,000 | No. People             | 22.36  |  | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0      | 0          | 0.0   | 0.0   | Exhaust                  | 36,000  | 36,000  | Htg % OA               | 2,400  |  | Fn MtrTD              | 0.4  | 0.0  |
| Opt Vent                         | 0.0      | 0          | 0.0   | 0.0   | Rm Exh                   | 0       | 0       | Htg Cfm/Sqft           | 13.3   |  | Fn BldTD              | 0.3  | 0.0  |
| Total                            | -2,655.7 |            |       |       | Auxil                    | 0       | 0       | Htg Btuh/Sqft          | 0.75   |  | Fn Frict              | 0.9  | 0.0  |
|                                  |          |            |       |       |                          |         |         |                        | -7.38  |  |                       |      |      |

ZONE PSYCHROMETRICS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- PSYCHROMETRIC STATE POINTS -----

Zone 1

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.2               | 50.9                    | 75.4                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.7                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.7               | 66.0               | 46.6                    | 75.4                    | 31.2                 |                       |
| Outdoor Air                       | 95.5               | 78.6               | 48.2                    | 126.0                   | 42.8                 |                       |
| Return/Outdoor Air Mix            | 82.7               | 67.9               | 47.5                    | 82.1                    | 32.7                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.7               | 67.9               | 47.5                    | 82.1                    | 32.7                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.6                    | 72.5                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

ZONE PSYCHROMETRICS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- PSYCHROMETRIC STATE POINTS -----

Zone 2

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.2               | 50.9                    | 75.4                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.7                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.7               | 66.0               | 46.6                    | 75.4                    | 31.2                 |                       |
| Outdoor Air                       | 95.5               | 78.6               | 48.2                    | 126.0                   | 42.8                 |                       |
| Return/Outdoor Air Mix            | 82.7               | 67.9               | 47.5                    | 82.1                    | 32.7                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.7               | 67.9               | 47.5                    | 82.1                    | 32.7                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.6                    | 72.5                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

ZONE PSYCHROMETRICS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- PSYCHROMETRIC STATE POINTS -----

Zone 3

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.1               | 50.7                    | 75.1                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.7                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.7               | 66.0               | 46.4                    | 75.1                    | 31.1                 |                       |
| Outdoor Air                       | 96.1               | 77.8               | 44.8                    | 119.0                   | 41.8                 |                       |
| Return/Outdoor Air Mix            | 82.8               | 67.7               | 46.7                    | 80.9                    | 32.6                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.8               | 67.7               | 46.7                    | 80.9                    | 32.6                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.2                    | 72.2                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.2                    | 72.2                    | 26.1                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.2                    | 72.2                    | 26.1                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

BUILDING U-VALUES - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- B U I L D I N G U - V A L U E S -----

|                |               | Room U-Values<br>(Btu/hr/sqft/F) |       |                |                |       |                |                |       |       | Room<br>Mass  | Room<br>Capac.   |
|----------------|---------------|----------------------------------|-------|----------------|----------------|-------|----------------|----------------|-------|-------|---------------|------------------|
| Room<br>Number | Description   | Part.                            | ExFlr | Summr<br>Skylt | Wintr<br>Skylt | Roof  | Summr<br>Windo | Wintr<br>Windo | Wall  | Ceil. | (lb/<br>sqft) | (Btu/<br>sqft/F) |
| Zone 1         | 1 FIRST FLOOR | 0.000                            | 0.000 | 0.000          | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9          | 3.17             |
|                | Total/Ave.    | 0.000                            | 0.000 | 0.000          | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9          | 3.17             |
| Zone 2         | 2 FIRST FLOOR | 0.000                            | 0.000 | 0.000          | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9          | 3.17             |
|                | Total/Ave.    | 0.000                            | 0.000 | 0.000          | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9          | 3.17             |
| Zone 3         | 3 FIRST FLOOR | 0.000                            | 0.000 | 0.000          | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 33.7          | 7.63             |
|                | Total/Ave.    | 0.000                            | 0.000 | 0.000          | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 33.7          | 7.63             |
| System         | 1 Total/Ave.  | 0.000                            | 0.000 | 0.000          | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 21.8          | 4.66             |
| Building       |               | 0.000                            | 0.000 | 0.000          | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 21.8          | 4.66             |

BUILDING AREAS - ALTERNATIVE 1  
ENERGY CONSERVATION SIMULATION

----- B U I L D I N G A R E A S -----

| Room<br>Number | Description | Number of<br>Duplicate |    | Floor<br>Area/Dupl<br>Room | Total<br>Floor<br>Area | Partition<br>Area | Exposed<br>Floor<br>Area | Skylight<br>Area | Skl<br>/Rf | Net Roof<br>Area | Window<br>Area | Win<br>/Wl | Net Wall<br>Area |
|----------------|-------------|------------------------|----|----------------------------|------------------------|-------------------|--------------------------|------------------|------------|------------------|----------------|------------|------------------|
|                |             | Flr                    | Rm | (sqft)                     | (sqft)                 | (sqft)            | (sqft)                   | (sqft)           | (%)        | (sqft)           | (sqft)         | (%)        | (sqft)           |
| 1              | FIRST FLOOR | 1                      | 1  | 120,000                    | 120,000                | 0                 | 0                        | 0                | 0          | 0                | 3,360          | 15         | 19,040           |
| Zone 1         | Total/Ave.  |                        |    |                            | 120,000                | 0                 | 0                        | 0                | 0          | 0                | 3,360          | 15         | 19,040           |
| 2              | FIRST FLOOR | 1                      | 1  | 120,000                    | 120,000                | 0                 | 0                        | 0                | 0          | 0                | 3,360          | 15         | 19,040           |
| Zone 2         | Total/Ave.  |                        |    |                            | 120,000                | 0                 | 0                        | 0                | 0          | 0                | 3,360          | 15         | 19,040           |
| 3              | FIRST FLOOR | 1                      | 1  | 120,000                    | 120,000                | 0                 | 0                        | 0                | 0          | 120,000          | 3,360          | 15         | 19,040           |
| Zone 3         | Total/Ave.  |                        |    |                            | 120,000                | 0                 | 0                        | 0                | 0          | 120,000          | 3,360          | 15         | 19,040           |
| System 1       | Total/Ave.  |                        |    |                            | 360,000                | 0                 | 0                        | 0                | 0          | 120,000          | 10,080         | 15         | 57,120           |
| Building       |             |                        |    |                            | 360,000                | 0                 | 0                        | 0                | 0          | 120,000          | 10,080         | 15         | 57,120           |

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC             | DEMAND          | WATER    |
|-------|------------------|-----------------|----------|
|       | On Peak<br>(kWh) | On Peak<br>(kW) |          |
|       |                  |                 | (1000 G) |
| Jan   | 611,326          | 1,244           | 261      |
| Feb   | 544,477          | 1,254           | 216      |
| March | 689,033          | 1,345           | 395      |
| April | 726,229          | 1,412           | 518      |
| May   | 783,372          | 1,478           | 661      |
| June  | 778,064          | 1,496           | 719      |
| July  | 826,273          | 1,510           | 823      |
| Aug   | 832,672          | 1,515           | 839      |
| Sept  | 783,472          | 1,504           | 727      |
| Oct   | 718,949          | 1,432           | 477      |
| Nov   | 661,178          | 1,356           | 371      |
| Dec   | 619,548          | 1,277           | 253      |
| Total | 8,574,594        | 1,515           | 6,261    |

Building Energy Consumption = 81,292 (Btu/Sq Ft/Year)  
 Source Energy Consumption = 243,900 (Btu/Sq Ft/Year)

Floor Area = 360,000 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

EQUIPMENT ENERGY CONSUMPTION

| Ref | Equip<br>Num Code | Monthly Consumption       |        |        |        |        |        |        |        |        |        |        |        | Total     |
|-----|-------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
|     |                   | Jan                       | Feb    | Mar    | Apr    | May    | June   | July   | Aug    | Sep    | Oct    | Nov    | Dec    |           |
| 0   | LIGHTS            |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 169442                    | 153045 | 169442 | 163976 | 169442 | 163976 | 169442 | 169442 | 163976 | 169442 | 163976 | 169442 | 1,995,047 |
|     | PK                | 430.9                     | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9  | 430.9     |
| 1   | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 2   | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | GAS               | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 3   | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | OIL               | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 4   | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | P STEAM           | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
|     | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | P HOTH2O          | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 6   | MISC LD           |                           |        |        |        |        |        |        |        |        |        |        |        |           |
|     | P CHILL           | 0                         | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|     | PK                | 0.0                       | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 1   | EQ1001S           | 2-STG CTV <555 TONS       |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 60832                     | 51559  | 90566  | 123379 | 160427 | 175213 | 203328 | 209727 | 180621 | 110235 | 85873  | 60344  | 1,512,104 |
|     | PK                | 204.0                     | 224.7  | 305.0  | 371.4  | 437.7  | 455.5  | 469.5  | 474.3  | 463.2  | 391.1  | 315.6  | 236.4  | 474.3     |
| 1   | EQ5100            | COOLING TOWER             |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 9098                      | 3915   | 21378  | 27107  | 28010  | 27106  | 28010  | 28010  | 27107  | 25676  | 22589  | 11860  | 259,866   |
|     | PK                | 37.6                      | 26.5   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6   | 37.6      |
| 1   | EQ5100            | COOLING TOWER             |        |        |        |        |        |        |        |        |        |        |        |           |
|     | WATER             | 261                       | 216    | 395    | 518    | 661    | 719    | 823    | 839    | 727    | 477    | 371    | 253    | 6,261     |
|     | PK                | 1.0                       | 1.1    | 1.4    | 1.6    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.7    | 1.4    | 1.1    | 1.8       |
| 1   | EQ5001            | CHILLED WATER PUMP C.V.   |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 65652                     | 59298  | 91912  | 101654 | 105042 | 101654 | 105042 | 105042 | 101654 | 96289  | 84712  | 70028  | 1,087,980 |
|     | PK                | 141.2                     | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2     |
| 1   | EQ5010            | CONDENSER WATER PUMP C.V. |        |        |        |        |        |        |        |        |        |        |        |           |
|     | ELEC              | 23117                     | 20880  | 32363  | 35794  | 36987  | 35794  | 36987  | 36987  | 35794  | 33905  | 29828  | 24658  | 383,092   |
|     | PK                | 49.7                      | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7      |
|     | EQ5300            | CONTROL PANEL & INTERLOCK |        |        |        |        |        |        |        |        |        |        |        |           |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

|   |        |                      |        |        |        |        |        |        |        |        |        |        |        |           |
|---|--------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
|   | ELEC   | 465                  | 420    | 651    | 720    | 744    | 720    | 744    | 744    | 720    | 682    | 600    | 496    | 7,706     |
|   | PK     | 1.0                  | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0       |
| 1 | EQ4003 | FC CENTRIF. FAN C.V. |        |        |        |        |        |        |        |        |        |        |        |           |
|   | ELEC   | 282720               | 255360 | 282720 | 273600 | 282720 | 273600 | 282720 | 282720 | 273600 | 282720 | 273600 | 282720 | 3,328,800 |
|   | PK     | 380.0                | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0     |



UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

----- UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 1,514.8 (kW)  
Yearly Time of Peak 12 (hr) 8 (mo)

Hour 12 Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|------------------------|
|----------------------|------------------------|-----------------------|---------------------------|------------------------|

Cooling Equipment

|   |         |                     |       |       |
|---|---------|---------------------|-------|-------|
| 1 | EQ1001S | 2-STG CTV <555 TONS | 703.9 | 46.47 |
|---|---------|---------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 703.9 | 46.47 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |       |       |
|---|--|------------------------------------|-------|-------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 380.0 | 25.09 |
|---|--|------------------------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 380.0 | 25.09 |
|-----------|--|--|-------|-------|

|       |  |  |     |      |
|-------|--|--|-----|------|
| Total |  |  | 0.0 | 0.00 |
|-------|--|--|-----|------|

Miscellaneous

|                |  |  |       |       |
|----------------|--|--|-------|-------|
| Lights         |  |  | 430.9 | 28.45 |
| Base Utilities |  |  | 0.0   | 0.00  |
| Misc Equipment |  |  | 0.0   | 0.00  |
| Sub Total      |  |  | 430.9 | 28.45 |

|             |  |  |         |        |
|-------------|--|--|---------|--------|
| Grand Total |  |  | 1,514.8 | 100.00 |
|-------------|--|--|---------|--------|

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\*\* TRACE 600 ANALYSIS \*\*  
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\*\* by \*\*  
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FORT SAM HOUSTON EEAP  
SAN ANTONIO  
FWD-COE  
SCOTT CLARK  
HVAC IMPROVEMENTS

Weather File Code: SANANTON  
Location: FORT SAM HOUSTON  
Latitude: 29.0 (deg)  
Longitude: 98.0 (deg)  
Time Zone: 6  
Elevation: 792 (ft)  
Barometric Pressure: 29.0 (in. Hg)

Summer Clearness Number: 0.90  
Winter Clearness Number: 0.90  
Summer Design Dry Bulb: 97 (F)  
Summer Design Wet Bulb: 76 (F)  
Winter Design Dry Bulb: 30 (F)  
Summer Ground Relectance: 0.20  
Winter Ground Relectance: 0.20

Air Density: 0.0738 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.0818 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,761.9 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.4255 (Lb-min./hr/cuft)

Design Simulation Period: January To December  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 12: 3:14 4/18/94  
Dataset Name: 2399 .TM

AIRFLOW - ALTERNATIVE 2  
NEW CHILLER

----- SYSTEM SUMMARY -----  
(Design Airflow Quantities)

| System Number | System Type | Outside Airflow (Cfm) | Cooling Airflow (Cfm) | Main Heating Airflow (Cfm) | Return Airflow (Cfm) | Exhaust Airflow (Cfm) | Auxil. Supply Airflow (Cfm) | Room Exhaust Airflow (Cfm) |
|---------------|-------------|-----------------------|-----------------------|----------------------------|----------------------|-----------------------|-----------------------------|----------------------------|
| 1             | VTCV        | 36,000                | 270,000               | 270,000                    | 270,000              | 36,000                | 0                           | 0                          |
| Totals        |             | 36,000                | 270,000               | 270,000                    | 270,000              | 36,000                | 0                           | 0                          |

CAPACITY - ALTERNATIVE 2  
NEW CHILLER

----- SYSTEM SUMMARY -----  
(Design Capacity Quantities)

| System Number | System Type | Cooling                   |                           |                           |                      |                       | Heating                   |                           |                         |                        |                          |                           |                       |
|---------------|-------------|---------------------------|---------------------------|---------------------------|----------------------|-----------------------|---------------------------|---------------------------|-------------------------|------------------------|--------------------------|---------------------------|-----------------------|
|               |             | Main Sys. Capacity (Tons) | Aux. Sys. Capacity (Tons) | Sys. Opt. Capacity (Tons) | Vent Capacity (Tons) | Cooling Totals (Tons) | Main Sys. Capacity (Btuh) | Aux. Sys. Capacity (Btuh) | Preheat Capacity (Btuh) | Reheat Capacity (Btuh) | Humidif. Capacity (Btuh) | Opt. Vent Capacity (Btuh) | Heating Totals (Btuh) |
| 1             | VTCV        | 668.5                     | 0.0                       | 0.0                       | 0.0                  | 668.5                 | -2,655,673                | 0                         | 0                       | 0                      | 0                        | 0                         | -2,655,673            |
| Totals        |             | 668.5                     | 0.0                       | 0.0                       | 0.0                  | 668.5                 | -2,655,673                | 0                         | 0                       | 0                      | 0                        | 0                         | -2,655,673            |

The building peaked at hour 15 month 8 with a capacity of 661.7 tons

ENGINEERING CHECKS - ALTERNATIVE 2  
NEW CHILLER

----- ENGINEERING CHECKS -----

| System Number | Main/Auxiliary | System Type | Percent Outside Air | Cfm/ Sq Ft | Cooling Cfm/ Ton | Sq Ft /Ton | Btuh/ Sq Ft | Heating Cfm/ Sq Ft | Btuh/ Sq Ft | Floor Area Sq Ft |
|---------------|----------------|-------------|---------------------|------------|------------------|------------|-------------|--------------------|-------------|------------------|
| 1             | Main           | VTCV        | 13.33               | 0.75       | 403.9            | 538.5      | 22.28       | 0.75               | -7.38       | 360,000          |

System 1 Peak VTCV - VARIABLE TEMP CONSTANT VOL

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*  
Peaked at Time ==> Mo/Hr: 8/14 \* Mo/Hr: 7/16 \* Mo/Hr: 13/ 1  
Outside Air ==> OADB/WB/HR: 96/ 79/126.0 \* OADB: 96 \* OADB: 30

|                 | Space<br>Sens.+Lat.<br>(Btuh) | Ret. Air<br>Sensible<br>(Btuh) | Ret. Air<br>Latent<br>(Btuh) | Net<br>Total<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space<br>Sensible<br>(Btuh) | Perct<br>Of Tot<br>(%) |   | Space Peak<br>Space Sens<br>(Btuh) | Coil Peak<br>Tot Sens<br>(Btuh) | Perct<br>Of Tot<br>(%) |
|-----------------|-------------------------------|--------------------------------|------------------------------|------------------------|------------------------|---|-----------------------------|------------------------|---|------------------------------------|---------------------------------|------------------------|
| Envelope Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Skylite Solr    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Skylite Cond    | 0                             | 0                              |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Roof Cond       | 0                             | 513,864                        |                              | 513,864                | 6.41                   | * | 0                           | 0.00                   | * | 0                                  | -326,920                        | 12.31                  |
| Glass Solar     | 386,400                       | 0                              |                              | 386,400                | 4.82                   | * | 467,040                     | 9.99                   | * | 0                                  | 0                               | 0.00                   |
| Glass Cond      | 162,863                       | 0                              |                              | 162,863                | 2.03                   | * | 173,648                     | 3.72                   | * | -473,488                           | -473,488                        | 17.83                  |
| Wall Cond       | 197,374                       | 93,238                         |                              | 290,611                | 3.62                   | * | 232,450                     | 4.97                   | * | -227,520                           | -339,607                        | 12.79                  |
| Partition       | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Exposed Floor   | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Infiltration    | 0                             |                                |                              | 0                      | 0.00                   | * | 0                           | 0.00                   | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 746,636                       | 607,102                        |                              | 1,353,738              | 16.87                  | * | 873,138                     | 18.68                  | * | -701,008                           | -1,140,015                      | 42.93                  |
| Internal Loads  |                               |                                |                              |                        |                        |   |                             |                        |   |                                    |                                 |                        |
| Lights          | 787,486                       | 337,494                        |                              | 1,124,980              | 14.02                  | * | 809,360                     | 17.32                  | * | 0                                  | 0                               | 0.00                   |
| People          | 1,195,440                     |                                |                              | 1,195,440              | 14.90                  | * | 591,600                     | 12.66                  | * | 0                                  | 0                               | 0.00                   |
| Misc            | 1,085,334                     | 0                              | 0                            | 1,085,334              | 13.53                  | * | 1,105,812                   | 23.66                  | * | 0                                  | 0                               | 0.00                   |
| Sub Total==>    | 3,068,259                     | 337,494                        | 0                            | 3,405,753              | 42.45                  | * | 2,506,772                   | 53.64                  | * | 0                                  | 0                               | 0.00                   |
| Ceiling Load    | 265,294                       | -265,294                       |                              | 0                      | 0.00                   | * | 294,286                     | 6.30                   | * | -123,298                           | 0                               | 0.00                   |
| Outside Air     | 0                             | 0                              | 0                            | 1,874,371              | 23.36                  | * | 0                           | 0.00                   | * | 0                                  | -1,557,752                      | 58.66                  |
| Sup. Fan Heat   |                               |                                |                              | 480,000                | 5.98                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Ret. Fan Heat   |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Duct Heat Pkup  |                               | 0                              |                              | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| OV/UNDR Sizing  | 999,060                       |                                |                              | 999,060                | 12.45                  | * | 999,060                     | 21.38                  | * | 0                                  | 0                               | 0.00                   |
| Heat Heat       |                               | -90,573                        | 0                            | -90,573                | -1.13                  | * |                             | 0.00                   | * |                                    | 42,095                          | -1.59                  |
| Terminal Bypass |                               | 0                              | 0                            | 0                      | 0.00                   | * |                             | 0.00                   | * |                                    | 0                               | 0.00                   |
| Grand Total==>  | 5,079,249                     | 588,728                        | 0                            | 8,022,349              | 100.00                 | * | 4,673,256                   | 100.00                 | * | -824,306                           | -2,655,673                      | 100.00                 |

| -----COOLING COIL SELECTION----- |                          |                    |                     |                   |       |        |                  |       |        | -----AREAS----- |            |           |
|----------------------------------|--------------------------|--------------------|---------------------|-------------------|-------|--------|------------------|-------|--------|-----------------|------------|-----------|
|                                  | Total Capacity<br>(Tons) | Sens Cap.<br>(Mbh) | Coil Airfl<br>(cfm) | Entering DB/WB/HR |       |        | Leaving DB/WB/HR |       |        | Gross Total     | Glass (sf) | (%)       |
|                                  |                          |                    |                     | Deg F             | Deg F | Grains | Deg F            | Deg F | Grains | Floor           |            |           |
| Main Clg                         | 668.5                    | 8,022.3            | 6,225.3             | 270,000           | 82.4  | 67.8   | 81.7             | 60.4  | 58.6   | 73.3            | 360,000    |           |
| Aux Clg                          | 0.0                      | 0.0                | 0.0                 | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |           |
| Opt Vent                         | 0.0                      | 0.0                | 0.0                 | 0                 | 0.0   | 0.0    | 0.0              | 0.0   | 0.0    | 0.0             | 0          |           |
| Totals                           | 668.5                    | 8,022.3            |                     |                   |       |        |                  |       |        |                 |            |           |
|                                  |                          |                    |                     |                   |       |        |                  |       |        | Roof            | 120,000    | 0 0       |
|                                  |                          |                    |                     |                   |       |        |                  |       |        | Wall            | 67,200     | 10,080 15 |

| -----HEATING COIL SELECTION----- |                   |                     |              |              | -----AIRFLOWS (cfm)----- |         |         | --ENGINEERING CHECKS-- |       |  | --TEMPERATURES (F)--- |      |      |
|----------------------------------|-------------------|---------------------|--------------|--------------|--------------------------|---------|---------|------------------------|-------|--|-----------------------|------|------|
|                                  | Capacity<br>(Mbh) | Coil Airfl<br>(cfm) | Ent<br>Deg F | Lvg<br>Deg F | Type                     | Cooling | Heating | Clg % OA               |       |  | Type                  | Clg  | Htg  |
|                                  |                   |                     |              |              | Vent                     | 36,000  | 36,000  | 13.3                   |       |  | SADB                  | 62.0 | 72.8 |
| Main Htg                         | -2,655.7          | 270,000             | 63.7         | 72.8         | Infil                    | 0       | 0       | 0.75                   |       |  | Plenum                | 80.3 | 68.9 |
| Aux Htg                          | 0.0               | 0                   | 0.0          | 0.0          | Supply                   | 270,000 | 270,000 | 403.87                 |       |  | Return                | 80.3 | 68.9 |
| Preheat                          | -0.0              | 270,000             | 63.7         | 60.4         | Mincfm                   | 0       | 0       | 538.50                 |       |  | Ret/OA                | 82.4 | 63.7 |
| Reheat                           | 0.0               | 0                   | 0.0          | 0.0          | Return                   | 270,000 | 270,000 | 22.28                  |       |  | Runarnd               | 78.0 | 70.0 |
| Humidif                          | 0.0               | 0                   | 0.0          | 0.0          | Exhaust                  | 36,000  | 36,000  | No. People             | 2,400 |  | Fn MtrTD              | 0.4  | 0.0  |
| Opt Vent                         | 0.0               | 0                   | 0.0          | 0.0          | Rm Exh                   | 0       | 0       | Htg % OA               | 13.3  |  | Fn BldTD              | 0.3  | 0.0  |
| Total                            | -2,655.7          |                     |              |              | Auxil                    | 0       | 0       | Htg Cfm/SqFt           | 0.75  |  | Fn Frict              | 0.9  | 0.0  |
|                                  |                   |                     |              |              |                          |         |         | Htg Btuh/SqFt          | -7.38 |  |                       |      |      |

