

FINAL SUBMITTAL

ENERGY SURVEY OF
EISENHOWER ARMY MEDICAL CENTER
FORT GORDON

AUGUSTA, GEORGIA

VOLUME IV
PROJECT DOCUMENTS

CONTRACT NO. DACA01-94-D-0038

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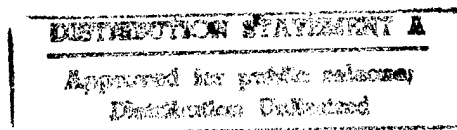
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SAVANNAH DISTRICT

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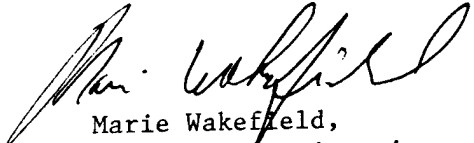

Marie Wakefield,
Librarian Engineering

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ENERGY PROJECT

PROGRAMMING DOCUMENTATION

Project Number and Title

FEMP1 - Energy Saving Projects

Project Funding Category

Federal Energy Management Program (FEMP)

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PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 1

DESCRIPTION OF WORK

FEMP 1 ENERGY SAVING PROJECTS

This project is a combination of the following ECOs. Their descriptions follow.

- EL6 Convert to energy efficient motors
- HS13 Use damper controls to shut off air to unoccupied areas
- HS18 Reduce heated or cooled outside air
- HS24 Surgical suite supply air reset
- LT2 Reduce lighting levels
- LT4C1 Retrofit compact fluorescents in restrooms
- LT4C2 Retrofit compact fluorescents in lobby downlights
- MI3B Install occupational sensors to control lighting-breakrooms

ECO #EL6 Convert to Energy-Efficient Motors

Description

This project consists of replacing 29 existing standard-efficiency electric motors with high-efficiency electric motors. Supply, return, and exhaust fan motors are the primary candidates for replacement since they are not scheduled for removal during the FY96 Renovation Project.

Analysis

High-efficiency electric motors can save significant amounts of energy over standard efficiency types. It is always cost effective to replace failed standard efficiency motors with high efficiency units. Care should be taken when replacing standard motors with high-efficiency types because of their different operating speeds. High-efficiency motors typically operate about 1.5 percent faster than corresponding standard types. The result is a five-percent increase in load on the motor. The increased speed can be easily adjusted on AHUs, but not on pumps and other direct-coupled devices.

ECO #HS13 Use Damper Controls to Shut Off Air to Unoccupied Areas

Description

This project consists of installing variable frequency drives on fan motors; motorized dampers in the supply, return and exhaust ductwork; and associated controls for the fourth floor branches of AHU-4E and AHU-4W.

Analysis

The fourth floor of the hospital is primarily administrative offices which are only occupied during regular business hours. By using damper controls to shut off air to this area at night, significant energy and cost savings can be realized. Variable frequency drives (VFDs) are installed on two 125-hp supply fan motors, two 30-hp return air fan motors, one 7.5-hp exhaust fan motor and one five-hp exhaust fan motors. The VFDs have isolating transformers to protect the motors from power surges and spikes. Motorized dampers in the fourth floor branch ductwork and controls are included as part of this project. The damper control system will reset the VFDs to maintain required air flows on the fifth through fourteenth floors of the hospital. This can be done in the following manner. Measure total AHU airflow and airflow to the fourth floor with the fourth floor dampers open. Close fourth floor dampers and manually adjust the AHU VFD until the total flow is equal to the flow with the damper open less the fourth floor airflow (with damper open). Record this setting and use controls to reset the VFD to this position when dampers are closed.

ECO #HS18 Reduce Heated or Cooled Outside Air

Description

This ECO addresses the energy savings that can be achieved by reducing outside air (OSA) flows to design requirements for AHU-4E and AHU-4W.

Analysis

Design, measured and required outside air volumes were compared for the hospital. Four AHUs--4E, 4W, 5 and 6--show considerably more OSA than is required by Army standards. Two AHUs (5 and 6) are 100 percent OSA units and cannot be reduced with coincidently reducing cooling capacity. However, AHUs 4E and 4W can be reduced from 29 percent and 37 percent, respectively to 22.5 percent and 23.6 percent.

ECO #HS24 Setback Supply and Exhaust Air for the Surgical Suite

Description

This project utilizes the variable frequency drives (VFDs) and direct digital controls DDC installed with the funded renovations. The new DDC system will be programmed to setback the supply and exhaust fans during periods when the area is unoccupied. Manual override controls (hand/off/auto switch) will be installed in the Supervising Surgical Nurse's Station. This ECO will allow the supply and exhaust fans for the surgical suite to operate at reduced power at night and on weekends.

Analysis

The surgical suite is located on the third floor and includes the surgical intensive care unit, post anesthesia recovery ward, doctors lounge area and the operating rooms. These areas are typically not occupied at night or during weekends. Current supply air flow to the surgical suite provides approximately 8.25 air changes per hour. Supply air to these areas can be reduced to three air changes per hour during unoccupied times according to MIL-HDBK-1191, Military Handbook, DoD Medical and Dental Treatment Facilities, Design and Construction Criteria, October 15, 1991. Energy savings can be achieved by modulating the supply air volume to administrative areas when the cooling and heating loads are lower than the peak design loads.

Conditioned outside air is supplied to the surgical suite by SF-6 and exhausted by EF-6. The funded Renovation Project includes installing VFDs on the 40 horsepower motor for SF-6 and the five horsepower motor for EF-6. DDC hardware and software for day/night setback, speed control, start/stop, alarm status and power monitoring is also being installed.

A setback schedule and minimum flow rates for the supply and exhaust fans will be programmed into the DDC control system. The design positive pressure for the surgical suite is about 18 percent of the supply air flow. The minimum supply and exhaust flows will be set to maintain the same positive pressure during unoccupied times. The fans will be able to operate at full capacity during unoccupied times to maintain the required space conditions.

The project costs include labor for engineering, calibration, start-up and checkout for each control point. Fan motor energy savings will be achieved by operating the supply and exhaust fan motors at about 40 percent of full capacity during unoccupied hours. Calculations for fan motor energy savings are contained in the appendix.

ECO #LT2 Reduce Lighting Levels

Description

The ECO involves delamping fluorescent fixtures in over-lighted areas.

Analysis

Lighting levels were measured throughout the hospital. Some overlighted areas were observed. These are the fourth floor library, the medical records area in the family practice wing, most hallways and several offices and examination rooms.

All overlighted areas, except for hallways, use four lamp fluorescent fixtures. Removing one lamp from each hallway fixture would reduce average light levels in hallways from 30 to 35 foot candles to 15 to 18 foot candles. The fixtures in the family practice records area are circuited so that half of the lamps in the four-lamp fixtures can be de-energized from the wall switch. The fixtures in the fourth floor library would have to be delamped and ballasts disconnected.

ECO #LT4C1 Compact Fluorescents in Restrooms

Description

This ECO involves the one-for-one replacement of incandescent lamps with compact fluorescents in patient and other restroom areas.

Analysis

Most of the patient restrooms have incandescent fixtures. Compact fluorescents have incandescent fixtures. Compact fluorescents can be installed and improve the fixture efficiency from 15 lumens per watt to about 44 lumens per watt. Replace labor costs are also reduced since compact fluorescent lifetime is about 10,000 hours compared to 1,000 hours for an incandescent lamp.

ECO #LT4C2 Compact Fluorescents in Lobby Area Downlights

Description

In this ECO, 52-watt incandescents are replaced with 18-watt compact fluorescents in lobby area "high hat" fixtures.

Analysis

Incandescents are used for lighting in the south lobby of the fourth floor. Compact fluorescents offer increased efficiencies (44 lumens per watt, compared to 15 lumens per watt for incandescents) and increased lifetimes (10,000 hours versus 1,000 hours). This is particularly important in areas that are difficult to relamp such as high-ceiling lobbies.

ECO# MI3B Install Occupancy Sensors for Lighting Control in Breakrooms

Description

This ECO addresses occupancy sensors for breakrooms:

These devices can save energy by de-energizing lighting when intermittently used areas are not occupied.

Analysis

The cost effectiveness of occupancy sensors depends on how long can the lights be de-energized and how many watts of lighting are being turned off. Breakrooms were evaluated on actual lamp counts which are listed by room in the back materials.