ZONE PSYCHROMETRICS - ALTERNATIVE 2  
NEW CHILLER

----- PSYCHROMETRIC STATE POINTS -----

Zone 1

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.2               | 50.9                    | 75.4                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.6                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.6               | 66.0               | 46.8                    | 75.4                    | 31.1                 |                       |
| Outdoor Air                       | 95.5               | 78.6               | 48.2                    | 126.0                   | 42.8                 |                       |
| Return/Outdoor Air Mix            | 82.6               | 67.9               | 47.7                    | 82.1                    | 32.7                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.6               | 67.9               | 47.7                    | 82.1                    | 32.7                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.6                    | 72.5                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

ZONE PSYCHROMETRICS - ALTERNATIVE 2  
NEW CHILLER

----- PSYCHROMETRIC STATE POINTS -----

Zone 2

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.2               | 50.9                    | 75.4                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.6                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.6               | 66.0               | 46.8                    | 75.4                    | 31.1                 |                       |
| Outdoor Air                       | 95.5               | 78.6               | 48.2                    | 126.0                   | 42.8                 |                       |
| Return/Outdoor Air Mix            | 82.6               | 67.9               | 47.7                    | 82.1                    | 32.7                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.6               | 67.9               | 47.7                    | 82.1                    | 32.7                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.6                    | 72.5                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.5                    | 72.5                    | 26.2                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

ZONE PSYCHROMETRICS - ALTERNATIVE 2  
NEW CHILLER

----- PSYCHROMETRIC STATE POINTS -----

Zone 3

|                                   | Dry<br>Bulb<br>(F) | Wet<br>Bulb<br>(F) | Relat.<br>Humid.<br>(%) | Humid.<br>Ratio<br>(GR) | Enthalpy<br>(Btu/Lb) | Temp.<br>Diff.<br>(F) |
|-----------------------------------|--------------------|--------------------|-------------------------|-------------------------|----------------------|-----------------------|
| Space                             | 78.0               | 65.1               | 50.7                    | 75.1                    | 30.5                 |                       |
| Main System                       |                    |                    |                         |                         |                      |                       |
| Return Air Heat Pickup            |                    |                    |                         |                         |                      | 2.6                   |
| Return Fan                        |                    |                    |                         |                         |                      | 0.0                   |
| Return Air                        | 80.6               | 65.9               | 46.6                    | 75.1                    | 31.1                 |                       |
| Outdoor Air                       | 96.1               | 77.8               | 44.8                    | 119.0                   | 41.8                 |                       |
| Return/Outdoor Air Mix            | 82.6               | 67.7               | 46.9                    | 80.9                    | 32.5                 |                       |
| Blow through Fan                  |                    |                    |                         |                         |                      | 0.0                   |
| Entering Coil                     | 82.6               | 67.7               | 46.9                    | 80.9                    | 32.5                 |                       |
| Leaving Coil                      | 60.4               | 58.4               | 89.2                    | 72.2                    | 25.7                 |                       |
| Draw Through Fan                  |                    |                    |                         |                         |                      | 0.7                   |
| Duct Frictional Heat              |                    |                    |                         |                         |                      | 0.9                   |
| Supply Duct Heat Gain             |                    |                    |                         |                         |                      | 0.0                   |
| Cold Deck Supply Air              | 62.0               | 59.0               | 84.2                    | 72.2                    | 26.1                 |                       |
| Supply Air                        | 62.0               | 59.0               | 84.2                    | 72.2                    | 26.1                 |                       |
| Percent Outside Air               | 13.33              | (%)                |                         |                         |                      |                       |
| Sensible Heat Ratio (SHR)         | 0.884              |                    |                         |                         |                      |                       |
| Percent Supply Air Bypassing Coil | 0.00               | (%)                |                         |                         |                      |                       |
| Coil Airflow                      | 90,000             | (Cfm)              |                         |                         |                      |                       |

BUILDING U-VALUES - ALTERNATIVE 2  
NEW CHILLER

----- B U I L D I N G U - V A L U E S -----

| Room<br>Number | Description | Part. | ExFlr | Room U-Values<br>(Btu/hr/sqft/F) |                |       |                |                |       |       | Room<br>Mass<br>(lb/<br>sqft) | Room<br>Capac.<br>(Btu/<br>sqft/F) |
|----------------|-------------|-------|-------|----------------------------------|----------------|-------|----------------|----------------|-------|-------|-------------------------------|------------------------------------|
|                |             |       |       | Summr<br>Skylt                   | Wintr<br>Skylt | Roof  | Summr<br>Windo | Wintr<br>Windo | Wall  | Cell. |                               |                                    |
| 1              | FIRST FLOOR | 0.000 | 0.000 | 0.000                            | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9                          | 3.17                               |
| Zone 1         | Total/Ave.  | 0.000 | 0.000 | 0.000                            | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9                          | 3.17                               |
| 2              | FIRST FLOOR | 0.000 | 0.000 | 0.000                            | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9                          | 3.17                               |
| Zone 2         | Total/Ave.  | 0.000 | 0.000 | 0.000                            | 0.000          | 0.000 | 1.070          | 1.175          | 0.150 | 0.317 | 15.9                          | 3.17                               |
| 3              | FIRST FLOOR | 0.000 | 0.000 | 0.000                            | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 33.7                          | 7.63                               |
| Zone 3         | Total/Ave.  | 0.000 | 0.000 | 0.000                            | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 33.7                          | 7.63                               |
| System 1       | Total/Ave.  | 0.000 | 0.000 | 0.000                            | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 21.8                          | 4.66                               |
| Building       |             | 0.000 | 0.000 | 0.000                            | 0.000          | 0.070 | 1.070          | 1.175          | 0.150 | 0.317 | 21.8                          | 4.66                               |

BUILDING AREAS - ALTERNATIVE 2  
NEW CHILLER

----- B U I L D I N G A R E A S -----

| Room<br>Number | Description   | Number of<br>Duplicate |    | Floor<br>Area/Dupl<br>Room<br>(sqft) | Total<br>Floor<br>Area<br>(sqft) | Partition<br>Area<br>(sqft) | Exposed<br>Floor<br>Area<br>(sqft) | Skylight<br>Area<br>(sqft) | Skl<br>/Rf<br>(%) | Net Roof<br>Area<br>(sqft) | Window<br>Area<br>(sqft) | Win<br>/Wl<br>(%) | Net Wall<br>Area<br>(sqft) |
|----------------|---------------|------------------------|----|--------------------------------------|----------------------------------|-----------------------------|------------------------------------|----------------------------|-------------------|----------------------------|--------------------------|-------------------|----------------------------|
|                |               | Flr                    | Rm |                                      |                                  |                             |                                    |                            |                   |                            |                          |                   |                            |
| Zone 1         | 1 FIRST FLOOR | 1                      | 1  | 120,000                              | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 0                          | 3,360                    | 15                | 19,040                     |
|                | 1 Total/Ave.  |                        |    |                                      | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 0                          | 3,360                    | 15                | 19,040                     |
| Zone 2         | 2 FIRST FLOOR | 1                      | 1  | 120,000                              | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 0                          | 3,360                    | 15                | 19,040                     |
|                | 2 Total/Ave.  |                        |    |                                      | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 0                          | 3,360                    | 15                | 19,040                     |
| Zone 3         | 3 FIRST FLOOR | 1                      | 1  | 120,000                              | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 120,000                    | 3,360                    | 15                | 19,040                     |
|                | 3 Total/Ave.  |                        |    |                                      | 120,000                          | 0                           | 0                                  | 0                          | 0                 | 120,000                    | 3,360                    | 15                | 19,040                     |
| System         | 1 Total/Ave.  |                        |    |                                      | 360,000                          | 0                           | 0                                  | 0                          | 0                 | 120,000                    | 10,080                   | 15                | 57,120                     |
| Building       |               |                        |    |                                      | 360,000                          | 0                           | 0                                  | 0                          | 0                 | 120,000                    | 10,080                   | 15                | 57,120                     |



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

| Month | ELEC             | DEMAND          | WATER     |
|-------|------------------|-----------------|-----------|
|       | On Peak<br>(kWh) | On Peak<br>(kW) |           |
|       |                  |                 | (1000 GL) |
| Jan   | 557,567          | 1,105           | 218       |
| Feb   | 498,026          | 1,080           | 181       |
| March | 625,567          | 1,141           | 338       |
| April | 656,611          | 1,169           | 445       |
| May   | 696,679          | 1,197           | 572       |
| June  | 683,204          | 1,213           | 622       |
| July  | 715,067          | 1,231           | 709       |
| Aug   | 717,471          | 1,249           | 719       |
| Sept  | 684,329          | 1,234           | 621       |
| Oct   | 638,361          | 1,171           | 406       |
| Nov   | 609,005          | 1,143           | 316       |
| Dec   | 566,611          | 1,117           | 210       |
| Total | 7,648,496        | 1,249           | 5,356     |

Building Energy Consumption = 72,512 (Btu/Sq Ft/Year)  
Source Energy Consumption = 217,558 (Btu/Sq Ft/Year)

Floor Area = 360,000 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

----- EQUIPMENT ENERGY CONSUMPTION -----

| Ref<br>Num | Equip<br>Code | ----- Monthly Consumption ----- |        |        |        |        |        |        |        |        |        |        |        | Total     |
|------------|---------------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
|            |               | Jan                             | Feb    | Mar    | Apr    | May    | June   | July   | Aug    | Sep    | Oct    | Nov    | Dec    |           |
| 0          | LIGHTS        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 146581                          | 132396 | 146581 | 141852 | 146581 | 141852 | 146581 | 146581 | 141852 | 146581 | 141853 | 146581 | 1,725,872 |
|            | PK            | 372.8                           | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8  | 372.8     |
| 1          | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 2          | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | GAS           | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 3          | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | OIL           | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 4          | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | P STEAM       | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
|            | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | P HOTH2O      | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 6          | MISC LD       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            | P CHILL       | 0                               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0         |
|            | PK            | 0.0                             | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0       |
| 1          | EQ1001S       |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | 2-STG CTV <555 TONS             |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 33091                           | 28407  | 48808  | 64079  | 84396  | 90672  | 102784 | 105188 | 91797  | 56575  | 45986  | 32732  | 784,515   |
|            | PK            | 106.3                           | 114.8  | 142.2  | 170.4  | 198.2  | 214.1  | 232.6  | 250.3  | 234.9  | 172.6  | 144.4  | 118.8  | 250.3     |
| 1          | EQ5100        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | COOLING TOWER                   |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 11891                           | 1265   | 28481  | 38911  | 40209  | 38911  | 40209  | 40209  | 38911  | 33507  | 32426  | 15344  | 360,274   |
|            | PK            | 54.0                            | 20.4   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0   | 54.0      |
| 1          | EQ5100        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | COOLING TOWER                   |        |        |        |        |        |        |        |        |        |        |        |           |
|            | WATER         | 218                             | 181    | 338    | 445    | 572    | 622    | 709    | 719    | 621    | 406    | 316    | 210    | 5,356     |
|            | PK            | 0.8                             | 0.9    | 1.2    | 1.4    | 1.5    | 1.6    | 1.7    | 1.8    | 1.8    | 1.4    | 1.2    | 1.0    | 1.8       |
| 1          | EQ5001        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | CHILLED WATER PUMP C.V.         |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 61275                           | 59298  | 87535  | 101654 | 105042 | 101654 | 105042 | 105042 | 101654 | 87535  | 84712  | 65652  | 1,066,096 |
|            | PK            | 141.2                           | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2  | 141.2     |
| 1          | EQ5010        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | CONDENSER WATER PUMP C.V.       |        |        |        |        |        |        |        |        |        |        |        |           |
|            | ELEC          | 21576                           | 20880  | 30822  | 35794  | 36987  | 35794  | 36987  | 36987  | 35794  | 30822  | 29828  | 23117  | 375,386   |
|            | PK            | 49.7                            | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7   | 49.7      |
|            | EQ5300        |                                 |        |        |        |        |        |        |        |        |        |        |        |           |
|            |               | CONTROL PANEL & INTERLOCK       |        |        |        |        |        |        |        |        |        |        |        |           |

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

|   |        |                      |        |        |        |        |        |        |        |        |        |        |        |           |
|---|--------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
|   | ELEC   | 434                  | 420    | 620    | 720    | 744    | 720    | 744    | 744    | 720    | 620    | 600    | 465    | 7,551     |
|   | PK     | 1.0                  | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0       |
| 1 | EQ4003 | FC CENTRIF. FAN C.V. |        |        |        |        |        |        |        |        |        |        |        |           |
|   | ELEC   | 282720               | 255360 | 282720 | 273600 | 282720 | 273600 | 282720 | 282720 | 273600 | 282720 | 273600 | 282720 | 3,328,800 |
|   | PK     | 380.0                | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0  | 380.0     |

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

----- U T I L I T Y   P E A K   C H E C K S U M S -----

Utility    ELECTRIC DEMAND

Peak Value    1,249.0    (kW)  
Yearly Time of Peak    15 (hr)    8 (mo)

Hour 15    Month 8

| Eqp.<br>Ref.<br>Num. | Equipment<br>Code Name | Equipment Description | Utility<br>Demand<br>(kW) | Perct<br>Of Tot<br>(%) |
|----------------------|------------------------|-----------------------|---------------------------|------------------------|
|----------------------|------------------------|-----------------------|---------------------------|------------------------|

Cooling Equipment

|   |         |                     |       |       |
|---|---------|---------------------|-------|-------|
| 1 | EQ1001S | 2-STG CTV <555 TONS | 496.3 | 39.73 |
|---|---------|---------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 496.3 | 39.73 |
|-----------|--|--|-------|-------|

|           |  |  |     |      |
|-----------|--|--|-----|------|
| Sub Total |  |  | 0.0 | 0.00 |
|-----------|--|--|-----|------|

Air Moving Equipment

|   |  |                                    |       |       |
|---|--|------------------------------------|-------|-------|
| 1 |  | SUMMATION OF FAN ELECTRICAL DEMAND | 380.0 | 30.42 |
|---|--|------------------------------------|-------|-------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 380.0 | 30.42 |
|-----------|--|--|-------|-------|

|       |  |  |     |      |
|-------|--|--|-----|------|
| Total |  |  | 0.0 | 0.00 |
|-------|--|--|-----|------|

Miscellaneous

|        |  |  |       |       |
|--------|--|--|-------|-------|
| Lights |  |  | 372.8 | 29.85 |
|--------|--|--|-------|-------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Base Utilities |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|                |  |  |     |      |
|----------------|--|--|-----|------|
| Misc Equipment |  |  | 0.0 | 0.00 |
|----------------|--|--|-----|------|

|           |  |  |       |       |
|-----------|--|--|-------|-------|
| Sub Total |  |  | 372.8 | 29.85 |
|-----------|--|--|-------|-------|

|             |  |  |         |        |
|-------------|--|--|---------|--------|
| Grand Total |  |  | 1,249.0 | 100.00 |
|-------------|--|--|---------|--------|

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# Texas Trane - Fort Worth

## Facsimile Cover Sheet

**To:** Scott Clark  
**Company:** Carter & Burgess  
**Phone:** 817-735-6038  
**Fax:** 817-735-6064

**From:** Arthur Murnan  
**Company:** Texas Trane  
**Phone:** 817-838-1301  
**Fax:** 817-831-8135

**Date:** October 11, 1993  
**Pages including this**  
**cover page:** 13

**Comments:**

Here is the information you requested. The Trane Centravac will cost about \$235,000.

10/11/93 14:53

2817 831 8135

TRANE FT. WORTH --- CARTER BURGESS 002/013

## TRANE CENTRAVAC SELECTION PROGRAM

Rev Level 55014

Version 13.09

Mon Oct 11, 1993

PROJECT : HOSPITAL CHILLER REPLACEMENT  
 LOCATION : FORT SAM HOUSTON - SAN ANTONIO  
 BLDG. OWNER : U.S. ARMY  
 PROGRAM USER : MURNAN  
 COMMENTS : SCOTT CLARK - CARTER & BURGESS  
 MACHINE : CVHF

TECU 28

TECU 28

\*\*\*\*\* INPUT CONDITIONS \*\*\*\*\*

|                        |       |                        |       |  |
|------------------------|-------|------------------------|-------|--|
| DESIGN DUTY            | 710   |                        |       |  |
| EXITING EVAP TEMP      | 44    |                        |       |  |
| EVAP FLOW RATE         | 2260  | ENTERING COND TEMP     | 85    |  |
| EVAPORATOR PASSES      | 2     | COND FLOW RATE         | 2830  |  |
| MAX EVAP PRESSURE DROP | 33    | CONDENSER PASSES       | 2     |  |
| FLUID TYPE             | WATER | MAX COND PRESSURE DROP | 24    |  |
| FLUID %                | 0     | FLUID TYPE             | WATER |  |
|                        |       | FLUID %                | 0     |  |
| VOLTAGE                | 4160  |                        |       |  |
| FREQUENCY              | 60    |                        |       |  |
| REFRIGERANT            | 123   |                        |       |  |

\*\*\*\*\* OUTPUT DATA \*\*\*\*\*  
 NOTE - PERFORMANCE CERTIFIED IN ACCORDANCE WITH ARI STANDARD 550-92  
 NOTE - EXTENDED SHELL SELECTION.

| %LOAD                 |      | 100%    | 75%   | 50%   | 25%   |
|-----------------------|------|---------|-------|-------|-------|
| DESIGN DUTY           | TONS | 710     | 533   | 355   | 178   |
| POWER CONSUMED        | KW   | 383     | 256   | 171   | 100   |
| KW PER DESIGN DUTY    |      | 0.539   | 0.481 | 0.482 | 0.563 |
| APLV                  |      | 0.498   |       |       |       |
| EXIT EVAP TEMP        | F    | 44.00   | 44.00 | 44.00 | 44.00 |
| EVAP FLOW RATE        | GPM  | 2260.0  |       |       |       |
| ENTERING EVAP TEMP    | F    | 51.54   |       |       |       |
| EVAP PD (NON-MAR)     | FEET | 29.67   |       |       |       |
| EVAP PD (MARINE)      | FEET | 30.33   |       |       |       |
| EVAP FOULING FACTOR   |      | 0.00025 |       |       |       |
| FLUID TYPE AND %      |      | WATER 0 |       |       |       |
| ENTERING COND TEMP    | F    | 85.00   | 78.75 | 72.50 | 66.25 |
| COND FLOW RATE        | GPM  | 2830.0  |       |       |       |
| EXIT COND TEMP        | F    | 91.97   |       |       |       |
| COND PD (NON-MAR)     | FEET | 20.60   |       |       |       |
| COND PD (MARINE)      | FEET | 21.64   |       |       |       |
| COND FOULING FACTOR   |      | 0.00025 |       |       |       |
| FLUID TYPE AND %      |      | WATER 0 |       |       |       |
| MAX LRA AT MOTOR KW   | AMPS | 405     |       |       |       |
| RLA AT MOTOR KW       | AMPS | 62      |       |       |       |
| RLA AT SELECTION KW   | AMPS | 59      |       |       |       |
| REFRIGERANT CHARGE    | LBS  | 1600    |       |       |       |
| SHIP WT. (W/NMAR WB.) | LBS  | 30721   |       |       |       |
| OPER WT. (W/NMAR WB.) | LBS  | 35397   |       |       |       |

|           |          |           |           |           |          |          |
|-----------|----------|-----------|-----------|-----------|----------|----------|
| mod1-CVHF | nton-650 | volt-4160 | hrtz-60   | type-SNGL | cpkw-403 | cpim-275 |
| evtm-TECU | evth-28  | evsz-142M | evbs-980  | evwp-2    | orsz-880 | refg-123 |
| cdtm-TECU | cdth-28  | cdsz-142S | cdbs-1220 | cdwp-2    | cdty-STD |          |

OCT-11-1993 13:29 TRANE CO

787 2166 P.04

**TRADE CENTRAVAC**

ARCHITECT

ENGINEER

SAN ANTONIO, TEXAS

**BROOKE ARMY MEDICAL CENTER**

ORDER DATE: 7-9-73

CUSTOMER ORDER NO. 1535

CUSTOMER ACCOUNT NO. L6-81-7399-9

DATA SHEET

SHIP DATE MAY

TO: NCT 30

FROM: LAX FRT. ALL'D

MARK PACKAGES

BROOKS ARMY MEDICAL CENTER MARK B/L:

CALL 826-3271 24 HRS. BEFORE

ATTEMPTING DELIVERY.

SHIP VIA TRUCK-CALL TRAFFIC FOR

ROUTING-SEE ABOVE

COLLECT PSE

L.C. MOSEL CO.

P.O. BOX 12070

SAN ANTONIO, TEXAS 78212

L.C. MOSEL CO.

C/O BROOKE ARMY MEDICAL CENTER

FT. SAM HOUSTON

SAN ANTONIO, TEXAS 78234

FILE COPY

|                                                                    |  |                      |  |                          |  |                  |  |               |  |
|--------------------------------------------------------------------|--|----------------------|--|--------------------------|--|------------------|--|---------------|--|
| TAX CHILLER 1                                                      |  | SUBMITTAL 04513-7105 |  | STD. WOOD-M              |  | ORDERING NO.     |  | CYN 47        |  |
| MODEL                                                              |  | COMPA. 59            |  | 4160 20/2 3600 RPM LA    |  | 70550346         |  |               |  |
| PEV-40                                                             |  | PURGE UNIT           |  | 480 10/2 1800 RPM        |  | 70550008         |  |               |  |
| DESIGN CAPACITY 436                                                |  | TONS REQUIRING 432   |  | RTW 4 GPM AUL' CH. WATER |  | Comp. Motor Dwg. |  |               |  |
|                                                                    |  | ENTERING WATER       |  | LEAVING WATER            |  | GPM              |  | PRESSURE DROP |  |
| EVAP. 54 °F                                                        |  | 48.8 °F              |  | 2260                     |  | 17 FT.           |  | .0005         |  |
| COND. 85 °F                                                        |  | 95 °F                |  | 1415                     |  | 19 FT.           |  | .001          |  |
|                                                                    |  |                      |  |                          |  |                  |  | 1 PASS        |  |
|                                                                    |  |                      |  |                          |  |                  |  | 2 PASS LH     |  |
| SPECIAL FEATURES                                                   |  |                      |  |                          |  |                  |  |               |  |
| COMPRESSOR MOTOR STARTER 3 FULL VOLTAGE 12-120V 0 AUTO TRANSFORMER |  |                      |  |                          |  |                  |  |               |  |
| 17 OPEN 0 CLOSED TRANSITION STAR DELTA                             |  |                      |  |                          |  |                  |  |               |  |
| 4160 60 39 283 62 50                                               |  |                      |  |                          |  |                  |  |               |  |
| SPECIAL FEATURES ORD. FOR DIRECT SHIPMENT                          |  |                      |  |                          |  |                  |  |               |  |
| B2 2 2 2 2 2 2 2 2 2                                               |  |                      |  |                          |  |                  |  |               |  |
| NEC210 2A-15 PRESSURE ELECTRIC SWITCH                              |  |                      |  |                          |  |                  |  |               |  |
| TEMPERATURE CONTROLLED                                             |  |                      |  |                          |  |                  |  |               |  |
| FLOW SWITCH 150 PSI NEMA 1                                         |  |                      |  |                          |  |                  |  |               |  |
| NAMEPLATE                                                          |  |                      |  |                          |  |                  |  |               |  |
| 880 POUNDS REPRESENTATIVE 811 811 ORD. FOR DIRECT SHIPMENT.        |  |                      |  |                          |  |                  |  |               |  |
| T9/0K                                                              |  |                      |  |                          |  |                  |  |               |  |

Basic Dwg. A4516-9678-5

Impeller 29.0

C-2 D-2

Comm. Exp. K-5

Lead Limit Relay 5.79

Sup. LTC Setting 37

FOR SRS 1411.00

STARTER SUBMITTAL

OFFICE

F5228000

13170063

13040029

0857-1

PURCHASE C.O. TO

|                   |                               |          |               |                       |                       |                       |                       |
|-------------------|-------------------------------|----------|---------------|-----------------------|-----------------------|-----------------------|-----------------------|
| ENTERED 662       | DATE 10/11/93                 | ON ORDER | NO. OF REMITS | APPROVAL NOT REQUIRED | APPROVAL NOT REQUIRED | APPROVAL NOT REQUIRED | APPROVAL NOT REQUIRED |
| ORDER CLASS H-231 | JOB NO. 21                    | EXEMPT   | TAX STATUS    | TAX CODE 341          | TAX AMOUNT            | SALTS ORDER           |                       |
| OFFICE SALES      | SAN ANTONIO 558 FT. WORTH 355 |          |               | SNOW L6-C66           |                       |                       | CALLAHAN L3-M31       |
| BILLING           | DD                            | 1161     | 115 73        | FILE COPY             |                       |                       |                       |

710 tons

2260 GPM

27 Ft. Evap P.D.

19 Ft. Cond P.D.

2830 GPM

715

L6-R 2

1

| JOB NAME AND LOCATION                        |              | Brooke Army Medical Center |      |              |                                |             | ELEVATION ABOVE SEA LEVEL | S.O. NO.               | 167231                       |                      |
|----------------------------------------------|--------------|----------------------------|------|--------------|--------------------------------|-------------|---------------------------|------------------------|------------------------------|----------------------|
| #1                                           |              | FIFTEEN MINUTE INTERVALS   |      |              |                                |             | FT.                       | MODEL NO.              | PGY-4D-U2-D2                 |                      |
| VOLTS                                        |              | A-R                        | 4160 | 4160         | 4160                           | 4160        | 4160                      | 4160                   | IMMEDIATE DATA               |                      |
|                                              |              | A-C                        | 4160 | 4160         | 4160                           | 4160        | 4160                      | 4160                   | CTV                          | 371                  |
|                                              |              | C-R                        | 4160 | 4160         | 4160                           | 4160        | 4160                      | 4160                   | PNL                          | 4583                 |
| AMPERES LINE                                 | 1            | 55                         | 35   | 25           | 20                             | 18          | 18                        | 18                     | WPK                          | 118                  |
|                                              | 2            | 55                         | 35   | 25           | 20                             | 18          | 18                        | 18                     | WPK                          | 52                   |
|                                              | 3            | 55                         | 35   | 25           | 20                             | 18          | 18                        | 18                     | WPK                          | 1080                 |
|                                              | 4            |                            |      |              |                                |             |                           |                        | WPK                          |                      |
|                                              | 5            |                            |      |              |                                |             |                           |                        | WPK                          |                      |
| CDS WATER IN                                 |              |                            | 82   | 86           | 84                             | 80          | 76                        | 78                     | COM                          |                      |
| CDS WATER OUT                                |              |                            | 92   | 92           | 90                             | 82          | 78                        | 80                     | COM                          |                      |
| CONDENSING TEMP.                             |              |                            | 96   | 96           | 92                             | 86          | 80                        | 82                     | COM                          |                      |
| CHILLED WATER IN                             |              |                            | 66   | 51           | 49                             | 48          | 47                        | 47                     | LTC                          | CUT OUT 32 CUT IN 42 |
| CHILLED WATER OUT                            |              |                            | 61   | 48           | 47                             | 47          | 46                        | 46                     | LTC                          |                      |
| EVAP. TEMP.                                  |              |                            | 46   | 43           | 44                             | 45          | 45                        | 45                     | OPC                          | 4 8                  |
| EVAP. PRESS.                                 |              |                            | 15"  | 16"          | 16"                            | 16"         | 16"                       | 16"                    | WPC                          | 14 9                 |
| CDS PRESS.                                   |              |                            | 10#  | 7#           | 5#                             | 3#          | 2.5#                      | 3#                     | WTC                          | 110 105              |
| NET OIL PRESS.                               |              |                            | 14#  | 14#          | 14#                            | 14#         | 14#                       | 14#                    | DIL SUMP T.C.                | 135 130              |
| OIL TEMP. SUMP                               |              |                            | 135  | 135          | 135                            | 135         | 135                       | 135                    | OIL COOLFR T.C.              | 117 117              |
| OIL TEMP. TO BRU.                            |              |                            | 115  | 117          | 117                            | 117         | 117                       | 117                    |                              |                      |
| PRESSURE TESTED AT                           |              |                            | 8    | PSIG         | MOTOR DATA                     |             |                           |                        | STARTER DATA                 |                      |
| EVACUATED                                    |              |                            | .04  | MM. Hg.      | MFR.                           | Louis Allis |                           |                        | MFR.                         | General Electric     |
| STANDING VACUUM TEST                         |              |                            | 1.0  | MM. Hg.      | FRAME                          | RCS 1972    |                           |                        | TYPE                         | X Line               |
| MOTOR LIQUID LEVEL                           |              |                            | 14   | MIN. TO FILL | SERIAL                         | 3385061M001 |                           |                        | OVERLOAD SETTING             | 62                   |
| REFRIG. CHARGE                               |              |                            | 800  | LB.          | VOLTS                          | 4160        | AMPS.                     | 59                     | CTC.                         | 60                   |
| CDS. PRESS. DROP                             | DESIGN       |                            | 8.2  | PSI          | BEFORE BREAKING HOLDING CHARGE | PH 1        | 800                       |                        | TRIP AMPS                    | 62                   |
|                                              | ACTUAL       |                            | 8.4  | PSI          |                                | PH 2        | 800                       |                        | "AUTO TRANS. STAR DELTA ETC. |                      |
| EVAP. PRESS. DROP                            | DESIGN       |                            | 7.4  | PSI          | AFTER CHARGING WITH R-11       | PH 3        | 800                       |                        | NO. OF DAYS ON JOB           | 5                    |
|                                              | ACTUAL       |                            | 4.0  | PSI          |                                | PH 1        | 200                       |                        | DATE STARTED                 | October 24, 1973     |
| LOAD LIMIT RELAY                             | AMP. SETTING |                            | 5.5  |              | PH 2                           | 200         |                           | SERVICE ENGR.          | R. H. Schmiedt               |                      |
|                                              | CT RATIO     |                            | 50:5 |              | PH 3                           | 200         |                           | OWNER'S REPRESENTATIVE | Charles Torppenvier          |                      |
| NUMBER OF LEAKS FOUND, LOCATION AND COMMENTS |              |                            |      |              |                                |             |                           |                        |                              |                      |



OCT-11-1993 13:28 TRANE CO 787 2166 P.02  
 SELLING SALES OFFICE ~~TRANE~~ STARTING SALES OFFICE ~~TRANE~~

**CENTRAVAC INSPECTION, SHIPMENT, AND START-UP ASSIGNMENT RECORD**

JOB NAME Beck's Home Air Conditioning UNIT SERIAL NO. 16786  
 LOCATION Spa, Auburn, Texas SALES ORDER NO. 26-2291  
 SOLD TO A.C. Hise Co. SHIPMENT DATE \_\_\_\_\_  
 DWG. LIST 4516-9678 START-UP DATE 10-24-73  
 SIZE Rev. 42 C-2 D-3-29.0

| MOTOR AND STARTER INFORMATION <u>50-5</u> |                    |             |                |            |            |             |             |           |          |  |
|-------------------------------------------|--------------------|-------------|----------------|------------|------------|-------------|-------------|-----------|----------|--|
| DESCRIPTION & CODE                        | SERIAL NO.         | MGR.        | FRAME          | BHP/KW     | FLA        | LRA         | VOLTS       | CYCLES    | PHASE    |  |
| Compressor Motor <u>4516-9678</u>         | <u>37854611001</u> | <u>LA</u>   | <u>PLS1972</u> | <u>-</u>   | <u>59</u>  | <u>283</u>  | <u>4160</u> | <u>60</u> | <u>3</u> |  |
| Oil Pump Motor <u>4516-9678</u>           |                    | <u>CEUT</u> | <u>F4817</u>   | <u>1/4</u> | <u>52</u>  | <u>2.88</u> | <u>480</u>  | <u>60</u> | <u>3</u> |  |
| Purge Unit Motor                          | <u>N-3</u>         | <u>CEUT</u> | <u>G48</u>     | <u>1/4</u> | <u>6.0</u> | <u>-</u>    | <u>115</u>  | <u>60</u> | <u>1</u> |  |
| Compressor Starter                        |                    |             |                |            |            |             |             |           |          |  |

| UNIT MODEL NUMBERS |             |            |           | EVAPORATOR  | CONDENSER |
|--------------------|-------------|------------|-----------|-------------|-----------|
| General            | <u>371</u>  | Cond.      |           | Combination |           |
| Compr.             | <u>1080</u> | Evap.      |           | Pass        | <u>LH</u> |
| Cnt. Panel         | <u>4583</u> | Purge Unit | <u>52</u> | Special     | <u>2</u>  |
| Base and Tank      | <u>118</u>  | Remarks    |           |             |           |

Tag: Chiller

| COMPRESSOR AND RUN-IN TEST INFORMATION                   |                                                                                                      |                                                              |  |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--|
| Date <u>7-2-73</u>                                       | Type Refrigerant <u>R11</u>                                                                          | Hour Run-in Test <u>3144</u>                                 |  |
| Vibration Readings<br>(.001 in. max.)                    | a. 1st Stage (Terminal - Hor. <u>0.025</u><br>Ver. <u>0.025</u> )                                    | b. 2nd Stage (Compr.) Hor. <u>0.032</u><br>Ver. <u>0.029</u> |  |
| GV Return Oil<br>Flow @ 12 psig                          | a. 1st Stage Bearing <u>1</u> min. <u>1</u> sec.<br>b. 2nd Stage Bearing <u>1</u> min. <u>1</u> sec. | 6 sec. max. and<br>20 min. min.                              |  |
| PCV Return Oil <u>Static</u><br>Flow @ 12 psig in 2 min. | a. Terminal Bearing <u>0</u> pints.<br>b. Compressor Bearing <u>1</u> pints.                         | (1 - 4 pints min. & max.)<br>(1 - 3 pints min. & max.)       |  |

- COMPRESSOR ASSEMBLY**
- Valve
  - Suction Cover
  - Diaphragm Plate
  - Impeller
  - Seal Clearances
  - Impeller axial clearance.
  - Motor insulation 100 megohms (10 megohms resistance minimum)
  - Cooling water of water cooled motor \_\_\_\_\_°F (110°F maximum outlet temperature)
  - Oil pump amperage 14 amps (at 12 psig oil pressure).
  - Float valve
  - Comments 06A Tube C-2 7x14
- a. 1st Stage Dwg. No. 4513-2845 b. 2nd Stage Dwg. No. 4518-2065  
 a. 1st Stage Dwg. No. \_\_\_\_\_ b. 2nd Stage Dwg. No. 4516-4365  
 a. Dwg. No. 4952 b. 2nd Stage Dwg. No. \_\_\_\_\_  
 a. 1st Stage Dwg. No. 4513-5843 b. 2nd Stage Dwg. No. 4512-5844  
 a. Shaft Seal - 1st stage 003 b. Impeller Seal - 1st stage 015-019  
 2nd stage 003 2nd stage 018-021  
 a. 1st stage \_\_\_\_\_ b. 2nd stage \_\_\_\_\_

Dept. 437 forward original to Products Engineering when complete.

INSPECTOR W. Bartlett APPROVAL FOR SHIPMENT FOREMAN W. Pinto

7168

FILE COPY

|                                                                  |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
|------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------|--|--------------------------------------|--|------------------------------------|--|----------------------|--|
| ARCHITECT                                                        |  | DATE SHIPPED                                                                                    |  | BILL OF LADING NO.                   |  | INVOICE DATE                       |  | INVOICE NO.          |  |
| ENGINEER                                                         |  | TERMINAL DATE RET                                                                               |  | P.O.D.                               |  | L6-E2                              |  | NO. INVOICE          |  |
| PROJECT AND LOCATION<br>SAN ANTONIO, TEXAS                       |  | NET 30                                                                                          |  | LAX FRT. ALL'D                       |  | 3                                  |  |                      |  |
| BROOKS ARMY MEDICAL CTR                                          |  | MARK PACKAGES                                                                                   |  | BROOKS ARMY MEDICAL CENTER MARK      |  | CALL 826-3271 24 HRS. BEFORE       |  | ATTEMPTING DELIVERY  |  |
| ORDER DATE<br>3-8-73                                             |  | CUSTOMER ORDER NO.<br>1535                                                                      |  | CUSTOMER ACCOUNT NO.<br>L6-81-7149-9 |  | SHIP VIA<br>TRUCK-CALL TRAFFIC FOR |  | ROUTING-SEE ABOVE    |  |
| L.C. MOSEL CO.<br>P.O. BOX 12070<br>SAN ANTONIO, TEXAS 78212     |  | L.C. MOSEL CO.<br>C/O BROOKE ARMY MEDICAL CENTER<br>FT. SAM HOUSTON<br>SAN ANTONIO, TEXAS 78234 |  |                                      |  |                                    |  |                      |  |
| TAG<br>CHILLER 2                                                 |  | SUBMITTAL<br>DRAWING<br>04514-490                                                               |  | STD. WIRING<br>DRAWING               |  | ORDERING NO.<br>70550386           |  | CTV 47               |  |
| MODEL<br>PCV-4K                                                  |  | COMP. 60.4 AMP. 4160 RPM 5000 RPM LA                                                            |  | PURGE UNIT 1/2 HP 1150/1 1000 RPM    |  | OIL PUMP 1/2 HP 480 RPM 1200 RPM   |  | CENT. E48YT          |  |
| DESIGN CAPACITY 451 TONS REQUIRING 432 KW 4.00 HP AUX. CL. WATER |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| EVAP. 48.8 °F                                                    |  | LEAVING WATER 44 °F                                                                             |  | GPM 2260                             |  | PRESSURE DROP 10 FT.               |  | FOULING FACTOR .0005 |  |
| COND. 85 °F                                                      |  | 95 °F                                                                                           |  | 1415                                 |  | 15 FT.                             |  | .001                 |  |
| SPECIAL FEATURES                                                 |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1- COMPRESSOR MOTOR STARTER. FULL VOLTAGE STARTER                |  | 1- AUTO TRANSFORMER                                                                             |  |                                      |  |                                    |  |                      |  |
| 1- OPEN. 1- CLOSED TRANSITION STAG DELTA                         |  | 1- POTENTIAL REACTOR                                                                            |  |                                      |  |                                    |  |                      |  |
| 4160 V 60 Hz 3 Ph 60.4 KVA 350 LBS 630T TRANSFORMER 50           |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| SPECIAL FEATURES. ORD. FOR DIRECT SHIPMENT.                      |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1- HERCOLD 2A-1-0 PRESSURE ELECTRIC SWITCH                       |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1- TEMPERATURE CONTROLLER                                        |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1- FLOW SWITCH 150 PSI NEMA 1                                    |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1- NAMEPLATE                                                     |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| 1100 POUNDS REFRIGERANT CHILL DRILL ORD. FOR DIRECT SHIPMENT.    |  |                                                                                                 |  |                                      |  |                                    |  |                      |  |
| ENTERED<br>662                                                   |  | RECEIVED                                                                                        |  | NO. OF INVOICES                      |  | NO. OF INVOICES                    |  | NO. OF INVOICES      |  |
| ORDER CLASS<br>H231                                              |  | TAX CODE<br>EXEMPT                                                                              |  | TAX CODE<br>341                      |  | TAX CODE                           |  | TAX CODE             |  |
| OFFICE ORDER<br>MEN & DATE                                       |  | SAN ANTONIO 63V                                                                                 |  | FT. WORTH 33V                        |  | CALLAHAN                           |  | L6-E2                |  |
| BILLING<br>11/11/93                                              |  | L6-C06                                                                                          |  | L3-K31                               |  | 300                                |  | 11/11/93             |  |
| 11/11/93                                                         |  | 11/11/93                                                                                        |  | 11/11/93                             |  | 11/11/93                           |  | 11/11/93             |  |