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 2

LIFE CYCLE COST ANALYSIS SUMMARY

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: F 1
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 LCCID FY95 (92)
 PROJECT NO. & TITLE: FEMP1 ENERGY SAVING PROJECTS
 FISCAL YEAR 95 DISCRETE PORTION NAME: N/A
 ANALYSIS DATE: 07-09-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	\$	177200.	
B. SIOH	\$	10632.	
C. DESIGN COST	\$	10632.	
D. TOTAL COST (1A+1B+1C)	\$	198464.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	198464.	

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS				OCT 1991	
FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	5600.	\$ 42672.	13.68	\$ 583753.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	3521.	\$ 9507.	17.25	\$ 163991.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		9121.	\$ 52179.		\$ 747744.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 9000.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 116100.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 116100.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 61179.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.24 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 863844.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.35
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 12.58 %

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 3

CALCULATIONS, COST ESTIMATE AND BACK-UP DATA

FEMP #1 - Energy Saving Project

No.	ECO ID	Description	Construction Cost	Annual Savings			Annual Cost Savings	Simple Payback (yrs)
				Energy (MBtu/yr) Elec.	NGas	O&M		
1	EL6	Convert to energy efficient motors	\$17,200	284	-	-	\$2,200	1.5
2	HS13	Use damper controls to shut off air to unoccupied areas	\$11,500	2,041	1,505	-	\$19,600	2.3
3	HS18	Reduce heated or cooled outside air	\$1,100	136	32	-	\$1,100	12.7
4	HS24	Surgical suite supply air reset	\$1,400	738	1,984	-	\$11,000	108.0
5	LT2	Reduce lighting levels	\$5,500	1,158	-	-	\$8,800	19.6
6	LT4C1	Retrofit compact fluor's in restrooms.	\$37,500	231	-	\$8,500	\$10,300	3.3
7	LT4C2	Retrofit compact fluor's in lobby downlights.	\$1,100	13	-	\$500	\$600	6.6
8	MI3B	Install occ. sensors to control lighting-breakrooms.	\$1,900	999	-	-	\$7,600	4.9
Totals			\$177,200	5,600	3,521	\$9,000	\$61,200	4.4
								3.2

FMP-11

ECO #EL6 Convert to energy-efficient motors.

Field survey notes were reviewed to determine which electric motors were candidates for analysis which were not scheduled to be changed out as part of the Renovation Project.

The table on p. EL6-2 contains the calculation and/or estimates of motor hp for exhaust fans whose nameplate data was not obtained during field surveys.

A preliminary screening analysis of all motors from 1 hp to 200 hp is shown on p. EL6-3. Since all motors from 5 hp to 60 hp have a simple payback less than 10 years, these sizes were selected for detailed analysis.

Detailed energy and cost savings for specific motors were calculated on p. EL6-4 under current operation conditions and on p. EL-5 under projected operating conditions after the Renovation Project has been completed. Motor ID #'s refer to the following types:

<u>ID#</u>	<u>Type</u>
EF	AHU exhaust fan
HW Supply	Hot water supply pump
MUA	Make up air fan
RA	AHU Return air fan
SF	AHU Supply fan

EEMEF

Energy Efficient Motors										
Filename: EEMEF.XLS										
Fort Gordon										
Augusta, GA										
EXHAUST		STATIC		CALC			CALC		FIELD	HP USED
FAN		PRESS	CALC	MOTOR	MOTOR	MEAS'D	HP FROM	MOTOR	DATA	FOR
NO	CFM	(IN)	BHP	HP	HP (EST)	KW	KW	HP (EST)	MOTOR HP	EVAL
1	16600	0.75	3.26	5	5				5	5
2	22000	0.75	4.33	6	7.5				7.5	7.5
3	3700	1.75	1.70	3	3				2	3
4	16900	1.25	5.54	8	10				15	15
5	14400	0.75	2.83	4	5					5
6	27900	0.75	5.49	8	10					10
7	35600	2.75	25.67	35	40				100	100
8	6500	0.5	0.85	2	2				5	5
9	26000	0.5	3.41	5	5					5
10	1490	2	0.78	2	2					2
11	11950	-	-	-	-					
12	17300	0.75	3.40	5	5					5
13	15265	0.75	3.00	5	5	3.70	7.00	7.50		7.5
14	14700	0.75	2.89	4	5	0.75	2.00	2.00		5
15	12000	0.75	2.36	4	5	2.55	5.00	5.00		5
16	16610	0.75	3.27	5	5	4.00	8.00	10.00		10
17	325	2.5	0.21	1	1					1