FILE COPY

OCT-11-1993 13:30

TRANE CO

787 2166

P.06

| JOB NAME AND LOCATION                        |              | Brooke Army Medical Center<br>San Antonio, Texas |      |      |      |      | ELEVATION ABOVE SEA LEVEL | S.O. NO.        | 16-E231      |                        |                              |          |
|----------------------------------------------|--------------|--------------------------------------------------|------|------|------|------|---------------------------|-----------------|--------------|------------------------|------------------------------|----------|
|                                              |              |                                                  |      |      |      |      | FT.                       | MODEL NO.       | PCV-4X-C1-n1 |                        |                              |          |
|                                              |              |                                                  |      |      |      |      |                           | SERIAL NO.      | L3216791     |                        |                              |          |
| #2                                           |              | FIFTEEN MINUTE INTERVALS                         |      |      |      |      |                           | NAMEPLATE DATA  |              |                        |                              |          |
| VOLTS                                        | A-B          | 4160                                             | 4160 | 4160 | 4160 | 4160 | 4160                      | CTV             | 372          |                        |                              |          |
|                                              | A-C          | 4160                                             | 4160 | 4160 | 4160 | 4160 | 4160                      |                 |              |                        |                              |          |
|                                              | C-B          | 4160                                             | 4160 | 4160 | 4160 | 4160 | 4160                      | PNL             | 4583         |                        |                              |          |
| AMPERE LINE                                  | 1            | 58                                               | 40   | 40   | 35   | 30   |                           | KKE HD          | 118          |                        |                              |          |
|                                              | 2            | 58                                               | 40   | 40   | 35   | 30   |                           | PRG.            | 52           |                        |                              |          |
|                                              | 3            | 58                                               | 40   | 40   | 35   | 30   |                           | COM             | 1081         |                        |                              |          |
|                                              | 4            |                                                  |      |      |      |      |                           | EVP             |              |                        |                              |          |
|                                              | 5            |                                                  |      |      |      |      |                           | CO3             |              |                        |                              |          |
| COOL. WATER IN                               |              | 84                                               | 83   | 84   | 84   | 84   |                           | LTC             | CUT OUT      | CUT IN                 |                              |          |
| CO3. WATER OUT                               |              | 94                                               | 90   | 91   | 91   | 90   |                           | OPC             | 32           | 42                     |                              |          |
| CONDENSING TEMP.                             |              | 96                                               | 95   | 95   | 95   | 93   |                           | NPC             | 4            | 8                      |                              |          |
| CHILLED WATER IN                             |              | 55                                               | 50   | 46   | 45   | 43   |                           | HPC             | 14           | 9                      |                              |          |
| CHILLED WATER OUT                            |              | 50                                               | 47   | 44   | 43   | 42   |                           | WTC             | 110          | 105                    |                              |          |
| EVAP. TEMP.                                  |              | 43                                               | 42   | 40   | 40   | 38   |                           | OIL SUMP T.C.   | 135          | 130                    |                              |          |
| EVAP. PRESS.                                 |              | 16"                                              | 16"  | 16"  | 16"  | 16"  |                           | OIL COOLER T.C. | 117          | 117                    |                              |          |
| CO3 PRESS.                                   |              | 10 #                                             | 8#   | 7.5# | 7#   | 6#   |                           |                 |              |                        |                              |          |
| NET OIL PRESS.                               |              | 14#                                              | 14#  | 14#  | 14#  | 14#  |                           |                 |              |                        |                              |          |
| OIL TEMP. SUMP                               |              | 135                                              | 135  | 135  | 135  | 135  |                           |                 |              |                        |                              |          |
| OIL TEMP. TO DRG.                            |              | 117                                              | 117  | 117  | 117  | 117  |                           |                 |              |                        |                              |          |
| PRESSURE TESTED AT                           |              | 7 PSIG                                           |      |      |      |      | MOTOR DATA                |                 | STARTER DATA |                        |                              |          |
| EVACUATED                                    |              | .06 MM.                                          |      |      |      |      | MFR.                      | Louis Allin     |              | MFR.                   | General Electric             |          |
| STANDING VACUUM TEST                         |              | 1.2 MM. RISE                                     |      |      |      |      | FRANC                     | RGS 1976        |              | TYPE                   | X Line                       |          |
| MOTOR LIQUID LEVEL                           |              | 12 MRS.                                          |      |      |      |      | SERIAL                    | 3389505M001     |              | OVERLOAD SETTING       | 62                           |          |
| REFRIG. CHARGE                               |              | 1100 LBS.                                        |      |      |      |      | VOLTS                     | 440             | AMPS         | 60.4                   | CTC                          | 60       |
| CO3. PRESS. DROP                             | DESIGN       | 6.4 PSI                                          |      |      |      |      | INSULATION RESISTANCE     | PH 1            | 600          |                        | TIME TO TRIP                 | 1 Minute |
|                                              | ACTUAL       | 6.6 PSI                                          |      |      |      |      |                           | PH 2            | 600          |                        | TRIP AMPS                    | 63       |
| EVAP. PRESS. DROP                            | DESIGN       | 4.3 PSI                                          |      |      |      |      | AFTER CHARGING WITH Q-11  | PH 1            | 600          |                        | *AUTO TRANS. STAR DELTA ETC. |          |
|                                              | ACTUAL       | 3.0 PSI                                          |      |      |      |      |                           | PH 2            | 600          |                        | NO. OF DAYS ON JOB           | 3        |
| LOAD LIMIT RELAY                             | AMP. SETTING | 5.8                                              |      |      |      |      | PH 1                      | 200             |              | DATE STARTED           | 10/24/73                     |          |
|                                              | CT RATIO     | 50 - 5                                           |      |      |      |      | PH 2                      | 200             |              | SERVICE ENG.           | R. H. Schmidt                |          |
| NUMBER OF LEAKS FOUND, LOCATION AND COMMENTS |              |                                                  |      |      |      |      | PH 3                      | 200             |              | OWNER'S REPRESENTATIVE | Charles Torppenvier          |          |

77.09 - (171)

THE TRANE COMPANY, 11000 W. 11TH AVE., MINNEAPOLIS, MN 55426

OCT-11-1993 13:30

TRANE CO

787 2166

P.05

## CENTRAVAC INSPECTION, SHIPMENT, AND START-UP ASSIGNMENT RECORD

JOB NAME General EngineeringLOCATION San Antonio, TexasSOLD TO L.D. Misco Co.DWG. LIST 516-96770SIZE Rev. 4K-C1-D1-300UNIT SERIAL NO. 16791SALES ORDER NO. 46-52513

SHIPMENT DATE

START-UP DATE 7-17-73  
10-24-73

| MOTOR AND STARTER INFORMATION 50-5 |              |      |        |        |      |     |       |        |       |
|------------------------------------|--------------|------|--------|--------|------|-----|-------|--------|-------|
| DESCRIPTION & CODE                 | SERIAL NO.   | MGR. | FRAME  | BHP/KW | FLA  | LRA | VOLTS | CYCLES | PHASE |
| Compressor Motor                   | 3387505/1001 | LA   | PCS197 |        | 60   | 350 | 460   | 60     | 3     |
| Oil Pump Motor                     | N-2          | Cent | F4871  | 1/4    | 1.52 | 128 | 480   | 60     | 3     |
| Purge Unit Motor                   | N-3          | Cent | G48    | 1/2    | 6.0  |     | 115   | 60     | 1     |
| Compressor Starter                 |              |      |        |        |      |     |       |        |       |

| UNIT MODEL NUMBERS |      |            |    | EVAPORATOR  |  | CONDENSER |  |
|--------------------|------|------------|----|-------------|--|-----------|--|
| General            | 372  | Cond.      |    | Combination |  | RH        |  |
| Compr.             | 1081 | Evap.      |    | Pass        |  | A         |  |
| Ctrl. Panel        | 4583 | Purge Unit | 52 | Special     |  |           |  |
| Base and Tank      | 118  | Remarks    |    |             |  |           |  |

Tag: Chiller 2

| COMPRESSOR AND RUN-IN TEST INFORMATION     |                                                                                                                              |                  |     |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------|-----|
| Date                                       | 7-5-73                                                                                                                       | Type Refrigerant | R11 |
| Vibration Readings<br>(.001 in. max.)      | a. 1st Stage (Terminal - Hor. <u>0006</u><br>Vert. <u>00054</u> )                                                            |                  |     |
| CTV Return Oil<br>Flow @ 12 psig.          | b. 2nd Stage (Compr.) Hor. <u>00034</u><br>Vert. <u>00032</u>                                                                |                  |     |
| PCV Return Oil<br>Flow @ 12 psig in 2 min. | a. 1st Stage Bearing min. 7 sec. 6 sec. max. and<br>b. 2nd Stage Bearing min. 7 sec. 20 min. min.                            |                  |     |
|                                            | a. Terminal Bearing min. 4 pints. (1 - 4 pints min. & max.)<br>b. Compressor Bearing min. 4 pints. (1 - 3 pints min. & max.) |                  |     |

## COMPRESSOR ASSEMBLY

1. Valve
2. Suction Cover
3. Diaphragm Plate
4. Impeller
5. Seal Clearances
6. Impeller axial clearance.
7. Motor insulation 100 megohms (10 megohms resistance minimum)
8. Cooling water of water cooled motor --- °F (110°F maximum outlet temperature)
9. Oil pump amperage 14 amps (at 12 psig oil pressure).
10. Float valve
11. Comments add tube code 7+14

Dept. 437 forward original to Products Engineering when complete.

INSPECTOR

Charles

APPROVAL FOR SHIPMENT

FOREMAN

McBrito

71.04

## GENERAL DATA

ABLE 18-1 — General Data

| Model                                       | CGAA 100 J  | CGAA 150 J  | CGAA 200 M                   | CGAA 250 M                   | CGAA 300 M                   | CGAA 400 F                   | CGAA 400 M                   |
|---------------------------------------------|-------------|-------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Compressor                                  | CRHJ-050    | CRHJ-075    | CRHM 200                     | CRHM 250                     | CRHM 300                     | 2FSC88                       | 2-CRHM 200                   |
| Unit Capacity Steps %                       | 100-50      | 100-50      | 100-50-25                    | 100-65-33                    | 100-65-33                    | 100-75-50-25                 | 100-75-50-25                 |
| Condenser <sup>1</sup>                      | CDS 286     | CDS 287     | CDS 272 (RH)<br>CDS 273 (LH) | CDS 274 (RH)<br>CDS 275 (LH) | CDS 276 (RH)<br>CDS 277 (LH) | CDS 278 (RH)<br>CDS 279 (LH) | CDS 278 (RH)<br>CDS 279 (LH) |
| Coil (H x L) Each                           | 21 x 168    | 24 x 203    | 30 x 53                      | 30 x 77                      | 30 x 77                      | 45 x 70                      | 45 x 70                      |
| Subcooler (H x L) Each                      | 3 x 168     | 6 x 203     | 5 x 53                       | 5 x 77                       | 5 x 77                       | 6.25 x 70                    | 6.25 x 70                    |
| Total Face Area Ft. <sup>2</sup>            | 28          | 42.3        | 25.78                        | 37.45                        | 37.45                        | 49.83                        | 49.83                        |
| Coil Rows Each                              | 1           | 1           | 3                            | 2                            | 3                            | 3                            | 3                            |
| Condenser Fans                              | 2-24" Prop. | 3-24" Prop. | 2-28" Prop.                  | 3-28" Prop.                  | 3-28" Prop.                  | 4-28" Prop.                  | 4-28" Prop.                  |
| CFM (Total)                                 | 8,450       | 12,650      | 12,400                       | 19,250                       | 19,250                       | 24,500                       | 24,500                       |
| Nominal RPM                                 | 825         | 825         | 1,140                        | 1,140                        | 1,140                        | 1,140                        | 1,140                        |
| Tip Speed FPM                               | 5,190       | 5,190       | 7,750                        | 7,750                        | 7,750                        | 7,750                        | 7,750                        |
| HP (Each)                                   | 1/8         | 1/8         | 1                            | 1                            | 1                            | 1                            | 1                            |
| Drive                                       | Direct      | Direct      | Direct                       | Direct                       | Direct                       | Direct                       | Direct                       |
| Evaporator                                  | EVP 295     | EVP 296     | EVP 297                      | EVP 298                      | EVP 299                      | EVP 301                      | EVP 300                      |
| Gal. H <sub>2</sub> O (Evap. + Unit Piping) | 7           | 9           | 10.8                         | 22.2                         | 20.4                         | 34.3                         | 34.3                         |
| Min. Startup °F (Std.)                      | 35°         | 35°         | 45°                          | 45°                          | 45°                          | 45°                          | 45°                          |
| (Low Ambient)                               | 0           | 0           | 0                            | 0                            | 0                            | 0                            | 0                            |
| Std. Unit Operation                         |             |             |                              |                              |                              |                              |                              |
| Fans on Above 65 F                          | 2           | 3           | 2                            | 3                            | 3                            | 4                            | 4                            |
| Fans on 65-45 F                             | 1           | 2           | 1                            | 2                            | 2                            | 2                            | 2                            |
| Fans on 45-35 F                             | 1           | 1           | 0                            | 1                            | 1                            | 1                            | 0                            |
| Unit Cut Off Temp °F (Std.)                 | 35°         | 35°         | 45°                          | 45°                          | 45°                          | 45°                          | 45°                          |
| Low Ambient Unit Oper.                      |             |             |                              |                              |                              |                              |                              |
| Fans on Above 65 F                          | 1           | 3           | 2                            | 3                            | 3                            | 4                            | 4                            |
| Fans on 65-45 F                             | 1           | 2           | —                            | 2                            | 2                            | 2                            | 2                            |
| Fans on 45-0 F                              | 1           | 2           | —                            | —                            | —                            | —                            | —                            |
| <sup>2</sup> Fans Modulate 65-0 F           | —           | —           | 1                            | —                            | —                            | —                            | —                            |
| <sup>2</sup> Fans Modulate 45-0 F           | —           | —           | —                            | 1                            | 1                            | 1                            | 2                            |
| Unit Cut Off Temp °F (Low Ambient)          | 0           | 0           | 0                            | 0                            | 0                            | 0                            | 0                            |
| Std and Low Ambient                         |             |             |                              |                              |                              |                              |                              |
| R-22 Charge (Lbs.)                          | 20          | 27.5        | 31                           | 37                           | 46                           | 60                           | 60                           |
| Total Unit Operating Wt.                    |             |             |                              |                              |                              |                              |                              |
| Incl. Refrigerant (Lbs.)                    | 1,090       | 1,316       | 1,950                        | 2,300                        | 2,450                        | 4,075                        | 4,075                        |
| Shipping Weight (Lbs.)                      | 1,125       | 1,250       | 1,990                        | 2,285                        | 2,440                        | 3,990                        | 3,990                        |

| Model                                       | CGAA 500 E                   | CGAA 500 M                   | CGAA 600 M                   | CGAA 750 E                   | CGAA 1000 E                  | CGAA 1200 R                  |
|---------------------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Compressor                                  | 2ESF48                       | 2-CRHM 250                   | 2-CRHM 300                   | 2ESG68                       | 2ESG88                       | 2-CRHR 500                   |
| Unit Capacity Steps %                       | 100-75-50-25                 | 100-63-50-33                 | 100-63-50-33                 | 100-67-50-33                 | 100-75-50-37                 | 100-83-50-33                 |
| Condenser <sup>1</sup>                      | CDS 280 (RH)<br>CDS 281 (LH) | CDS 280 (RH)<br>CDS 281 (LH) | CDS 282 (RH)<br>CDS 283 (LH) | CDS 290 (RH)<br>CDS 291 (LH) | CDS 292 (RH)<br>CDS 293 (LH) | CDS 294 (RH)<br>CDS 295 (LH) |
| Coil (H x L) Each                           | 48.75 x 95                   | 48.75 x 95                   | 50 x 95                      | 47.25 x 162                  | 47.25 x 200                  | 49.5 x 200                   |
| Subcooler (H x L) Each                      | 7.5 x 95                     | 7.5 x 95                     | 8.25 x 95                    | 6.75 x 162                   | 6.75 x 200                   | 7.5 x 200                    |
| Total Face Area Ft. <sup>2</sup>            | 74.2                         | 74.2                         | 74.2                         | 121.5                        | 150                          | 156                          |
| Coil Rows Each                              | 2                            | 2                            | 3                            | 2                            | 2                            | 3                            |
| Condenser Fans                              | 5-28" Prop.                  | 5-28" Prop.                  | 5-28" Prop.                  | 2-48" Prop.                  | 3-48" Prop.                  | 3-48" Prop.                  |
| CFM (Total)                                 | 38,500                       | 38,500                       | 36,900                       | 53,200                       | 76,900                       | 73,200                       |
| Nominal RPM                                 | 1,140                        | 1,140                        | 1,140                        | 610                          | 610                          | 610                          |
| Tip Speed FPM                               | 7,750                        | 7,750                        | 7,750                        | 7,660                        | 7,660                        | 7,880                        |
| HP (Each)                                   | 1                            | 1                            | 1                            | 7.5                          | 7.5                          | 7.5                          |
| Drive                                       | Direct                       | Direct                       | Direct                       | Belt                         | Belt                         | Belt                         |
| Evaporator                                  | EVP 303                      | EVP 302                      | EVP 304                      | EVP 307                      | EVP 308                      | EVP 309                      |
| Gal. H <sub>2</sub> O (Evap. + Unit Piping) | 33.6                         | 33.6                         | 29.4                         | 45                           | 52                           | 60                           |
| Min. Startup °F (Std.)                      | 45°                          | 45°                          | 45°                          | 30°                          | 30°                          | 25°                          |
| (Low Ambient)                               | 0                            | 0                            | 0                            | 0                            | 0                            | 0                            |
| Std. Unit Operation                         |                              |                              |                              |                              |                              |                              |
| Fans on Above 65 F                          | 6                            | 6                            | 8                            | 2                            | 3                            | 3                            |
| Fans on 65-45 F                             | 4                            | 4                            | 4                            | 1                            | 2                            | 2                            |
| Fans on 45-35 F                             | 2                            | 2                            | 2                            | 1                            | 1                            | 1                            |
| Unit Cut Off Temp °F (Std.)                 | 45°                          | 45°                          | 45°                          | 30°                          | 30°                          | 25°                          |
| Low Ambient Unit Oper.                      |                              |                              |                              |                              |                              |                              |
| Fans on Above 65 F                          | 6                            | 6                            | 6                            | 2                            | 3                            | 3                            |
| Fans on 65-45 F                             | 4                            | 4                            | 4                            | 1                            | 2                            | 2                            |
| Fans on 45-0 F                              | —                            | —                            | —                            | —                            | —                            | —                            |
| <sup>2</sup> Fans Modulate 65-0 F           | —                            | —                            | —                            | —                            | —                            | —                            |
| <sup>2</sup> Fans Modulate 45-0 F           | 1                            | 2                            | 2                            | —                            | —                            | —                            |
| Unit Cut Off Temp °F (Low Ambient)          | 0                            | 0                            | 0                            | 0                            | 0                            | 0                            |
| Std and Low Ambient                         |                              |                              |                              |                              |                              |                              |
| R-22 Charge (Lbs.)                          | 72                           | 72                           | 92                           | 180                          | 210                          | 310                          |
| Total Unit Operating Wt.                    |                              |                              |                              |                              |                              |                              |
| Incl. Refrigerant (Lbs.)                    | 4,810                        | 4,500                        | 4,760                        | 7,825                        | 8,850                        | 10,450                       |
| Shipping Weight (Lbs.)                      | 4,755                        | 4,445                        | 4,730                        | 7,780                        | 8,970                        | 10,470                       |

TES: 1. Right (RH) and Left Hand (LH) condenser coils determined by viewing unit from compressor end.  
2. 200, 230, 460 V units only.

TABLE 16-1 — Electrical Data

| Model       | Unit Characteristics (1) |               |                      |                      |               |                                   | Circuit Characteristics (2) |               |                      |               | Compressor |            |             |             | Condenser Fan Motors |         |          |
|-------------|--------------------------|---------------|----------------------|----------------------|---------------|-----------------------------------|-----------------------------|---------------|----------------------|---------------|------------|------------|-------------|-------------|----------------------|---------|----------|
|             | Line Volts (3)           | Voltage Range | Wire Sizing Amps (4) | Max. Inrush Amps (5) | Max. Fuse (6) | Recommended Dual Element Fuse (6) | Comp. Ckts. (Per Comp.)     |               | Fan/Control Circuit  |               | No.        | Type Start | FLA Ea. (7) | LRA Ea. (8) | No.                  | FLA Ea. | KW Ea.   |
|             |                          |               |                      |                      |               |                                   | Wire Sizing Amps (4)        | Max. Fuse (6) | Wire Sizing Amps (4) | Max. Fuse (6) |            |            |             |             |                      |         |          |
| CGAA-1006-J | 208/240                  | 187-264       | 63                   | 138                  | 80            | 60                                | —                           | —             | —                    | —             | 2          | XL         | 24.3        | 129         | 2                    | 2.3     | 1/2 H.P. |
| CGAA 1004-J | 440/480                  | 408-528       | 31                   | 72                   | 40            | 30                                | —                           | —             | —                    | —             | 2          | XL         | 12.2        | 66          | 2                    | 1.3     | 1/2 H.P. |
| CGAA 1806-J | 208/240                  | 187-264       | 98                   | 178                  | 110           | 80                                | —                           | —             | —                    | —             | 2          | XL         | 37.8        | 169         | 3                    | 2.3     | 1/2 H.P. |
| CGAA 1504-J | 440/480                  | 408-528       | 47                   | 91                   | 60            | 50                                | —                           | —             | —                    | —             | 2          | XL         | 18.9        | 85          | 3                    | 1.3     | 1/2 H.P. |
| CGAA 2006-M | 200                      | 180-220       | 127                  | 299                  | 200           | 150                               | —                           | —             | —                    | —             | 1          | PW         | 82          | 396/241     | 2                    | 6.0     | 1.2      |
| CGAA 2003-M | 230                      | 207-253       | 111                  | 260                  | 175           | 125                               | —                           | —             | —                    | —             | 1          | PW         | 80          | 345/210     | 2                    | 5.2     | 1.2      |
| CGAA 2004-M | 480                      | 414-506       | 58                   | 198                  | 90            | 60                                | —                           | —             | —                    | —             | 1          | XL         | 40          | 173         | 2                    | 2.6     | 1.2      |
| CGAA 2001-M | 480                      | 414-506       | 58                   | 130                  | 90            | 60                                | —                           | —             | —                    | —             | 1          | PW         | 40          | 173/105     | 2                    | 2.6     | 1.2      |
| CGAA 2005-M | 575                      | 517-633       | 46                   | 156                  | 70            | 50                                | —                           | —             | —                    | —             | 1          | XL         | 33          | 138         | 2                    | 2.0     | 1.2      |
| CGAA 2002-M | 575                      | 517-633       | 46                   | 100                  | 70            | 50                                | —                           | —             | —                    | —             | 1          | PW         | 33          | 138/84      | 2                    | 2.0     | 1.2      |
| CGAA 2506-M | 200                      | 180-220       | 163                  | 363                  | 250           | 175                               | —                           | —             | —                    | —             | 1          | PW         | 116         | 483/276     | 3                    | 6.0     | 1.2      |
| CGAA 2503-M | 230                      | 207-253       | 141                  | 315                  | 225           | 150                               | —                           | —             | —                    | —             | 1          | PW         | 100         | 420/240     | 3                    | 5.2     | 1.2      |
| CGAA 2504-M | 480                      | 414-506       | 71                   | 248                  | 110           | 80                                | —                           | —             | —                    | —             | 1          | XL         | 50          | 210         | 3                    | 2.6     | 1.2      |
| CGAA 2501-M | 480                      | 414-506       | 71                   | 158                  | 110           | 80                                | —                           | —             | —                    | —             | 1          | PW         | 50          | 210/120     | 3                    | 2.6     | 1.2      |
| CGAA 2505-M | 575                      | 517-633       | 56                   | 192                  | 90            | 80                                | —                           | —             | —                    | —             | 1          | XL         | 40          | 168         | 3                    | 2.0     | 1.2      |
| CGAA 2502-M | 575                      | 517-633       | 56                   | 120                  | 90            | 60                                | —                           | —             | —                    | —             | 1          | PW         | 40          | 168/96      | 3                    | 2.0     | 1.2      |
| CGAA 3006-M | 200                      | 180-220       | 186                  | 409                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | PW         | 134         | 551/322     | 3                    | 6.0     | 1.2      |
| CGAA 3003-M | 230                      | 207-253       | 161                  | 355                  | 250           | 175                               | —                           | —             | —                    | —             | 1          | PW         | 116         | 480/280     | 3                    | 5.2     | 1.2      |
| CGAA 3004-M | 480                      | 414-506       | 81                   | 278                  | 125           | 90                                | —                           | —             | —                    | —             | 1          | XL         | 58          | 240         | 3                    | 2.8     | 1.2      |
| CGAA 3001-M | 480                      | 414-506       | 81                   | 178                  | 125           | 90                                | —                           | —             | —                    | —             | 1          | PW         | 58          | 240/140     | 3                    | 2.8     | 1.2      |
| CGAA 3005-M | 575                      | 517-633       | 85                   | 216                  | 110           | 70                                | —                           | —             | —                    | —             | 1          | XL         | 47          | 192         | 3                    | 2.0     | 1.2      |
| CGAA 3002-M | 575                      | 517-633       | 85                   | 138                  | 110           | 70                                | —                           | —             | —                    | —             | 1          | PW         | 47          | 192/112     | 3                    | 2.0     | 1.2      |
| CGAA 4006-F | 200                      | 187-220       | 204                  | 506                  | 300           | 225                               | —                           | —             | —                    | —             | 1          | PW         | 144         | 533/390     | 4                    | 6.0     | 1.2      |
| CGAA 4003-F | 230                      | 207-253       | 185                  | 550                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | PW         | 130         | 614/450     | 4                    | 5.2     | 1.2      |
| CGAA 4004-F | 480                      | 414-506       | 92                   | 357                  | 150           | 110                               | —                           | —             | —                    | —             | 1          | XL         | 65          | 307         | 4                    | 2.8     | 1.2      |
| CGAA 4001-F | 480                      | 414-506       | 92                   | 275                  | 150           | 110                               | —                           | —             | —                    | —             | 1          | PW         | 65          | 307/225     | 4                    | 2.8     | 1.2      |
| CGAA 4005-F | 575                      | 517-633       | 78                   | 258                  | 125           | 90                                | —                           | —             | —                    | —             | 1          | XL         | 55          | 226         | 4                    | 2.0     | 1.2      |
| CGAA 4002-F | 575                      | 517-633       | 78                   | 197                  | 125           | 90                                | —                           | —             | —                    | —             | 1          | PW         | 55          | 226/185     | 4                    | 2.0     | 1.2      |
| CGAA 4006-M | 200                      | 180-220       | 233                  | 299                  | —             | —                                 | 115                         | 200           | 29                   | 45            | 2          | PW         | 92          | 396/241     | 4                    | 6.0     | 1.2      |
| CGAA 4003-M | 230                      | 207-253       | 203                  | 260                  | —             | —                                 | 100                         | 175           | 26                   | 40            | 2          | PW         | 80          | 345/210     | 4                    | 5.2     | 1.2      |
| CGAA 4004-M | 480                      | 414-506       | 102                  | 198                  | —             | —                                 | 50                          | 90            | 13                   | 20            | 2          | XL         | 40          | 173         | 4                    | 2.6     | 1.2      |
| CGAA 4001-M | 480                      | 414-506       | 102                  | 130                  | —             | —                                 | 50                          | 90            | 13                   | 20            | 2          | PW         | 40          | 173/105     | 4                    | 2.6     | 1.2      |
| CGAA 4005-M | 575                      | 517-633       | 84                   | 156                  | —             | —                                 | 42                          | 70            | 10                   | 15            | 2          | XL         | 33          | 138         | 4                    | 2.0     | 1.2      |
| CGAA 4002-M | 575                      | 517-633       | 84                   | 100                  | —             | —                                 | 42                          | 70            | 10                   | 15            | 2          | PW         | 33          | 138/84      | 4                    | 2.0     | 1.2      |
| CGAA 5006-E | 200                      | 187-220       | 250                  | 614                  | 400           | 250                               | —                           | —             | —                    | —             | 1          | PW         | 171         | 652/440     | 6                    | 6.0     | 1.2      |
| CGAA 5003-E | 230                      | 207-253       | 222                  | 555                  | 350           | 250                               | —                           | —             | —                    | —             | 1          | PW         | 155         | 750/505     | 6                    | 5.2     | 1.2      |
| CGAA 5004-E | 480                      | 414-506       | 114                  | 450                  | 175           | 125                               | —                           | —             | —                    | —             | 1          | XL         | 78          | 375         | 6                    | 2.6     | 1.2      |
| CGAA 5001-E | 480                      | 414-506       | 114                  | 328                  | 175           | 125                               | —                           | —             | —                    | —             | 1          | PW         | 78          | 375/253     | 6                    | 2.6     | 1.2      |
| CGAA 5005-E | 575                      | 517-633       | 94                   | 322                  | 125           | 110                               | —                           | —             | —                    | —             | 1          | XL         | 65          | 274         | 6                    | 2.0     | 1.2      |
| CGAA 5002-E | 575                      | 517-633       | 94                   | 233                  | 125           | 110                               | —                           | —             | —                    | —             | 1          | PW         | 65          | 274/185     | 6                    | 2.0     | 1.2      |
| CGAA 5006-M | 200                      | 180-220       | 299                  | 363                  | —             | —                                 | 145                         | 250           | 41                   | 50            | 2          | PW         | 116         | 483/276     | 6                    | 6.0     | 1.2      |
| CGAA 5003-M | 230                      | 207-253       | 260                  | 315                  | —             | —                                 | 125                         | 225           | 36                   | 45            | 2          | PW         | 100         | 420/240     | 6                    | 5.2     | 1.2      |
| CGAA 5004-M | 480                      | 414-506       | 130                  | 248                  | —             | —                                 | 63                          | 110           | 18                   | 25            | 2          | XL         | 50          | 210         | 6                    | 2.6     | 1.2      |
| CGAA 5001-M | 480                      | 414-506       | 130                  | 158                  | —             | —                                 | 63                          | 110           | 18                   | 25            | 2          | PW         | 50          | 210/120     | 6                    | 2.6     | 1.2      |
| CGAA 5005-M | 575                      | 517-633       | 104                  | 192                  | —             | —                                 | 50                          | 90            | 15                   | 20            | 2          | XL         | 40          | 168         | 6                    | 2.0     | 1.2      |
| CGAA 5002-M | 575                      | 517-633       | 104                  | 120                  | —             | —                                 | 50                          | 90            | 15                   | 20            | 2          | PW         | 40          | 168/96      | 6                    | 2.0     | 1.2      |

TABLE 16-1 — Electrical Data (Continued)

| Model        | Unit Characteristics (1) |               |                      |                      |               |                                   | Circuit Characteristics (2) |               |                      |               | Compressor |      |             |             | Condenser Fan Motors |         |        |
|--------------|--------------------------|---------------|----------------------|----------------------|---------------|-----------------------------------|-----------------------------|---------------|----------------------|---------------|------------|------|-------------|-------------|----------------------|---------|--------|
|              | Line Volt (3)            | Voltage Range | Wire Sizing Amps (4) | Max. Inrush Amps (5) | Max. Fuse (6) | Recommended Dual Element Fuse (6) | Comp. Ckt. (Per Comp.)      |               | Fan/Control Circuit  |               | No.        | Type | FLA Ea. (7) | LRA Ea. (8) | No.                  | FLA Ea. | KW Ea. |
|              |                          |               |                      |                      |               |                                   | Wire Sizing Amps (4)        | Max. Fuse (6) | Wire Sizing Amps (4) | Max. Fuse (6) |            |      |             |             |                      |         |        |
| CGAA 6006-M  | 200                      | 180-220       | 339                  | 409                  | —             | —                                 | 168                         | 300           | 41                   | 50            | 2          | PW   | 134         | 551/322     | 6                    | 6.0     | 1.2    |
| CGAA 6003-M  | 230                      | 207-253       | 294                  | 355                  | —             | —                                 | 145                         | 250           | 36                   | 45            | 2          | PW   | 116         | 480/280     | 6                    | 5.2     | 1.2    |
| CGAA 6004-M  | 460                      | 414-506       | 148                  | 278                  | —             | —                                 | 73                          | 125           | 18                   | 25            | 2          | XL   | 58          | 240         | 6                    | 2.6     | 1.2    |
| CGAA 6001-M  | 460                      | 414-506       | 148                  | 178                  | —             | —                                 | 73                          | 125           | 18                   | 25            | 2          | PW   | 58          | 240/140     | 6                    | 2.6     | 1.2    |
| CGAA 6005-M  | 575                      | 517-633       | 120                  | 216                  | —             | —                                 | 59                          | 100           | 15                   | 20            | 2          | XL   | 47          | 192         | 6                    | 2.0     | 1.2    |
| CGAA 6002-M  | 575                      | 517-633       | 120                  | 136                  | —             | —                                 | 59                          | 100           | 15                   | 20            | 2          | PW   | 47          | 192-112     | 6                    | 2.0     | 1.2    |
| CGAA 7506-E  | 200                      | 187-220       | 381                  | 987                  | 600           | 400                               | —                           | —             | —                    | —             | 1          | PW   | 264         | 958/715     | 2                    | 25.3    | 8.5    |
| CGAA 7503-E  | 230                      | 207-253       | 354                  | 1062                 | 600           | 400                               | —                           | —             | —                    | —             | 1          | PW   | 248         | 1100/822    | 2                    | 22      | 6.6    |
| CGAA 7504-E  | 460                      | 414-506       | 177                  | 610                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | XL   | 124         | 550         | 2                    | 11      | 5.5    |
| CGAA 7501-E  | 460                      | 414-506       | 177                  | 531                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | PW   | 124         | 550/411     | 2                    | 11      | 5.5    |
| CGAA 7505-E  | 575                      | 517-633       | 145                  | 496                  | 225           | 150                               | —                           | —             | —                    | —             | 1          | XL   | 101         | 400         | 2                    | 9       | 5.5    |
| CGAA 7502-E  | 575                      | 517-633       | 145                  | 397                  | 225           | 150                               | —                           | —             | —                    | —             | 1          | PW   | 101         | 400/301     | 2                    | 9       | 5.5    |
| CGAA 10006-E | 200                      | 187-220       | 505                  | 1308                 | 800           | 500                               | —                           | —             | —                    | —             | 1          | PW   | 342         | 1320/900    | 3                    | 25.3    | 8.5    |
| CGAA 10003-E | 230                      | 207-253       | 454                  | 1395                 | 700           | 500                               | —                           | —             | —                    | —             | 1          | PW   | 310         | 1520/1035   | 3                    | 22      | 5.5    |
| CGAA 10004-E | 460                      | 414-506       | 227                  | 940                  | 350           | 250                               | —                           | —             | —                    | —             | 1          | XL   | 155         | 760         | 3                    | 11      | 5.5    |
| CGAA 10001-E | 460                      | 414-506       | 227                  | 696                  | 350           | 250                               | —                           | —             | —                    | —             | 1          | PW   | 155         | 760/518     | 3                    | 11      | 5.5    |
| CGAA 10005-E | 575                      | 517-633       | 191                  | 699                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | XL   | 131         | 655         | 3                    | 9       | 5.5    |
| CGAA 10002-E | 575                      | 517-633       | 191                  | 523                  | 300           | 200                               | —                           | —             | —                    | —             | 1          | PW   | 131         | 565/379     | 3                    | 9       | 5.5    |
| CGAA 12006-R | 200                      | 180-220       | 589                  | 1028                 | —             | —                                 | 285                         | 500           | 86                   | 150           | 2          | PW   | 228         | 990/620     | 3                    | 25.3    | 8.5    |
| CGAA 12003-R | 230                      | 207-253       | 512                  | 895                  | —             | —                                 | 248                         | 400           | 75                   | 125           | 2          | PW   | 198         | 860/542     | 3                    | 22      | 5.5    |
| CGAA 12004-R | 460                      | 414-506       | 256                  | 610                  | —             | —                                 | 124                         | 200           | 38                   | 60            | 2          | XL   | 99          | 430         | 3                    | 11      | 5.5    |
| CGAA 12001-R | 460                      | 414-506       | 256                  | 468                  | —             | —                                 | 124                         | 200           | 38                   | 60            | 2          | PW   | 99          | 430/278     | 3                    | 11      | 5.5    |
| CGAA 12005-R | 575                      | 517-633       | 207                  | 490                  | —             | —                                 | 100                         | 175           | 31                   | 50            | 2          | XL   | 80          | 348         | 3                    | 9       | 5.5    |
| CGAA 12002-R | 575                      | 517-633       | 207                  | 364                  | —             | —                                 | 100                         | 175           | 31                   | 50            | 2          | PW   | 80          | 348/220     | 3                    | 9       | 5.5    |

## NOTES:

- Unit characteristics refer to entire unit considering single electrical source.
- Circuit characteristics refer to individual electrical sources to dual compressor units.
- Line voltage 3 phase 60 Hz. All motors 3 phase 60 Hz except variable speed PSC fan motors on 200, 230/460 volt Low Ambient (20-80 ton) units. Single phase power for these motor(s) and associated controls taken off internally and factory wired. 575 volt Low Ambient units (20-80 ton) use cycling 3 phase fans with dampers. Voltages available only as shown.
- Wire sizing amps per NEC 440-32 and NEC 440-33.
- Max. inrush current is peak rise or step surge of current which can occur during start (i.e., LRA of compressor first step plus LRA for all fan motors). Compressor sequence start on dual compressor units.
- Max. fuse sizing permitted by NEC 440-22 is 225% of largest component FLA plus remaining FLA. Recommended dual element fuses sized at approx. 150% of FLA of largest motor plus sum of the FLA's of the remaining motors.
- Compressor full load amps (FLA) based on the amp draw at 104 F air entering condenser; 62 F entering water and 50 F leaving water; nominal line voltage.

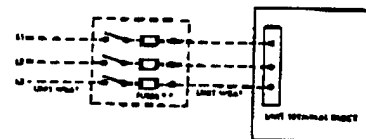
Full winding/part winding.

Voltage phase unbalance should not exceed 2%.

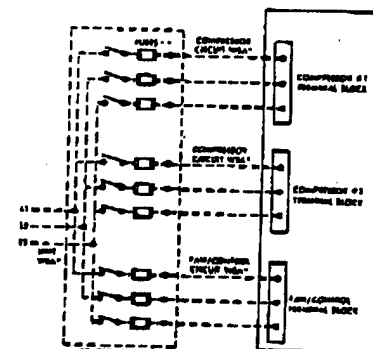
- Local codes may supersede NEC.

## Field Connections

COMPRESSOR UNITS CGAA 100-150J, 200-300M, 400F, 600-1000E



DUAL COMPRESSOR UNITS CGAA 400-600M, 1200R



\*Wire Sizing Amps - See Electrical Data Table

\*\*For Recommendations, See Electrical Data Table

TABLE 14-1 — Capacities (Continued)

| CGAA - 600 E              |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|---------------------------|-------|-------|-------|-------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|----|
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 43.5  | 104.4 | 44.6  | 40.3                                      | 96.7  | 47.2  | 37.4  | 89.9  | 49.7  | 34.8  | 83.5  | 51.8  |       |     |    |
| 42                        | 44.9  | 107.8 | 45.4  | 41.6                                      | 99.9  | 48.1  | 38.8  | 92.9  | 50.7  | 35.9  | 86.3  | 52.8  |       |     |    |
| 44                        | 46.3  | 111.3 | 46.2  | 42.9                                      | 103.1 | 49.0  | 40.0  | 96.0  | 51.6  | 37.0  | 88.9  | 53.7  |       |     |    |
| 45                        | 47.1  | 113.1 | 46.6  | 43.1                                      | 104.9 | 49.4  | 40.7  | 97.8  | 52.0  | 37.7  | 90.3  | 54.2  |       |     |    |
| 46                        | 47.8  | 114.9 | 46.9  | 44.3                                      | 106.6 | 49.8  | 41.3  | 99.1  | 52.3  | 38.3  | 91.7  | 54.8  |       |     |    |
| 48                        | 49.3  | 118.3 | 47.7  | 45.8                                      | 110.0 | 50.7  | 42.6  | 102.3 | 53.2  | —     | —     | —     |       |     |    |
| 50                        | 50.8  | 121.8 | 48.4  | 47.3                                      | 113.5 | 51.5  | 44.0  | 105.8 | 54.1  | —     | —     | —     |       |     |    |
| CGAA - 600 M              |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 44.4  | 106.5 | 53.0  | 41.8                                      | 99.7  | 58.5  | 38.8  | 92.5  | 60.3  | 36.5  | 85.1  | 64.1  |       |     |    |
| 42                        | 45.9  | 110.2 | 54.1  | 42.9                                      | 103.0 | 57.7  | 39.9  | 95.8  | 61.4  | 36.8  | 87.9  | 65.5  |       |     |    |
| 44                        | 47.4  | 113.7 | 55.2  | 44.4                                      | 106.8 | 58.9  | 41.3  | 99.0  | 62.7  | 37.8  | 90.7  | 66.8  |       |     |    |
| 45                        | 48.2  | 115.8 | 55.8  | 45.2                                      | 108.5 | 59.5  | 42.0  | 100.7 | 63.3  | 38.4  | 92.2  | 67.3  |       |     |    |
| 46                        | 49.0  | 117.5 | 56.3  | 46.0                                      | 110.4 | 60.0  | 42.8  | 102.4 | 63.9  | 39.0  | 93.8  | 67.9  |       |     |    |
| 48                        | 50.8  | 121.4 | 57.3  | 47.5                                      | 114.0 | 61.2  | 44.1  | 105.7 | 65.1  | 40.2  | 96.8  | 69.1  |       |     |    |
| 50                        | 52.2  | 125.3 | 58.4  | 49.1                                      | 117.8 | 62.3  | 45.5  | 109.1 | 66.3  | 41.5  | 99.7  | 70.4  |       |     |    |
| CGAA - 800 M              |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 54.0  | 129.4 | 63.8  | 50.5                                      | 121.2 | 67.3  | 47.0  | 112.8 | 70.8  | 43.5  | 104.2 | 74.1  |       |     |    |
| 42                        | 55.6  | 133.4 | 65.0  | 52.1                                      | 125.1 | 68.6  | 48.6  | 116.4 | 72.1  | 44.9  | 107.7 | 75.6  |       |     |    |
| 44                        | 57.3  | 137.5 | 66.1  | 53.8                                      | 128.9 | 69.8  | 50.1  | 120.2 | 73.4  | 46.3  | 111.3 | 77.0  |       |     |    |
| 45                        | 58.2  | 139.8 | 66.8  | 54.6                                      | 130.8 | 70.4  | 50.9  | 122.1 | 74.1  | 47.1  | 113.2 | 77.8  |       |     |    |
| 46                        | 59.0  | 141.8 | 67.1  | 55.3                                      | 132.8 | 70.9  | 51.6  | 123.9 | 74.8  | 47.9  | 115.1 | 78.8  |       |     |    |
| 48                        | 60.7  | 145.8 | 68.1  | 56.9                                      | 136.7 | 72.0  | 53.2  | 127.7 | 76.9  | 49.5  | 118.7 | 80.1  |       |     |    |
| 50                        | 62.4  | 149.8 | 69.2  | 58.5                                      | 140.6 | 73.3  | 54.8  | 131.5 | 77.4  | 51.0  | 122.3 | 81.5  |       |     |    |
| CGAA - 750 E              |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 66.0  | 158.5 | 67.3  | 62.1                                      | 149.1 | 71.0  | 58.0  | 139.3 | 74.0  | 53.3  | 128.0 | 75.5  |       |     |    |
| 42                        | 68.3  | 164.0 | 68.7  | 64.3                                      | 154.4 | 72.8  | 60.1  | 144.2 | 75.6  | 55.3  | 132.7 | 77.8  |       |     |    |
| 44                        | 70.9  | 170.1 | 70.4  | 66.6                                      | 159.7 | 74.2  | 62.2  | 149.2 | 77.2  | 57.6  | 138.3 | 79.4  |       |     |    |
| 45                        | 72.1  | 172.9 | 71.2  | 67.7                                      | 162.4 | 75.0  | 63.3  | 151.8 | 78.0  | 58.6  | 140.6 | 80.1  |       |     |    |
| 46                        | 73.2  | 175.7 | 72.1  | 68.7                                      | 165.1 | 75.9  | 64.3  | 154.3 | 78.8  | 59.6  | 142.9 | 80.9  |       |     |    |
| 48                        | 75.5  | 181.2 | 73.6  | 71.3                                      | 171.0 | 77.4  | 66.3  | 159.0 | 80.3  | —     | —     | —     |       |     |    |
| 50                        | 77.7  | 186.5 | 75.1  | 73.2                                      | 175.8 | 78.9  | 68.0  | 163.3 | 81.7  | —     | —     | —     |       |     |    |
| CGAA - 1000 E             |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 89.6  | 208.6 | 86.9  | 82.0                                      | 196.8 | 91.6  | 75.8  | 184.2 | 96.3  | 71.6  | 171.8 | 100.4 |       |     |    |
| 42                        | 90.6  | 217.5 | 88.2  | 84.8                                      | 203.4 | 93.3  | 79.5  | 190.6 | 98.0  | 74.1  | 177.8 | 102.4 |       |     |    |
| 44                        | 93.4  | 224.3 | 89.8  | 87.9                                      | 210.9 | 94.9  | 82.1  | 197.0 | 99.7  | 76.5  | 183.8 | 104.2 |       |     |    |
| 45                        | 94.9  | 227.7 | 90.1  | 89.3                                      | 214.3 | 95.5  | 83.5  | 200.2 | 100.4 | 77.8  | 186.4 | 105.1 |       |     |    |
| 46                        | 96.3  | 231.1 | 90.7  | 90.7                                      | 217.7 | 96.1  | 84.8  | 203.4 | 101.2 | 78.8  | 189.2 | 106.1 |       |     |    |
| 48                        | 99.0  | 237.8 | 92.1  | 93.4                                      | 224.3 | 97.5  | 87.7  | 210.5 | 102.9 | —     | —     | —     |       |     |    |
| 50                        | 102.1 | 245.1 | 93.5  | 96.3                                      | 231.0 | 99.2  | 90.2  | 216.5 | 104.8 | —     | —     | —     |       |     |    |
| CGAA - 1200 R             |       |       |       | Temperature of air entering the condenser |       |       |       |       |       |       |       |       |       |     |    |
|                           |       |       |       | 85 F                                      |       |       | 95 F  |       |       | 105 F |       |       | 115 F |     |    |
| Leaving water temperature | Tons  | GPM   | KW    | Tons                                      | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM   | KW    | Tons  | GPM | KW |
| 40                        | 109.7 | 263.5 | 115.9 | 103.8                                     | 248.8 | 122.5 | 97.2  | 233.3 | 128.8 | 90.5  | 217.3 | 134.8 |       |     |    |
| 42                        | 112.8 | 270.8 | 117.6 | 106.5                                     | 255.5 | 124.4 | 100.0 | 240.0 | 131.0 | 93.2  | 223.9 | 137.4 |       |     |    |
| 44                        | 115.5 | 278.4 | 119.3 | 109.9                                     | 263.7 | 126.4 | 102.8 | 246.8 | 133.2 | 96.1  | 230.8 | 140.0 |       |     |    |
| 45                        | 117.8 | 282.7 | 120.2 | 111.3                                     | 267.2 | 127.5 | 104.3 | 250.3 | 134.5 | 97.5  | 234.1 | 141.3 |       |     |    |
| 46                        | 119.6 | 287.0 | 121.2 | 112.7                                     | 270.8 | 128.6 | 105.7 | 253.7 | 135.8 | 98.8  | 237.5 | 142.8 |       |     |    |
| 48                        | 122.8 | 294.2 | 123.0 | 115.8                                     | 277.8 | 130.7 | 108.7 | 260.9 | 138.1 | 101.8 | 244.3 | 145.4 |       |     |    |
| 50                        | 125.8 | 301.6 | 124.7 | 119.4                                     | 286.6 | 132.7 | 112.2 | 269.2 | 140.5 | 104.7 | 251.0 | 148.2 |       |     |    |

## NOTES:

1. Chilled water flow is based on .0005 fouling factor in evaporator.
2. KW input shown is for compressor only. See ELECTRICAL DATA table for fan KW.
3. Ratings based on evaporator temperature drop of 10°F. Ratings are accurate for evaporator temperature drop from 8°F to 12°F.
4. Direct interpolation between rating points is permissible.
5. Extrapolation beyond catalog data is not permitted.
6. Blanks indicate improper full load operating point.
7. Rated in accordance with ARI standard S90-76.