Energy Efficient Motor Preliminary Analysis

19-Jun-96

Filename: EEM3.XLS

Site: Fort Gordon
Augusta, GA

Application : Various Motors Labor Cost: \$27.50 /hr
 Percent Motor Load: 75 %
 Operating Hours : 8760 Hrs/Yr
 Electric Rate
 Energy : \$0.026 /kWh
 Demand : /kW

MOTOR HP	EXIST EFF (1)	ENERGY EFF (2)	EXIST KW	ENEFF KW	KW SAVE	KWH/YR SAVED	\$/YR SAVED	MATL COST (3)	LABOR COST (4)	TOTAL COST (5)	SIMPLE PAYBACK	LABOR (HRS)
1.0	72.0%	84.0%	0.78	0.67	0.11	976	25	188	49	280	11.0	1.78
1.5	77.0%	84.0%	1.09	1.00	0.09	799	21	173	49	264	12.7	1.78
2.0	80.0%	84.0%	1.40	1.34	0.07	586	15	221	49	317	20.8	1.78
3.0	84.0%	90.2%	2.01	1.87	0.14	1,207	31	221	49	317	10.1	1.78
5.0	84.0%	89.5%	3.34	3.14	0.21	1,799	47	302	49	406	8.7	1.78
7.5	85.5%	91.7%	4.93	4.59	0.33	2,917	76	377	53	493	6.5	1.91
10.0	86.5%	91.7%	6.49	6.12	0.37	3,225	84	455	55	583	7.0	2.00
15.0	87.5%	93.0%	9.63	9.06	0.57	4,987	130	605	69	769	5.9	2.50
20.0	88.5%	93.6%	12.69	12.00	0.69	6,057	157	739	85	940	6.0	3.08
25.0	89.5%	94.1%	15.68	14.92	0.77	6,717	175	858	88	1,076	6.2	3.20
30.0	89.5%	94.1%	18.82	17.90	0.92	8,060	210	997	92	1,234	5.9	3.33
40.0	91.0%	95.0%	24.68	23.64	1.04	9,104	237	1,401	110	1,706	7.2	4.00
50.0	91.0%	95.0%	30.85	29.55	1.30	11,379	296	1,590	138	1,955	6.6	5.00
60.0	91.7%	95.4%	36.74	35.31	1.42	12,482	325	2,108	157	2,554	7.9	5.71
75.0	93.0%	95.4%	45.28	44.14	1.14	9,979	259	2,373	183	2,885	11.1	6.67
100.0	93.0%	95.4%	60.38	58.86	1.52	13,306	346	3,120	244	3,799	11.0	8.89
125.0	93.0%	95.4%	75.47	73.57	1.90	16,632	432	3,624	314	4,458	10.3	11.43
150.0	94.1%	96.2%	89.51	87.55	1.95	17,116	445	4,829	367	5,862	13.2	13.33
200.0	94.5%	95.8%	118.84	117.22	1.61	14,126	367	6,356	440	7,652	20.8	16.00

(1) NEMA nominal efficiency of a new standard efficient 1800 rpm ODP motor (460V, 3 phase).

(2) NEMA nominal efficiency of a new "GE Brand Premium Efficiency" 1800 RPM ODP motor.

(3) Grainger 1995 prices for GE Premium Efficiency, 1800 RPM, ODP motors

(4) Means 1995 Electrical Cost Data adjusted for Augusta, GA plus 53% mark-up.