## DIMENSIONS

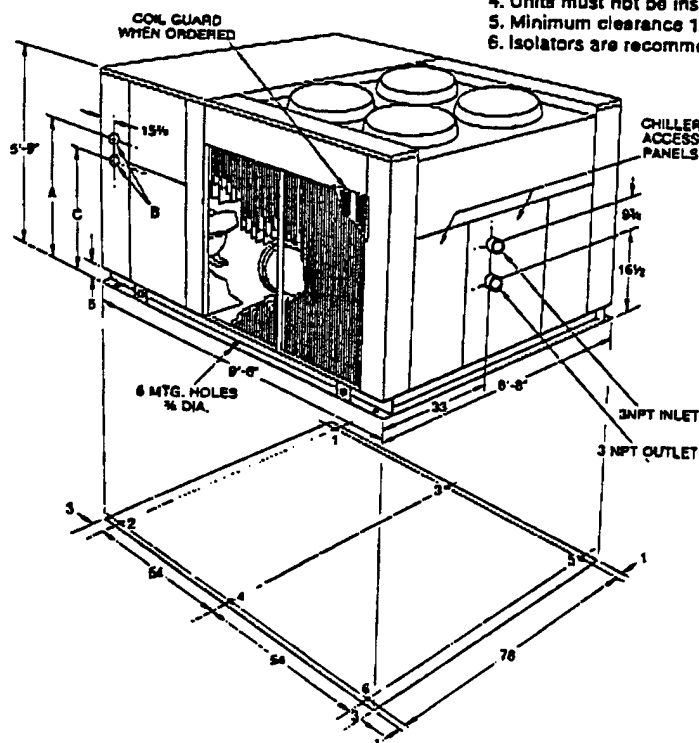
**TABLE 25-1 — Electrical Connections & Weight Distribution**

| ELECTRICAL CONNECTIONS & WEIGHT DISTRIBUTION |                                  |                                         |                                  |     |     |     |     |     |     |   |   |   |   |
|----------------------------------------------|----------------------------------|-----------------------------------------|----------------------------------|-----|-----|-----|-----|-----|-----|---|---|---|---|
| MODEL                                        | A                                | B                                       | C                                | D   | E   | F   | G   | H   | I   | J | K | L | M |
| CGAA-400F                                    | —                                | ONE 3 <sup>1</sup> / <sub>16</sub> DIA. | 42 <sup>13</sup> / <sub>16</sub> | 780 | 935 | 617 | 748 | 455 | 560 |   |   |   |   |
| CGAA-400M                                    | 48 <sup>13</sup> / <sub>16</sub> | TWO 2 <sup>7</sup> / <sub>16</sub> DIA. | 42 <sup>13</sup> / <sub>16</sub> | 780 | 935 | 617 | 748 | 455 | 560 |   |   |   |   |

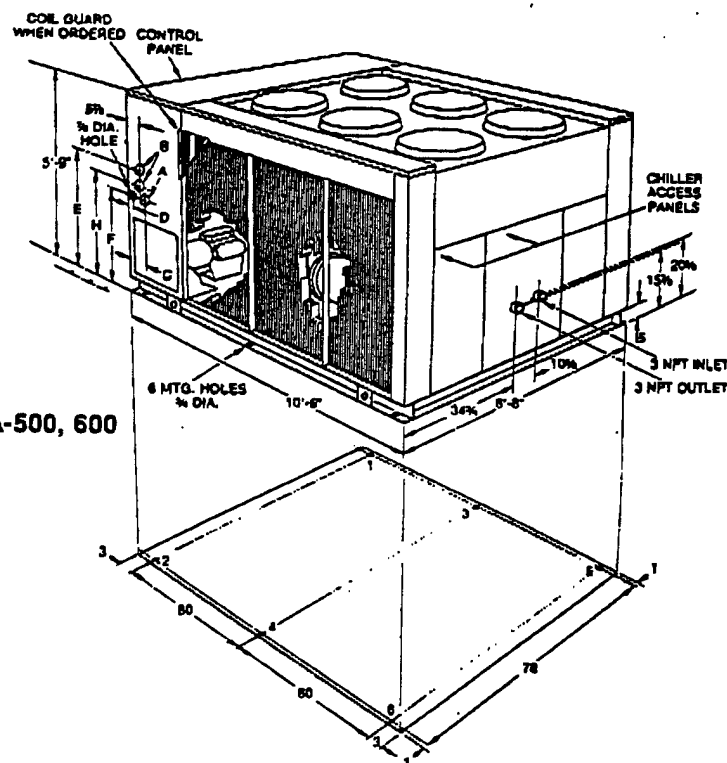
**NOTES:**

1. Minimum clearance 6 feet on coil side.
2. Minimum clearance between units is 12 feet.
3. Minimum tube-pull clearance 8 feet for evaporator and compressor, 6 feet on compressor end.
4. Units must not be installed in pit deeper than height of unit.
5. Minimum clearance 12 feet on coil sides if installed in pit.
6. Isolators are recommended when unit is roof mounted.

### CGAA-400



### CGAA-500, 600



All dimensions are approximate  
Certified dimensions available on request.

**TABLE 25-2 — CGAA 500-600, Electrical Connections & Weight Distribution**

| MODEL      | A                                   | B                                       | C                              | D                               | E                                | F                                | G                                | H   | I    | J   | K   | L   | M   | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|------------|-------------------------------------|-----------------------------------------|--------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------------------|-----|------|-----|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CGAA-500 E | —                                   | ONE 3 <sup>1</sup> / <sub>16</sub> DIA. | —                              | 5 <sup>13</sup> / <sub>16</sub> | —                                | 37 <sup>1</sup> / <sub>16</sub>  | 42 <sup>13</sup> / <sub>16</sub> | 980 | 1170 | 730 | 875 | 490 | 575 |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CGAA-500 M | 1 <sup>1</sup> / <sub>16</sub> DIA. | TWO 2 <sup>7</sup> / <sub>16</sub> DIA. | 7 <sup>1</sup> / <sub>16</sub> | 3 <sup>13</sup> / <sub>16</sub> | 48 <sup>13</sup> / <sub>16</sub> | 37 <sup>13</sup> / <sub>16</sub> | 42 <sup>13</sup> / <sub>16</sub> | 905 | 1080 | 684 | 818 | 461 | 552 |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CGAA-600 M | 1 <sup>1</sup> / <sub>16</sub> DIA. | TWO 2 <sup>7</sup> / <sub>16</sub> DIA. | 7 <sup>1</sup> / <sub>16</sub> | 3 <sup>13</sup> / <sub>16</sub> | 48 <sup>13</sup> / <sub>16</sub> | 37 <sup>13</sup> / <sub>16</sub> | 42 <sup>13</sup> / <sub>16</sub> | 945 | 1132 | 720 | 885 | 495 | 593 |   |   |   |   |   |   |   |   |   |   |   |   |   |

**NOTES:**

1. Minimum clearance 6 feet on coil side.
2. Minimum clearance between units is 12 feet.
3. Minimum tube-pull clearance 7 feet at evaporator end.
4. Units must not be installed in pit deeper than height of unit.
5. Minimum clearance 12 feet on coil sides if installed in pit.
6. Isolators are recommended when unit is roof mounted.

## CARTER & BURGESS COST ESTIMATING ANALYSIS

PROJECT NAME: FORT SAM HOUSTON EEAP

PROJECT NO: 91109912F

PROJECT LOCATION: SAN ANTONIO, TEXAS

ESTIMATOR: S.P. CLARK

|            |       |
|------------|-------|
| SUBMITTAL: | 35.0% |
|------------|-------|

DATE: 26-Oct-93

26-Oct-93

ECO NO/ BUILDING: IV. D. 1) / BLDG 2399

CHECKED BY: DJY

[illegible]

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2399 - ECO IV. D. 1) - REPLACE CHILLER W/ HIGHER EFF/CFC FREE CHILLER  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |           |     |           |
|----------------------------------------|-----------|-----|-----------|
| A. CONSTRUCTION COST                   | \$328,093 |     |           |
| B. SIOH                                | \$18,045  |     |           |
| C. DESIGN COST                         | \$19,686  |     |           |
| D. TOTAL COST (1A+1B+1C)               | \$365,824 |     |           |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |           | \$0 |           |
| F. PUBLIC UTILITY COMPANY REBATE       |           | \$0 |           |
| G. TOTAL INVESTMENT (1D-1E-1F)         |           |     | \$365,824 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 3160.8             | \$33,346             | 14.65              | \$488,525             |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 20.60              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$21,280             | 13.59              | \$289,195             |
| N. TOTAL          |                 | 3160.8             | \$54,626             |                    | \$777,721             |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) \$0  
 1. DISCOUNT FACTOR (TABLE A) \_\_\_\_\_  
 2. DISCOUNTED SAVINGS/COST (3A X 3A1) \_\_\_\_\_ \$0

**LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

**B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM        | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|-------------|-----------------------|-------------------|--------------------|----------------------------------|
| a. Chillers | \$339,208             | 1                 | 0.96               | \$325,640                        |
| b. N/A      | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A      | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A      | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A      | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A      | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A      | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A      | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A      | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A      | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A      | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A      | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A      | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A      | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A      | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL    | \$339,208             |                   |                    | \$325,640                        |

**C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)** \$325,640

**4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :** 5.1 YEARS

**5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):** \$1,103,360

**6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ :** 3.02

**7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):** 9.9%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2399

ECO NO: IV.F.1

ECO NAME: Install make-up air supply for kitchen areas.

#### SUMMARY DATA (DEPENDENT):

|                                        |                  |        |
|----------------------------------------|------------------|--------|
| KWH Savings:                           | <u>41,614</u>    | KWH/yr |
| Demand Savings:                        | <u>0</u>         | KW/yr  |
| Gas Savings:                           | <u>617.0</u>     | MCF/yr |
| Cost Savings:                          | <u>\$ 3,604</u>  | /yr    |
| Implementation Cost:                   | <u>\$ 31,268</u> |        |
| Simple Payback:                        | <u>8.7</u>       | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>2.09</u>      |        |

#### ECO DESCRIPTION:

Currently, a 10' x 28' kitchen hood is in use which does not include make-up air supply. As a result, approximately 40% of the exhaust during cooling months is drawn from the adjacent conditioned dining room. The kitchen and dining areas are both heated during heating months and 100% of the make-up air for the hood is brought in from outside. This ECO analyzes installing a make-up air hood with 70% supply air make-up.

#### COST SAVINGS CALCULATIONS:

(Refer to following spreadsheet)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

# MODIFIED BIN METHOD CALCULATIONS

REFER TO ASHRAE 1993 FUNDAMENTALS

| BLDG. NO.         |         |       |             | 44             | 368            | 407             | 1350           | 1387            | 1462                  | 2399           | 2652            |
|-------------------|---------|-------|-------------|----------------|----------------|-----------------|----------------|-----------------|-----------------------|----------------|-----------------|
| TIME OF OPERATION |         |       |             | 6:00A<br>1:30P | 6:00A<br>2:00P | 7A-10P<br>7A-2P | 4:00A<br>8:30P | 10:00A<br>9:00P | 9A-8:30P<br>9A-10:30P | 5:00A<br>7:30P | 10:00A<br>7:00P |
| DAYS/WEEK         |         |       |             | 5              | 5              | 4, 3            | 6              | 5               | 5, 2                  | 7              | 4               |
| DB RANGE          | MID PT. | MC WB | HUMID RATIO | HRS /YR.       | HRS /YR.       | HRS /YR.        | HRS /YR.       | HRS /YR.        | HRS /YR.              | HRS /YR.       | HRS /YR.        |
| 100/104           | 102     | 74    | 0.0116      | 6.4            | 7.0            | 14.6            | 14.5           | 10.1            | 15.8                  | 16.1           | 7.1             |
| 95/99             | 97      | 74    | 0.0126      | 59.4           | 64.8           | 139.8           | 139.4          | 97.9            | 152.8                 | 153.4          | 67.7            |
| 90/94             | 92      | 74    | 0.0139      | 135.0          | 147.3          | 309.0           | 307.1          | 213.4           | 334.4                 | 339.8          | 149.6           |
| 85/89             | 87      | 73    | 0.0143      | 173.8          | 189.6          | 418.5           | 418.7          | 296.3           | 461.3                 | 458.6          | 202.9           |
| 80/84             | 82      | 72    | 0.0146      | 213.2          | 231.4          | 530.6           | 557.5          | 382.4           | 589.7                 | 595.6          | 253.5           |
| 75/79             | 77      | 70    | 0.0142      | 0.0            | 0.0            | 0.0             | 0.0            | 0.0             | 0.0                   | 0.0            | 0.0             |
| 70/74             | 72      | 66    | 0.0123      | 0.0            | 0.0            | 0.0             | 0.0            | 0.0             | 0.0                   | 0.0            | 0.0             |
| 65/69             | 67      | 61    | 0.0101      | 196.1          | 208.4          | 418.7           | 527.9          | 283.1           | 433.6                 | 535.7          | 183.2           |
| 60/64             | 62      | 56    | 0.0082      | 161.8          | 172.0          | 346.9           | 437.0          | 235.1           | 359.9                 | 443.3          | 151.9           |
| 55/59             | 57      | 51    | 0.0066      | 132.3          | 140.5          | 288.0           | 363.6          | 196.9           | 300.7                 | 367.8          | 126.2           |
| 50/54             | 52      | 47    | 0.0057      | 118.4          | 125.4          | 256.0           | 332.4          | 174.6           | 265.8                 | 333.0          | 110.6           |
| 45/49             | 47      | 43    | 0.0050      | 92.0           | 96.8           | 190.1           | 260.7          | 127.1           | 192.8                 | 257.6          | 79.5            |
| 40/44             | 42      | 38    | 0.0039      | 72.4           | 75.9           | 138.6           | 198.4          | 88.8            | 135.1                 | 195.0          | 56.1            |
| 35/39             | 37      | 34    | 0.0034      | 44.4           | 46.1           | 75.5            | 120.8          | 44.9            | 68.1                  | 116.1          | 28.1            |
| 30/34             | 32      | 29    | 0.0028      | 23.0           | 23.8           | 34.9            | 60.3           | 18.9            | 28.8                  | 57.4           | 12.0            |
| 25/29             | 27      | 25    | 0.0023      | 8.3            | 8.4            | 9.6             | 21.3           | 3.8             | 5.8                   | 19.4           | 2.4             |
| 20/24             | 22      | 20    | 0.0016      | 2.4            | 2.5            | 3.6             | 6.1            | 2.0             | 3.0                   | 5.9            | 1.3             |
| 15/19             | 17      | 15    | 0.0013      | 0.4            | 0.4            | 0.3             | 0.9            | 0.0             | 0.0                   | 0.8            | 0.0             |
| 10/14             | 12      | 10    | 0.0009      | 0.2            | 0.2            | 0.1             | 0.4            | 0.0             | 0.0                   | 0.4            | 0.0             |

## ASSUMPTIONS

- 1) SUMMER ROOM DESIGN: 78FDB, 50%RH
- 2) WINTER ROOM DESIGN: 70FDB, 40%RH
- 3) HUMIDITY RATIOS FOR THE SPACE BASED ON SUMMER & WINTER ROOM DESIGN TEMP.

## EQUIPMENT:

SMALL AIR COOLED CHILLER (3-25 TONS): 8.57 BTU/WATT-H  
 LARGE AIR COOLED CHILLER (25-100 TONS): 8.63 BTU/WATT-H  
 SMALL WATER COOLED CHILLER (25-100 TONS): 11.11 BTU/WATT-H  
 LARGE WATER COOLED CHILLER (> 100 TONS): 12.12 BTU/WATT-H

## SYSTEM TYPES FOR ABOVE BUILDINGS

| BUILDING NUMBER | SYSTEM TYPE        |
|-----------------|--------------------|
| 44              | SMALL AIR COOLED   |
| 368             | SMALL AIR COOLED   |
| 407             | LARGE AIR COOLED   |
| 1350            | LARGE WATER COOLED |
| 1387            | SMALL AIR COOLED   |
| 1462            | LARGE AIR COOLED   |
| 2399            | LARGE WATER COOLED |
| 2652            | LARGE AIR COOLED   |

ASSUME 40% CONDITIONED AIR IS EXHAUSTED  
EXHAUST CFM=10FTx28FTx100FPM=28,000CFM  
BUILDING 2399

| CFM                                     | DB  | RM | HR     | OA     | HR     | RM     | BTUH   | SENS. LATENT | TOTAL  | BTUH   | HRS   | TOTAL     |
|-----------------------------------------|-----|----|--------|--------|--------|--------|--------|--------------|--------|--------|-------|-----------|
|                                         |     |    |        |        |        |        |        |              |        |        | /YEAR | BTU       |
| 11200                                   | 102 | 78 | 0.0116 | 0.0102 | 290304 | 75891  | 366195 |              | 366195 |        | 16.1  | 5882010   |
| 11200                                   | 97  | 78 | 0.0126 | 0.0102 | 229824 | 130099 | 359923 |              | 359923 |        | 153.4 | 55203221  |
| 11200                                   | 92  | 78 | 0.0139 | 0.0102 | 169344 | 200570 | 369914 |              | 369914 |        | 339.8 | 125678146 |
| 11200                                   | 87  | 78 | 0.0143 | 0.0102 | 108864 | 222253 | 331117 |              | 331117 |        | 458.6 | 151837748 |
| 11200                                   | 82  | 78 | 0.0146 | 0.0102 | 48384  | 238515 | 286899 |              | 286899 |        | 595.6 | 170866405 |
| 11200                                   | 67  | 70 | 0.0101 | 0.0062 | 36288  | 211411 | 247699 |              | 247699 |        | 535.7 | 132889365 |
| 11200                                   | 62  | 70 | 0.0082 | 0.0062 | 96768  | 108416 | 205184 |              | 205184 |        | 443.3 | 90960632  |
| 11200                                   | 57  | 70 | 0.0066 | 0.0062 | 157248 | 21683  | 178931 |              | 178931 |        | 367.8 | 65813132  |
| 11200                                   | 52  | 70 | 0.0057 | 0.0062 | 217728 | 27104  | 244832 |              | 244832 |        | 333.0 | 90052270  |
| 11200                                   | 47  | 70 | 0.0050 | 0.0062 | 278208 | 65050  | 343258 |              | 343258 |        | 257.6 | 114304781 |
| 11200                                   | 42  | 70 | 0.0039 | 0.0062 | 338688 | 124678 | 463366 |              | 463366 |        | 195.0 | 119345808 |
| 11200                                   | 37  | 70 | 0.0034 | 0.0062 | 399168 | 151782 | 550950 |              | 550950 |        | 116.1 | 107435328 |
| 11200                                   | 32  | 70 | 0.0027 | 0.0062 | 459648 | 189728 | 649376 |              | 649376 |        | 57.4  | 75368202  |
| 11200                                   | 27  | 70 | 0.0023 | 0.0062 | 520128 | 211411 | 731539 |              | 731539 |        | 19.4  | 41972062  |
| 11200                                   | 22  | 70 | 0.0017 | 0.0062 | 580608 | 243936 | 824544 |              | 824544 |        | 5.9   | 47308212  |
| 11200                                   | 17  | 70 | 0.0013 | 0.0062 | 641088 | 265619 | 906707 |              | 906707 |        | 0.8   | 17624121  |
| 11200                                   | 12  | 70 | 0.0009 | 0.0062 | 701568 | 287302 | 988870 |              | 988870 |        | 0.4   | 5809614   |
| TOTAL COOLING KBTU FOR THE YEAR         |     |    |        |        |        |        |        |              |        | 509468 |       |           |
| TOTAL HEATING KBTU FOR THE YEAR         |     |    |        |        |        |        |        |              |        | 908684 |       |           |
| EQUIPMENT 12.12 BTU/WATT-HR COOLING KWH |     |    |        |        |        |        |        |              |        | 59448  |       |           |

NOW 30% OF THE 11200 CFM IS EXHAUSTED  
EXHAUST CFM=10FTx28FTx100FPM=28,000CFM  
BUILDING 2399

| CFM                                     | DB  | RM | HR     | OA     | HR     | RM    | BTUH   | SENS. LATENT | TOTAL  | BTUH   | HRS   | TOTAL    |
|-----------------------------------------|-----|----|--------|--------|--------|-------|--------|--------------|--------|--------|-------|----------|
|                                         |     |    |        |        |        |       |        |              |        |        | /YEAR | BTU      |
| 3360                                    | 102 | 78 | 0.0116 | 0.0102 | 87091  | 22767 | 109859 |              | 109859 |        | 16.1  | 1784603  |
| 3360                                    | 97  | 78 | 0.0126 | 0.0102 | 68947  | 39030 | 107977 |              | 107977 |        | 153.4 | 16560986 |
| 3360                                    | 92  | 78 | 0.0139 | 0.0102 | 50803  | 60171 | 110974 |              | 110974 |        | 339.8 | 37703444 |
| 3360                                    | 87  | 78 | 0.0143 | 0.0102 | 32659  | 66676 | 99335  |              | 99335  |        | 458.6 | 45551324 |
| 3360                                    | 82  | 78 | 0.0146 | 0.0102 | 14515  | 71555 | 86070  |              | 86070  |        | 595.6 | 51259921 |
| 3360                                    | 67  | 70 | 0.0101 | 0.0062 | 10886  | 63423 | 74310  |              | 74310  |        | 535.7 | 39806810 |
| 3360                                    | 62  | 70 | 0.0082 | 0.0062 | 29030  | 32525 | 61555  |              | 61555  |        | 443.3 | 27288190 |
| 3360                                    | 57  | 70 | 0.0066 | 0.0062 | 47174  | 6505  | 53679  |              | 53679  |        | 367.8 | 19743940 |
| 3360                                    | 52  | 70 | 0.0057 | 0.0062 | 65318  | 8131  | 73450  |              | 73450  |        | 333.0 | 27015681 |
| 3360                                    | 47  | 70 | 0.0050 | 0.0062 | 83462  | 19515 | 102977 |              | 102977 |        | 257.6 | 34291434 |
| 3360                                    | 42  | 70 | 0.0039 | 0.0062 | 101606 | 37404 | 139010 |              | 139010 |        | 195.0 | 35803743 |
| 3360                                    | 37  | 70 | 0.0034 | 0.0062 | 119750 | 45535 | 165285 |              | 165285 |        | 116.1 | 32230598 |
| 3360                                    | 32  | 70 | 0.0027 | 0.0062 | 137894 | 58918 | 194813 |              | 194813 |        | 57.4  | 22610461 |
| 3360                                    | 27  | 70 | 0.0023 | 0.0062 | 156038 | 63423 | 219462 |              | 219462 |        | 19.4  | 12591618 |
| 3360                                    | 22  | 70 | 0.0017 | 0.0062 | 174182 | 73181 | 247363 |              | 247363 |        | 5.9   | 14192464 |
| 3360                                    | 17  | 70 | 0.0013 | 0.0062 | 192326 | 79686 | 272012 |              | 272012 |        | 0.8   | 5287236  |
| 3360                                    | 12  | 70 | 0.0009 | 0.0062 | 210470 | 86191 | 286861 |              | 286861 |        | 0.4   | 1742884  |
| TOTAL COOLING KBTU FOR THE YEAR         |     |    |        |        |        |       |        |              |        | 152840 |       |          |
| TOTAL HEATING KBTU FOR THE YEAR         |     |    |        |        |        |       |        |              |        | 272805 |       |          |
| EQUIPMENT 12.12 BTU/WATT-HR COOLING KWH |     |    |        |        |        |       |        |              |        | 17834  |       |          |

|                                          |                         |
|------------------------------------------|-------------------------|
| PROJECT NAME: FORT SAM HOUSTON EEAP      | PROJECT NO: 91109912F   |
| PROJECT LOCATION: SAN ANTONIO, TEXAS     | ESTIMATOR: C.M. JOHNSON |
| SUBMITTAL: 35.0%                         | DATE: 27 - Oct - 93     |
| ECO NO/BUILDING: IV. F./BLDG 2399 HOOD 4 | CHECKED BY: SPC         |

JOBNUMCE.WK1 407 27-Oct-93



# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2399 - ECO IV. F.) - INSTALL MAKE-UP AIR SUPPLY FOR KITCHEN AREAS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER C. M. JOHNSON

### 1. INVESTMENT COSTS:

|                                        |          |          |
|----------------------------------------|----------|----------|
| A. CONSTRUCTION COST                   | \$28,043 |          |
| B. SIOH                                | \$1,542  |          |
| C. DESIGN COST                         | \$1,683  |          |
| D. TOTAL COST (1A+1B+1C)               | \$31,268 |          |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | \$0      |          |
| F. PUBLIC UTILITY COMPANY REBATE       | \$0      |          |
| G. TOTAL INVESTMENT (1D-1E-1F)         |          | \$31,268 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 142.03             | \$1,498              | 14.65              | \$21,952              |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 636.08             | \$2,105              | 20.60              | \$43,372              |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$0                  | 13.59              | \$0                   |
| N. TOTAL          |                 | 778.11             | \$3,604              |                    | \$65,324              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) \$0  
 1. DISCOUNT FACTOR (TABLE A) \_\_\_\_\_  
 2. DISCOUNTED SAVINGS/COST (3A X 3A1) \$0

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

## **C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)**

\$0

## **4. SIMPLE PAYBACK $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :**

8.7 YEARS

## **5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):**

\$65,324

## **6. SAVINGS TO INVESTMENT RATIO (SIR) $5/1G$ :**

2.09

## **7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):**

7.9%

## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2399

ECO NO: IV.F.2

ECO NAME: Install make-up air supply for kitchen areas.

#### SUMMARY DATA (DEPENDENT):

|                                        |                 |        |
|----------------------------------------|-----------------|--------|
| KWH Savings:                           | <u>4.776</u>    | KWH/yr |
| Demand Savings:                        | <u>0</u>        | KW/yr  |
| Gas Savings:                           | <u>70.8</u>     | MCF/yr |
| Cost Savings:                          | <u>\$ 414</u>   | /yr    |
| Implementation Cost:                   | <u>\$ 3,976</u> |        |
| Simple Payback:                        | <u>9.6</u>      | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>1.89</u>     |        |

#### ECO DESCRIPTION:

Currently, a 4' x 4' kitchen hood is in use which does not include make-up air supply. As a result, approximately 40% of the exhaust during cooling months is drawn from the adjacent conditioned dining room. The kitchen and dining areas are both heated during heating months and 100% of the make-up air for the hood is brought in from outside. This ECO analyzes installing a make-up air hood with 70% supply air make-up.

#### COST SAVINGS CALCULATIONS:

(Refer to following spreadsheet)

#### IMPLEMENTATION COSTS:

(Refer to following Cost Estimate)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

# MODIFIED BIN METHOD CALCULATIONS

REFER TO ASHRAE 1993 FUNDAMENTALS

| BLDG. NO.         |         |       |             | 44             | 368            | 407             | 1350           | 1387            | 1462                  | 2399           | 2652            |
|-------------------|---------|-------|-------------|----------------|----------------|-----------------|----------------|-----------------|-----------------------|----------------|-----------------|
| TIME OF OPERATION |         |       |             | 6:00A<br>1:30P | 6:00A<br>2:00P | 7A-10P<br>7A-2P | 4:00A<br>8:30P | 10:00A<br>9:00P | 9A-8:30P<br>9A-10:30P | 5:00A<br>7:30P | 10:00A<br>7:00P |
| DAYS/WEEK         |         |       |             | 5              | 5              | 4, 3            | 6              | 5               | 5, 2                  | 7              | 4               |
| DB RANGE          | MID PT. | MC WB | HUMID RATIO | HRS /YR.       | HRS /YR.       | HRS /YR.        | HRS /YR.       | HRS /YR.        | HRS /YR.              | HRS /YR.       | HRS /YR.        |
| 100/104           | 102     | 74    | 0.0116      | 6.4            | 7.0            | 14.6            | 14.5           | 10.1            | 15.8                  | 16.1           | 7.1             |
| 95/99             | 97      | 74    | 0.0126      | 59.4           | 64.8           | 139.8           | 139.4          | 97.9            | 152.8                 | 153.4          | 67.7            |
| 90/94             | 92      | 74    | 0.0139      | 135.0          | 147.3          | 309.0           | 307.1          | 213.4           | 334.4                 | 339.8          | 149.6           |
| 85/89             | 87      | 73    | 0.0143      | 173.8          | 189.6          | 418.5           | 418.7          | 296.3           | 461.3                 | 458.6          | 202.9           |
| 80/84             | 82      | 72    | 0.0146      | 213.2          | 231.4          | 530.6           | 557.5          | 382.4           | 589.7                 | 595.6          | 253.5           |
| 75/79             | 77      | 70    | 0.0142      | 0.0            | 0.0            | 0.0             | 0.0            | 0.0             | 0.0                   | 0.0            | 0.0             |
| 70/74             | 72      | 66    | 0.0123      | 0.0            | 0.0            | 0.0             | 0.0            | 0.0             | 0.0                   | 0.0            | 0.0             |
| 65/69             | 67      | 61    | 0.0101      | 196.1          | 208.4          | 418.7           | 527.9          | 283.1           | 433.6                 | 535.7          | 183.2           |
| 60/64             | 62      | 56    | 0.0082      | 161.8          | 172.0          | 346.9           | 437.0          | 235.1           | 359.9                 | 443.3          | 151.9           |
| 55/59             | 57      | 51    | 0.0066      | 132.3          | 140.5          | 288.0           | 363.6          | 196.9           | 300.7                 | 367.8          | 126.2           |
| 50/54             | 52      | 47    | 0.0057      | 118.4          | 125.4          | 256.0           | 332.4          | 174.6           | 265.8                 | 333.0          | 110.6           |
| 45/49             | 47      | 43    | 0.0050      | 92.0           | 96.8           | 190.1           | 260.7          | 127.1           | 192.8                 | 257.6          | 79.5            |
| 40/44             | 42      | 38    | 0.0039      | 72.4           | 75.9           | 138.6           | 198.4          | 88.8            | 135.1                 | 195.0          | 56.1            |
| 35/39             | 37      | 34    | 0.0034      | 44.4           | 46.1           | 75.5            | 120.8          | 44.9            | 68.1                  | 116.1          | 28.1            |
| 30/34             | 32      | 29    | 0.0028      | 23.0           | 23.8           | 34.9            | 60.3           | 18.9            | 28.8                  | 57.4           | 12.0            |
| 25/29             | 27      | 25    | 0.0023      | 8.3            | 8.4            | 9.6             | 21.3           | 3.8             | 5.8                   | 19.4           | 2.4             |
| 20/24             | 22      | 20    | 0.0016      | 2.4            | 2.5            | 3.6             | 6.1            | 2.0             | 3.0                   | 5.9            | 1.3             |
| 15/19             | 17      | 15    | 0.0013      | 0.4            | 0.4            | 0.3             | 0.9            | 0.0             | 0.0                   | 0.8            | 0.0             |
| 10/14             | 12      | 10    | 0.0009      | 0.2            | 0.2            | 0.1             | 0.4            | 0.0             | 0.0                   | 0.4            | 0.0             |

## ASSUMPTIONS

- 1) SUMMER ROOM DESIGN: 78FDB, 50%RH
- 2) WINTER ROOM DESIGN: 70FDB, 40%RH
- 3) HUMIDITY RATIOS FOR THE SPACE BASED ON SUMMER & WINTER ROOM DESIGN TEMP.

## EQUIPMENT:

SMALL AIR COOLED CHILLER (3-25 TONS): 8.57 BTU/WATT-H  
 LARGE AIR COOLED CHILLER (25-100 TONS): 8.63 BTU/WATT-H  
 SMALL WATER COOLED CHILLER (25-100 TONS): 11.11 BTU/WATT-H  
 LARGE WATER COOLED CHILLER (>100 TONS): 12.12 BTU/WATT-H

## SYSTEM TYPES FOR ABOVE BUILDINGS

| BUILDING NUMBER | SYSTEM TYPE        |
|-----------------|--------------------|
| 44              | SMALL AIR COOLED   |
| 368             | SMALL AIR COOLED   |
| 407             | LARGE AIR COOLED   |
| 1350            | LARGE WATER COOLED |
| 1387            | SMALL AIR COOLED   |
| 1462            | LARGE AIR COOLED   |
| 2399            | LARGE WATER COOLED |
| 2652            | LARGE AIR COOLED   |

ASSUME 40% CONDITIONED AIR IS EXHAUSTED  
EXHAUST CFM=4FTx4FTx100FPM=1600CFM  
BUILDING 2399

| UILDING 2399                            |     |    |        |        |       |       | SENS. LATENT |       | TOTAL   | HRS   | TOTAL  |
|-----------------------------------------|-----|----|--------|--------|-------|-------|--------------|-------|---------|-------|--------|
| CFM                                     | DB  | RM | HR     | OA     | HR    | RM    | BTUH         | BTUH  | BTUH    | /YEAR | BTU    |
| 640                                     | 102 | 78 | 0.0116 | 0.0102 | 16589 | 4337  | 20925        | 16.1  | 336115  |       |        |
| 640                                     | 97  | 78 | 0.0126 | 0.0102 | 13133 | 7434  | 20567        | 153.4 | 3154470 |       |        |
| 640                                     | 92  | 78 | 0.0139 | 0.0102 | 9677  | 11461 | 21138        | 339.8 | 7181608 |       |        |
| 640                                     | 87  | 78 | 0.0143 | 0.0102 | 6221  | 12700 | 18921        | 458.6 | 8676443 |       |        |
| 640                                     | 82  | 78 | 0.0146 | 0.0102 | 2765  | 13629 | 16394        | 595.6 | 9763795 |       |        |
|                                         |     |    |        |        |       |       |              |       |         |       |        |
| 640                                     | 67  | 70 | 0.0101 | 0.0062 | 2074  | 12081 | 14154        | 535.7 | 7582249 |       |        |
| 640                                     | 62  | 70 | 0.0082 | 0.0062 | 5530  | 6195  | 11725        | 443.3 | 5197750 |       |        |
| 640                                     | 57  | 70 | 0.0066 | 0.0062 | 8986  | 1239  | 10225        | 367.8 | 3760750 |       |        |
| 640                                     | 52  | 70 | 0.0057 | 0.0062 | 12442 | 1549  | 13990        | 333.0 | 5145844 |       |        |
| 640                                     | 47  | 70 | 0.0050 | 0.0062 | 15898 | 3717  | 19615        | 257.6 | 6531702 |       |        |
| 640                                     | 42  | 70 | 0.0039 | 0.0062 | 19354 | 7124  | 26478        | 195.0 | 6819760 |       |        |
| 640                                     | 37  | 70 | 0.0034 | 0.0062 | 22810 | 8673  | 31483        | 116.1 | 6139162 |       |        |
| 640                                     | 32  | 70 | 0.0027 | 0.0062 | 26266 | 10842 | 37107        | 57.4  | 4306754 |       |        |
| 640                                     | 27  | 70 | 0.0023 | 0.0062 | 29722 | 12081 | 41802        | 19.4  | 2398404 |       |        |
| 640                                     | 22  | 70 | 0.0017 | 0.0062 | 33178 | 13939 | 47117        | 5.9   | 2703326 |       |        |
| 640                                     | 17  | 70 | 0.0013 | 0.0062 | 36634 | 15178 | 51812        | 0.8   | 1007093 |       |        |
| 640                                     | 12  | 70 | 0.0009 | 0.0062 | 40090 | 16417 | 56507        | 0.4   | 331978  |       |        |
| TOTAL COOLING KBTU FOR THE YEAR         |     |    |        |        |       |       |              |       |         |       | 58225  |
| TOTAL HEATING KBTU FOR THE YEAR         |     |    |        |        |       |       |              |       |         |       | 103850 |
| EQUIPMENT 12.12 BTU/WATT-HR COOLING KWH |     |    |        |        |       |       |              |       |         |       | 6784   |

NOW 30% OF THE 640 CFM IS EXHAUSTED  
EXHAUST CFM=4FTx4FTx100FPM=1600CFM  
BUILDING 2399

| BUILDING 2399                           |     |    |        |        |       |      | SENS. LATENT | TOTAL | HRS     | TOTAL |
|-----------------------------------------|-----|----|--------|--------|-------|------|--------------|-------|---------|-------|
| CFM                                     | DB  | RM | HR     | OA     | HR    | RM   | BTUH         | BTUH  | /YEAR   | BTU   |
| 190                                     | 102 | 78 | 0.0116 | 0.0102 | 4925  | 1287 | 6212         | 16.1  | 99784   |       |
| 190                                     | 97  | 78 | 0.0126 | 0.0102 | 3899  | 2207 | 6106         | 153.4 | 936483  |       |
| 190                                     | 92  | 78 | 0.0139 | 0.0102 | 2873  | 3403 | 6275         | 339.8 | 2132040 |       |
| 190                                     | 87  | 78 | 0.0143 | 0.0102 | 1847  | 3770 | 5617         | 458.6 | 2575819 |       |
| 190                                     | 82  | 78 | 0.0146 | 0.0102 | 821   | 4046 | 4867         | 595.6 | 2898627 |       |
|                                         |     |    |        |        |       |      |              |       |         |       |
| 190                                     | 67  | 70 | 0.0101 | 0.0062 | 616   | 3586 | 4202         | 535.7 | 2250980 |       |
| 190                                     | 62  | 70 | 0.0082 | 0.0062 | 1642  | 1839 | 3481         | 443.3 | 1543082 |       |
| 190                                     | 57  | 70 | 0.0066 | 0.0062 | 2668  | 368  | 3035         | 367.8 | 1116473 |       |
| 190                                     | 52  | 70 | 0.0057 | 0.0062 | 3694  | 460  | 4153         | 333.0 | 1527672 |       |
| 190                                     | 47  | 70 | 0.0050 | 0.0062 | 4720  | 1104 | 5823         | 257.6 | 1939099 |       |
| 190                                     | 42  | 70 | 0.0039 | 0.0062 | 5746  | 2115 | 7861         | 195.0 | 2024616 |       |
| 190                                     | 37  | 70 | 0.0034 | 0.0062 | 6772  | 2575 | 9346         | 116.1 | 1822584 |       |
| 190                                     | 32  | 70 | 0.0027 | 0.0062 | 7798  | 3219 | 11016        | 57.4  | 1278568 |       |
| 190                                     | 27  | 70 | 0.0023 | 0.0062 | 8824  | 3586 | 12410        | 19.4  | 712026  |       |
| 190                                     | 22  | 70 | 0.0017 | 0.0062 | 9850  | 4138 | 13988        | 5.9   | 802550  |       |
| 190                                     | 17  | 70 | 0.0013 | 0.0062 | 10876 | 4506 | 15382        | 0.8   | 298981  |       |
| 190                                     | 12  | 70 | 0.0009 | 0.0062 | 11902 | 4874 | 16775        | 0.4   | 98556   |       |
| TOTAL COOLING KBTU FOR THE YEAR         |     |    |        |        |       |      |              |       | 17286   |       |
| TOTAL HEATING KBTU FOR THE YEAR         |     |    |        |        |       |      |              |       | 30830   |       |
| EQUIPMENT 12.12 BTU/WATT-HR COOLING KWH |     |    |        |        |       |      |              |       | 2017    |       |

|                                          |                         |
|------------------------------------------|-------------------------|
| PROJECT NAME: FORT SAM HOUSTON EEAP      | PROJECT NO: 91109912F   |
| PROJECT LOCATION: SAN ANTONIO, TEXAS     | ESTIMATOR: C.M. JOHNSON |
| SUBMITTAL: 35.0%                         | DATE: 27-Oct-93         |
| ECO NO/BUILDING: IV. F./BLDG 2399 HOOD 5 | CHECKED BY: SPC         |

JOBNUMCE.WK1 413 27-Oct-93

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2399 - ECO IV. F.) - INSTALL MAKE-UP AIR SUPPLY FOR KITCHEN AREAS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 20 PREPARER C. M. JOHNSON

### 1. INVESTMENT COSTS:

|                                        |         |     |  |         |  |
|----------------------------------------|---------|-----|--|---------|--|
| A. CONSTRUCTION COST                   | \$3,566 |     |  |         |  |
| B. SIOH                                | \$196   |     |  |         |  |
| C. DESIGN COST                         | \$214   |     |  |         |  |
| D. TOTAL COST (1A+1B+1C)               | \$3,976 |     |  |         |  |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |  |         |  |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |  |         |  |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     |  | \$3,976 |  |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 16.3               | \$172                | 14.65              | \$2,519               |
| B. DIST           |                 |                    | \$0                  | 17.70              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 20.99              | \$0                   |
| D. NG             | \$3.31          | 73.02              | \$242                | 20.60              | \$4,979               |
| E. PPG            |                 |                    | \$0                  | 13.59              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 16.32              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 13.59              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 13.59              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 13.59              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 13.59              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 13.59              | \$0                   |
| L. OTHER          |                 |                    | \$0                  | 13.59              | \$0                   |
| M. DEMAND SAVINGS |                 |                    | \$0                  | 13.59              | \$0                   |
| N. TOTAL          |                 | 89.32              | \$414                |                    | \$7,498               |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) \$0  
 1. DISCOUNT FACTOR (TABLE A) \_\_\_\_\_  
 2. DISCOUNTED SAVINGS/COST (3A X 3A1) \_\_\_\_\_ \$0

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) \$0

4. SIMPLE PAYBACK  $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ : 9.6 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): \$7,498

6. SAVINGS TO INVESTMENT RATIO (SIR)  $5/1G$ : 1.89

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.4%



## ENERGY CONSERVATION ANALYSIS

### ENERGY CONSERVATION OPPORTUNITIES (ECO's) - BUILDING NO. 2399

ECO NO: VII D & IX A, B, C, D

ECO NAME: Improve lighting efficiency.