EL6-3

EXISTING MOTORS- CURRENT OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	85.5%	10	8,760	85,986	\$2,236	\$0
EF-6,16	10	2	75%	86.5%	13	8,760	113,323	\$2,946	\$0
EF-4	15	1	75%	87.5%	10	8,760	84,021	\$2,185	\$0
SF-5	20	1	100%	88.5%	17	8,760	147,683	\$3,840	\$0
MUA	20	1	75%	88.5%	13	8,760	110,762	\$2,880	\$0
HW SUPPLY	25	3	75%	89.5%	47	5,840	273,811	\$7,119	\$0
RA-1A,1B,2A,2B	30	4	75%	89.5%	75	8,760	657,147	\$17,086	\$0
SF-6	40	1	100%	91.0%	33	8,760	287,251	\$7,469	\$0
		15			217		1,759,984	\$45,760	\$0

TOTAL ELECTRIC COST \$45,760

HIGH EFFICIENCY MOTORS- CURRENT OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	91.7%	9	8,760	80,173	\$2,084	\$0
EF-6,16	10	2	75%	91.7%	12	8,760	106,897	\$2,779	\$0
EF-4	15	1	75%	93.0%	9	8,760	79,052	\$2,055	\$0
SF-5	20	1	100%	93.6%	16	8,760	139,636	\$3,631	\$0
MUA	20	1	75%	93.6%	12	8,760	104,727	\$2,723	\$0
HW SUPPLY	25	3	75%	94.1%	45	5,840	260,426	\$6,771	\$0
RA-1A,1B,2A,2B	30	4	75%	94.1%	71	8,760	625,023	\$16,251	\$0
SF-6	40	1	100%	95.0%	31	8,760	275,156	\$7,154	\$0
		15			206		1,671,089	\$43,448	\$0

TOTAL ELECTRIC COST \$43,448

ANNUAL KWH SAVINGS 88,895

ANNUAL COST SAVINGS \$2,311

SAVINGS

88,895 kwh x 3413

1 E6

= 303 MBtu

ELG-4

EXISTING MOTORS- PROJECTED OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	85.5%	10	8,760	85,986	\$2,236	\$0
EF-6	10	1	75%	86.5%	6	8,760	56,662	\$1,473	\$0
EF-16	10	1	75%	86.5%	6	5,096	32,962	\$857	\$0
EF-4	15	1	75%	87.5%	10	8,760	84,021	\$2,185	\$0
SF-5	20	1	75%	88.5%	13	8,760	110,762	\$2,880	\$0
MUA	20	1	75%	88.5%	13	5,460	69,037	\$1,795	\$0
HW SUPPLY	25	3	75%	89.5%	47	5,840	273,811	\$7,119	\$0
RA-1A,1B,2A,2B	30	4	75%	89.5%	75	8,760	657,147	\$17,086	\$0
SF-6	40	1	100%	91.0%	33	8,760	287,251	\$7,469	\$0
		15			212		1,657,638	\$43,099	\$0

TOTAL ELECTRIC COST

\$43,099

HIGH EFFICIENCY MOTORS- PROJECTED OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	91.7%	9	8,760	80,173	\$2,084	\$0
EF-6	10	1	75%	91.7%	6	8,760	53,448	\$1,390	\$0
EF-16	10	1	75%	91.7%	6	5,096	31,093	\$808	\$0
EF-4	15	1	75%	93.0%	9	8,760	79,052	\$2,055	\$0
SF-5	20	1	75%	93.6%	12	8,760	104,727	\$2,723	\$0
MUA	20	1	75%	93.6%	12	5,460	65,275	\$1,697	\$0
HW SUPPLY	25	3	75%	94.1%	45	5,840	260,426	\$6,771	\$0
RA-1A,1B,2A,2B	30	4	75%	94.1%	71	8,760	625,023	\$16,251	\$0
SF-6	40	1	100%	95.0%	31	8,760	275,156	\$7,154	\$0
		15			202		1,574,373	\$40,934	\$0

TOTAL ELECTRIC COST

\$40,934

ANNUAL KWH SAVINGS

83,266

ANNUAL COST SAVINGS

\$2,165

MBTU SAVINGS =

83,266 kwh x 3413

11.56

= 284 MBtu/yr

CONSTRUCTION COST ESTIMATE

Project: Energy Efficient Motors
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Hospital

RS&H No.: 694-1331-005
Date: 06/19/96
Estimator: T. Todd
Filename: EST2-EL6.xls

ITEM DESCRIPTION	QUANTITY		MATERIAL/EQUIP		LABOR (1)		TOTAL COST	SOURCE	
	No.	Unit	\$/Unit	Total	\$/Unit	Total		Material	Labor
Hi-eff 1800 RPM, 7.5 hp	2	ea	377	754	112	224	978	Gp26,27	MEp199
Hi-eff 1800 RPM, 10 hp	2	ea	455	910	117	234	1,144	Gp26,27	MEp199
Hi-eff 1800 RPM, 15 hp	1	ea	605	605	147	147	752	Gp26,27	MEp199
Hi-eff 1800 RPM, 20 hp	2	ea	739	1,478	180	361	1,839	Gp26,27	MEp199
Hi-eff 1800 RPM, 25 hp	3	ea	858	2,574	188	563	3,137	Gp26,27	MEp199
Hi-eff 1800 RPM, 30 hp	4	ea	997	3,988	195	781	4,769	Gp26,27	MEp199
Hi-eff 1800 RPM, 40 hp	1	ea	1,401	1,401	234	234	1,635	Gp26,27	MEp199
Subtotal Bare Costs				11,710		2,544	14,254		
Retrofit Cost Factors			0%	0	0%	0	0	MMp6	MMp6
Subtotal				11,710		2,544	14,254		
City Cost Index (Aug. GA)			0%	0	-46%	(1,170)	(1,170)	MMp533	MMp533
Subtotal				11,710		1,374	13,084		
OH & Profit Markup			10%	1,171	53%	728	1,899	MMp7	MMp475
Subtotal				12,881		2,102	14,983		
Sales Taxes			6.0%	773	NA		773	MMp476	
Subtotal				13,654		2,102	15,756		
Contingency			10%	1,171	10%	254	1,425	MEp6	MEp6
Construction Cost				14,825		2,356	17,181		
Design Fee				NA	6.0%	1,031	1,031		
SIOH				NA	6.0%	1,031	1,031		
Total Project Cost				14,825		4,418	19,243		

(1) Labor cost includes removal of old motors and installation of new motors, and is equal to twice the Means cost for Installation.

LEGEND:

Mmp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###.

EL 6-6

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: EL6

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-EL6 ENERGY EFFICIENT MOTORS

FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A

ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	17200.	
B. SIOH	\$	1032.	
C. DESIGN COST	\$	1032.	
D. TOTAL COST (1A+1B+1C)	\$	19264.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		19264.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	284.	\$ 2164.	13.68	\$ 29605.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		284.	\$ 2164.		\$ 29605.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 2164.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.90 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 29605.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.54
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.87 %



SUBJECT ECO-HS13
Rt. Gordon
DESIGNER B. Todd
CHECKER T. Todd

AEP NO 694-1331-005
SHEET OF
DATE 3-1-96
DATE

ECO-HS13 Use Damper Controls to Shut Off Air to Unoccupied Areas

AHU-4E and AHU-4W serve the 4th through 4th floors of the hospital. The 4th floor is primarily administrative offices which are only occupied during regular business hours. For this project evaluation, it is assumed that the 4th floor air will be turned off from 6 pm to 6 am.

Since one AHU serves many floors, outlet dampers and variable inlet vanes would not be suitable damper controls to reduce the air flow to the fourth floor because these controls would reduce air to all areas. Variable frequency drives on the supply, return & exhaust fan motors with motorized dampers can be used effectively in this application and are evaluated here.

The fans serving the 4th floor are listed on p. HS13-3, as well as the proposed AHU control diagram. Air flows for the 4 zones of the 4th floor are shown on p. HS13-4. From these calculations, the percent of design cfm that the 4th floor uses out of the total cfm for AHU's 4E & 4W is estimated at 20% supply, 20% return and 10% exhaust.

Energy savings shown on this page are results of simple hand calculations. Computer simulation results are used in the final evaluation (p. HS13-13).

Energy savings for the 125 hp, 30 hp, 7.5 hp and 5 hp fan motors are calculated on p. HS13-5 through p. HS13-8. BHP is assumed to equal HP. Efficiencies are from Grainger for standard efficiency General Electric, 3 phase ODP motors.

Total energy savings = $2(214,319) + 2(53,448) + 7767 + 5271 = 548,572 \frac{\text{kWh}}{\text{yr}}$
Total cost savings = $2(5572) + 2(1390) + 202 + 137 = \$14,263/\text{yr}$

(HS13-1)



SUBJECT ECO-HS13
Fl. Gordon
DESIGNER B. Todd
CHECKER T. Todd

AEP NO 694-1331-005
SHEET OF
DATE 3-1-96
DATE

ECO-HS13 (cont.)