#### SUMMARY DATA (DEPENDENT):

|                                        |                    |        |
|----------------------------------------|--------------------|--------|
| KWH Savings:                           | <u>18.019</u>      | KWH/yr |
| Demand Savings:                        | <u>28.42</u>       | KW/yr  |
| Gas Savings:                           | <u>n/a</u>         | MCF/yr |
| Cost Savings:                          | <u>\$ 1,574.00</u> | /yr    |
| Implementation Cost:                   | <u>\$ 8,895</u>    |        |
| Simple Payback:                        | <u>5.7</u>         | Years  |
| Savings to Investment:<br>Ratio (SIR): | <u>2.00</u>        |        |

#### ECO DESCRIPTION:

Currently, low efficiency lighting systems are in use. This ECO will update the lighting systems to improve efficiency while maintaining or increasing the current light levels. The existing lighting system and proposed retrofit action are as follows:

| QTY | FIXTURE TYPE       | ACTION                                       |
|-----|--------------------|----------------------------------------------|
| 6   | 2-Lamp, 2' Fluor.  | Retrofit w/T8 lamps and electronic ballasts. |
| 158 | 2-Lamp, 4' Fluor.  | Retrofit w/T8 lamps and electronic ballasts. |
| 10  | 4-Lamp, 4' Fluor.  | Retrofit w/T8 lamps and electronic ballasts. |
| 2   | Incandescent track | Retrofit with compact fluor. lamps.          |
| 10  | Incandescent hood  | None.                                        |
| 2   | Incandescent exit  | Replace w/LED exit fixture.                  |

#### COST SAVINGS CALCULATIONS:

(Refer to following Flex Output)

$$\begin{aligned} \text{Demand Savings} &= (18.392 \text{ KW} - 16.024 \text{ KW})(4 \text{ mo.} \times \$7.50/\text{KW} + 8 \text{ mo.} \times \$6.25/\text{KW}) \\ &= \$189.44/\text{yr} \end{aligned}$$

#### IMPLEMENTATION COSTS:

(Refer to following Flex Output and Lighting Implementation Cost located in Appendix E)

#### LIFE CYCLE COST ANALYSIS:

(Refer to following ECIP Life Cycle Cost Summary)

| Project Name<br>(*Base) | Annual Energy kWh | Net Present Value \$ | Present Value Total LCC \$ | Annual Value Total LCC \$ | Annual Energy Savings kWh | Savings Invest. Ratio (SIR) | Levelized Energy Cost cnts/kWh | Total Initial Cost \$ | Present Value Maint LCC \$ | Present Value Energy LCC \$ | Annual Value Maint LCC \$ | Annual Value Energy LCC \$ |
|-------------------------|-------------------|----------------------|----------------------------|---------------------------|---------------------------|-----------------------------|--------------------------------|-----------------------|----------------------------|-----------------------------|---------------------------|----------------------------|
| BLD2399A                | 87729             | 24737                | 217727                     | 16021                     | 12964                     | 3.101                       | 2.451                          | 7978                  | 13427                      | 196323                      | 988                       | 14446                      |
| *BLD2399B               | 100693            | 0                    | 242464                     | 17841                     | 0                         | 0.000                       | 0.000                          | 0                     | 17086                      | 225377                      | 1257                      | 16584                      |

Project Description: FT SAM HOUSTON EEAP

| File Names | Case Description        |
|------------|-------------------------|
| BLD2399A   | POST RETROFIT CONDITION |
| BLD2399B   | EXISTING CONDITIONS     |

=====

| Whole Building Summary Report |

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399A.WBR  
 Date: 10/16/1993

Lighting Annual : 87729 kWh  
 Lighting Capacity : 16.024 kW  
 Annual Cooling Effect : 121686 kWh  
 Annual Heating Effect : 12533 kWh  
 Total Surveyed Floor Area: 14648 SqFt  
 Percent Survey Completed : 1464800 %  
 Lighting Power Density : 1.094 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
|          | -----   | -----  | -----  | -----   | -----   | -----  |
| PVLCC \$ | 7978    | 86676  | 13427  | 111797  | -2151   | 217727 |
| AVLCC \$ | 587     | 6378   | 988    | 8226    | -158    | 16021  |

=====

| Lighting Level Comparison Report |

=====

Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399A.LLR

Date: 10/16/1993

| Room         |      |      |      |       |           |          |
|--------------|------|------|------|-------|-----------|----------|
| Foot Candles | MAX  | MIN  | AVG  | SDEV  | MAX Room  | MIN Room |
| Calculated   | 36.2 | 14.4 | 25.5 | 9.60  | 4-stor    | 3-scully |
| Measured     | 31.2 | 5.9  | 18.8 | 9.03  | 2-kitchen | 4-stor   |
| Required     | 50.0 | 5.0  | 32.0 | 24.65 | 2-kitchen | 1-dining |

| Foot Candle Comparison | MAX  | MIN   | AVG   | SDEV  | MAX Room | MIN Room  |
|------------------------|------|-------|-------|-------|----------|-----------|
| Calc - Req.            | 31.2 | -35.6 | -6.5  | 33.94 | 4-stor   | 3-scully  |
| Meas - Req.            | 15.3 | -33.1 | -13.2 | 20.85 | 1-dining | 5-kitchen |

=====

Lighting System Survey Summary

One Page for Each Defined System

=====

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399A.LSR  
 Date: 10/16/1993

System Number: 1      Descrip: 4 lamp, 2x4 lay-in

=====

Rooms Served: 1  
 Floor Area: 7192 SqFt  
 Possible kW: 8.352  
 Working kW: 8.352  
 Capacity kW: 8.352  
 Lighting: 45727 Annual kWh  
 Heating: 6532 Annual kWh  
 Cooling: 63423 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 1.161 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 72       | 288   | 72.0     |
| Working       | 72       | 288   | 72.0     |
| Capacity      | 72       | 288   | 72.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total  |
|----------|--------|--------|---------|---------|--------|
| PVLCC \$ | 45178  | 5225   | 58268   | -1121   | 111366 |
| AVLCC \$ | 3324   | 384    | 4287    | -82     | 8195   |

System Number: 2      Descrip: 2x2 rec. fluor.

=====

Rooms Served: 2  
 Floor Area: 11000 SqFt  
 Possible kW: 0.377  
 Working kW: 0.377  
 Capacity kW: 0.377  
 Lighting: 2063 Annual kWh  
 Heating: 295 Annual kWh  
 Cooling: 2861 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 0.034 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 6        | 12    | 6.0      |
| Working       | 6        | 12    | 6.0      |
| Capacity      | 6        | 12    | 6.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 2038   | 303    | 2629    | -51     | 5169  |
| AVLCC \$ | 150    | 22     | 193     | -4      | 380   |

System Number: 3      Descrip: 8' track w/PL

Rooms Served: 1  
 Floor Area: 7192 SqFt  
 Possible kW: 0.048  
 Working kW: 0.048  
 Capacity kW: 0.048  
 Lighting: 263 Annual kWh  
 Heating: 38 Annual kWh  
 Cooling: 372 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 31.0 Months  
 Power Density: 0.007 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 2     | 2.0      |
| Working       | 2        | 2     | 2.0      |
| Capacity      | 2        | 2     | 2.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 260    | 305    | 343     | -6      | 945   |
| AVLCC \$ | 19     | 22     | 25      | -0      | 70    |

System Number: 4      Descrip: 1x4 rec. fluor.

Rooms Served: 3  
 Floor Area: 6592 SqFt  
 Possible kW: 5.087  
 Working kW: 5.087  
 Capacity kW: 5.087  
 Lighting: 27850 Annual kWh  
 Heating: 3979 Annual kWh  
 Cooling: 38628 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 0.772 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 81       | 162   | 81.0     |
| Working       | 81       | 162   | 81.0     |
| Capacity      | 81       | 162   | 81.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 27516  | 4033   | 35488   | -683    | 69676 |
| AVLCC \$ | 2025   | 297    | 2611    | -50     | 5127  |

System Number: 5      Descrip: lensed gasketed hood fixture

Rooms Served: 1  
 Floor Area: 3808 SqFt  
 Possible kW: 1.000  
 Working kW: 1.000  
 Capacity kW: 1.000  
 Lighting: 5475 Annual kWh  
 Heating: 782 Annual kWh  
 Cooling: 7594 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 1.6 Months  
 Power Density: 0.263 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 10    | 0.0      |
| Working       | 10       | 10    | 0.0      |
| Capacity      | 10       | 10    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5409   | 2835   | 6977    | -134    | 15103 |
| AVLCC \$ | 398    | 209    | 513     | -10     | 1111  |

System Number: 6      Descrip: 4' wrap

Rooms Served: 1  
 Floor Area: 864 SqFt  
 Possible kW: 1.160  
 Working kW: 1.160  
 Capacity kW: 1.160  
 Lighting: 6351 Annual kWh  
 Heating: 907 Annual kWh  
 Cooling: 8809 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 1.343 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 40    | 10.0     |
| Working       | 10       | 40    | 10.0     |
| Capacity      | 10       | 40    | 10.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 6275   | 726    | 8093    | -156    | 15468 |
| AVLCC \$ | 462    | 53     | 595     | -11     | 1138  |



Room-By-Room Summary Report

Project: FT SAM HOUSTON EEAP  
 File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399A.RRR  
 Date: 10/16/1993

| Room Name  | Floor | # | Total Area | SYSTEM1                     | Work Watts | Pot. Watts | Watt sqft | SYSTEM2    | Work Watts | Pot. Watts | Watt sqft | SYSTEM3    | Work Watts | Pot. Watts | Watt sqft | Watt Meas. FootC | Calc. FootC | Req. FootC |
|------------|-------|---|------------|-----------------------------|------------|------------|-----------|------------|------------|------------|-----------|------------|------------|------------|-----------|------------------|-------------|------------|
| 1-dining   | 1     | 1 | 7192       | 300 4 lamp, 2x 6 1x4 rec. f | 8352       | 8352       | 1.16      | 2x2 rec. f | 314        | 314        | 0.04      | 8' track w | 8714       | 8714       | 1.21      | 20.3             | 34.8        | 5.0        |
| 2-kitchen  | 1     | 1 | 3808       | 6 1x4 rec. f                | 3014       | 3014       | 0.79      | lensed gas | 1000       | 1000       | 0.26      | 2x2 rec. f | 4077       | 4077       | 1.07      | 31.2             | 22.1        | 50.0       |
| 3-scullery | 1     | 1 | 1200       | 2 1x4 rec. f                | 754        | 754        | 0.63      |            |            |            |           |            | 754        | 754        | 0.63      | 19.5             | 14.4        | 50.0       |
| 4-stor     | 1     | 1 | 864        | 0 4' wrap                   | 1160       | 1160       | 1.34      |            |            |            |           |            | 1160       | 1160       | 1.34      | 5.9              | 36.2        | 5.0        |
| 5-kitchen  | 1     | 1 | 1584       | 6 1x4 rec. f                | 1319       | 1319       | 0.83      |            |            |            |           |            | 1319       | 1319       | 0.83      | 16.9             | 19.7        | 50.0       |

Total Rooms : 5  
 Total Area Sqft : 14648  
 Total People : 314  
 Total Working kW : 16.024  
 Total Potential kW : 16.024  
 Power Density w/sqft : 1.094

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| Whole Building Summary Report |

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399B.WBR

Date: 10/16/1993

Lighting Annual : 100693 kWh  
 Lighting Capacity : 18.392 kW  
 Annual Cooling Effect : 139704 kWh  
 Annual Heating Effect : 14385 kWh  
 Total Surveyed Floor Area: 14648 SqFt  
 Percent Survey Completed : 1464800 %  
 Lighting Power Density : 1.256 W/sqft

| Costs    | Initial | Energy | Maint. | Cooling | Heating | Total  |
|----------|---------|--------|--------|---------|---------|--------|
| -----    | -----   | -----  | -----  | -----   | -----   | -----  |
| PVLCC \$ | 0       | 99485  | 17086  | 128361  | -2468   | 242464 |
| AVLCC \$ | 0       | 7320   | 1257   | 9445    | -182    | 17841  |

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Lighting System Survey Summary

One Page for Each Defined System

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Project: FT SAM HOUSTON EEAP

File: H:\JOB\911099\12F\ELECT\FLEX\OUT\2399\BLD2399B.LSR

Date: 10/16/1993

System Number: 1      Descrip: 4 lamp, 2x4 lay-in

=====

Rooms Served: 1

Floor Area: 7192 SqFt

Possible kW: 6.720

Working kW: 6.720

Capacity kW: 6.720

Lighting: 36792 Annual kWh

Heating: 5256 Annual kWh

Cooling: 51030 Annual kWh

Op Hours/Year: 5475 Annual Hrs

Relamp Method: Spot

Relamp Time : 69.0 Months

Power Density: 0.934 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 70       | 140   | 35.0     |
| Working       | 70       | 140   | 35.0     |
| Capacity      | 70       | 140   | 35.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 36350  | 4655   | 46882   | -902    | 86986 |
| AVLCC \$ | 2675   | 343    | 3450    | -66     | 6401  |

System Number: 2      Descrip: 2x2 rec. fluor.

=====

Rooms Served: 2

Floor Area: 11000 SqFt

Possible kW: 0.675

Working kW: 0.579

Capacity kW: 0.675

Lighting: 3698 Annual kWh

Heating: 528 Annual kWh

Cooling: 5130 Annual kWh

Op Hours/Year: 5475 Annual Hrs

Relamp Method: Spot

Relamp Time : 41.4 Months

Power Density: 0.053 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 7        | 14    | 7.0      |
| Working       | 6        | 12    | 6.0      |
| Capacity      | 7        | 14    | 7.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 1        | 0     | 1.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 3654   | 784    | 4713    | -91     | 9060  |
| AVLCC \$ | 269    | 58     | 347     | -7      | 667   |

System Number: 3      Descrip: 8' track w/incand.

Rooms Served: 1  
 Floor Area: 7192 SqFt  
 Possible kW: 0.300  
 Working kW: 0.300  
 Capacity kW: 0.300  
 Lighting: 1643 Annual kWh  
 Heating: 235 Annual kWh  
 Cooling: 2323 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 4.4 Months  
 Power Density: 0.042 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 2        | 6     | 0.0      |
| Working       | 2        | 6     | 0.0      |
| Capacity      | 2        | 6     | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 1623   | 1022   | 2145    | -40     | 4750  |
| AVLCC \$ | 119    | 75     | 158     | -3      | 349   |

System Number: 4      Descrip: 1x4 rec. fluor.

Rooms Served: 3  
 Floor Area: 6592 SqFt  
 Possible kW: 7.776  
 Working kW: 7.776  
 Capacity kW: 7.776  
 Lighting: 42574 Annual kWh  
 Heating: 6082 Annual kWh  
 Cooling: 59049 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 1.180 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 81       | 162   | 81.0     |
| Working       | 81       | 162   | 81.0     |
| Capacity      | 81       | 162   | 81.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total  |
|----------|--------|--------|---------|---------|--------|
| PVLCC \$ | 42063  | 6460   | 54249   | -1044   | 101728 |
| AVLCC \$ | 3095   | 475    | 3992    | -77     | 7485   |

System Number: 5      Descrip: lensed gasketed hood fixture

Rooms Served: 1  
 Floor Area: 3808 SqFt  
 Possible kW: 1.000  
 Working kW: 1.000  
 Capacity kW: 1.000  
 Lighting: 5475 Annual kWh  
 Heating: 782 Annual kWh  
 Cooling: 7594 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 1.6 Months  
 Power Density: 0.263 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 10    | 0.0      |
| Working       | 10       | 10    | 0.0      |
| Capacity      | 10       | 10    | 0.0      |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 5409   | 2835   | 6977    | -134    | 15086 |
| AVLCC \$ | 398    | 209    | 513     | -10     | 1110  |

System Number: 6      Descrip: 4' wrap

Rooms Served: 1  
 Floor Area: 864 SqFt  
 Possible kW: 1.920  
 Working kW: 1.920  
 Capacity kW: 1.920  
 Lighting: 10512 Annual kWh  
 Heating: 1502 Annual kWh  
 Cooling: 14580 Annual kWh  
 Op Hours/Year: 5475 Annual Hrs  
 Relamp Method: Spot  
 Relamp Time : 69.0 Months  
 Power Density: 2.222 Watts/SqFt

| Equipment     | Fixtures | Lamps | Ballasts |
|---------------|----------|-------|----------|
| Possible      | 10       | 40    | 10.0     |
| Working       | 10       | 40    | 10.0     |
| Capacity      | 10       | 40    | 10.0     |
| Disconnected  | 0        | 0     | 0.0      |
| Broken/Burned | 0        | 0     | 0.0      |

| Costs    | Energy | Maint. | Cooling | Heating | Total |
|----------|--------|--------|---------|---------|-------|
| PVLCC \$ | 10386  | 1330   | 13395   | -258    | 24853 |
| AVLCC \$ | 764    | 98     | 986     | -19     | 1829  |

# LIFE CYCLE COST ANALYSIS SUMMARY

## ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT SAM HOUSTON REGION NO. 3 PROJECT NO. 91109912F  
 PROJECT TITLE: FORT SAM HOUSTON DINING FACILITIES EEAP FISCAL YEAR 1994  
 DISCRETE PORTION NAME: BUILDING 2399 - ECO VII D. & IX A, B., C., D. - LIGHTING IMPROVEMENTS  
 ANALYSIS DATE: NOVEMBER 1, 1993 ECONOMIC LIFE 15 PREPARER S. P. CLARK

### 1. INVESTMENT COSTS:

|                                        |         |     |         |
|----------------------------------------|---------|-----|---------|
| A. CONSTRUCTION COST                   | \$7,978 |     |         |
| B. SIOH                                | \$439   |     |         |
| C. DESIGN COST                         | \$479   |     |         |
| D. TOTAL COST (1A+1B+1C)               | \$8,895 |     |         |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT |         | \$0 |         |
| F. PUBLIC UTILITY COMPANY REBATE       |         | \$0 |         |
| G. TOTAL INVESTMENT (1D-1E-1F)         |         |     | \$8,895 |

### 2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS: NOVEMBER 4, 1992

| ENERGY SOURCE     | COST \$/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL \$ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|-------------------|-----------------|--------------------|----------------------|--------------------|-----------------------|
| A. ELEC           | \$10.55         | 44.25              | \$467                | 11.77              | \$5,495               |
| B. DIST           |                 |                    | \$0                  | 13.83              | \$0                   |
| C. RESID          |                 |                    | \$0                  | 16.15              | \$0                   |
| D. NG             | \$3.31          | 0.00               | \$0                  | 15.34              | \$0                   |
| E. PPG            |                 |                    | \$0                  | 11.12              | \$0                   |
| F. COAL           |                 |                    | \$0                  | 12.82              | \$0                   |
| G. SOLAR          |                 |                    | \$0                  | 11.12              | \$0                   |
| H. GEOTH          |                 |                    | \$0                  | 11.12              | \$0                   |
| I. BIOMA          |                 |                    | \$0                  | 11.12              | \$0                   |
| J. REFUS          |                 |                    | \$0                  | 11.12              | \$0                   |
| K. WIND           |                 |                    | \$0                  | 11.12              | \$0                   |
| L. COOLING        | \$10.55         | 61.5               | \$649                | 11.12              | \$7,215               |
| M. DEMAND SAVINGS |                 |                    | \$189                | 11.12              | \$2,107               |
| N. TOTAL          |                 | 105.75             | \$1,305              |                    | \$14,816              |

### 3. NON ENERGY SAVINGS (+) OR COST (-):

|                                       |       |      |         |
|---------------------------------------|-------|------|---------|
| A. ANNUAL RECURRING (+/-)             | \$269 |      |         |
| 1. DISCOUNT FACTOR (TABLE A)          |       | 11.1 |         |
| 2. DISCOUNTED SAVINGS/COST (3A X 3A1) |       |      | \$2,986 |

# **LIFE CYCLE COST ANALYSIS SUMMARY** **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

## **B. NON RECURRING SAVINGS (+) OR COST(-)**

| ITEM     | SAVINGS(+) COST(-)(1) | YEAR OF OCCUR.(2) | DISCOUNT FACTOR(3) | DISCOUNTED SAVINGS(+) COST(-)(4) |
|----------|-----------------------|-------------------|--------------------|----------------------------------|
| a. N/A   | \$0                   | 1                 | 0.96               | \$0                              |
| b. N/A   | \$0                   | 2                 | 0.92               | \$0                              |
| c. N/A   | \$0                   | 3                 | 0.89               | \$0                              |
| d. N/A   | \$0                   | 4                 | 0.85               | \$0                              |
| e. N/A   | \$0                   | 5                 | 0.82               | \$0                              |
| f. N/A   | \$0                   | 6                 | 0.79               | \$0                              |
| g. N/A   | \$0                   | 7                 | 0.76               | \$0                              |
| h. N/A   | \$0                   | 8                 | 0.73               | \$0                              |
| i. N/A   | \$0                   | 9                 | 0.7                | \$0                              |
| j. N/A   | \$0                   | 10                | 0.68               | \$0                              |
| k. N/A   | \$0                   | 11                | 0.65               | \$0                              |
| l. N/A   | \$0                   | 12                | 0.62               | \$0                              |
| m. N/A   | \$0                   | 13                | 0.6                | \$0                              |
| n. N/A   | \$0                   | 14                | 0.58               | \$0                              |
| o. N/A   | \$0                   | 15                | 0.56               | \$0                              |
| p. TOTAL | \$0                   |                   |                    | \$0                              |

## **C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4)**

\$2,986

## **4. SIMPLE PAYBACK $1G/(2N3+3A+(3Bp1/ECONOMIC\ LIFE))$ :**

5.7 YEARS

## **5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C):**

\$17,802

## **6. SAVINGS TO INVESTMENT RATIO (SIR) $5/1G$ :**

2.00

## **7. ADJUSTED INTERNAL RATE OF RETURN (AIRR):**

8.9%