The Construction Cost Estimate for this ECO is shown on p. HS13-9. Details of the variable frequency drive and isolating transformer costs are tabulated on p. HS13-10. Details of the VAV damper with motor costs are on p. HS13-11. Actual duct sizes are shown on the Construction Cost Estimate, although the replacements may be a different size and may require multiple units as listed on p. HS13-11.

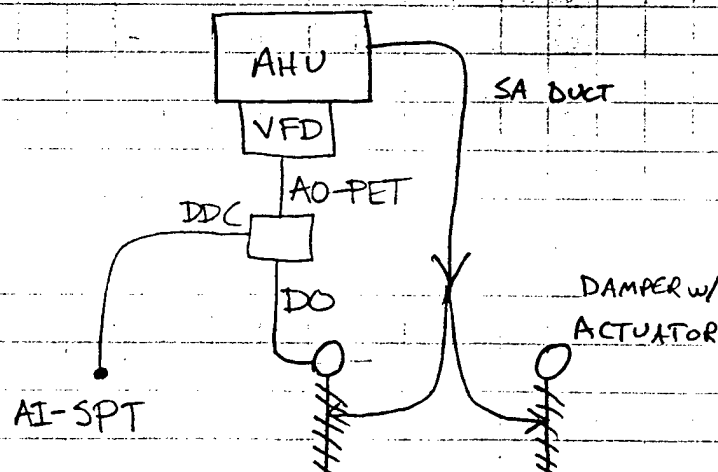
Motors - Variable Frequency Drives

AHU	FAN TYPE	FAN #	MOTOR HP
4W	SUPPLY	SF-4A	125
	RETURN	RA-2A	30
	EXHAUST	EF-1	5
4E	SUPPLY	SF-4B	125
	RETURN	RA-2B	30
	EXHAUST	EF-2	7.5

FROM AIR FLOWS SPREADSHEET,

SUPPLY % REDUCTION $\leq 20\%$
 RETURN % REDUCTION $\leq 20\%$
 EXHAUST % REDUCTION $\leq 10\%$

Vary fan speed as needed to maintain a constant pressure at the static pressure sensor for system.
 Revert to full speed on failure.



Air Flows for Hospital, 4th Floor
 Filename: VAV-4FL.WB2
 Location: Fort Gordon, GA

Plan Area	AHU	Zone	Supply		Return		Exhaust	
			Duct Size	CFM	Duct Size	CFM	Duct Size	CFM
A & B	4 W	Northwest	22 ϕ	8230	54 x 20	7430	10 x 8	190
A & B	4 W	Southwest	22 ϕ	8625	52 x 20	7320	14 x 8	320
C & B	4 E	Northeast	18 x 18	6190	52 x 16	6250	20 x 14	1415
C & B	4 E	Southeast	20 x 20	7610	62 x 18	5905	26 x 12	1435

A & B	4 W	4th Fl, West	16855	14750	510
		Percent of design cfm	21%	25%	3%

C & B	4 E	4th Fl, East	13800	12155	2850
		Percent of design cfm	16%	18%	13%

4th Floor	4E & 4W	4th Fl, All	30655	26905	3360
		Percent of design cfm	18%	21%	9%

Design	4 W	West, All	80500	59885	16665
Actual	4 W	West, All	102000	64710	37330

Design	4 E	East, All	85265	65935	21945
Actual	4 E	East, All	107000	76250	30700

(1) Assumes exhaust air cfm is equal to outside air cfm.

Variable Frequency Drive Preliminary Analysis

03/01/96

Filename: ECOHS13a.WB2

Application: Fort Gordon Hospital, 4th Floor

Motor bhp : 125 bhp

Exist. Control :

N/C

Motor Eff.: 93.0 %

New Control:

VFD

Oper Hours: 8760 Hours/Year

Elec. Rate: \$0.026 /kWh

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
12.0	0.50	100%	125.00	125.00	125.00	125.00	547,500	547,500	547,500	547,500
0.0	0.00	90%	125.00	121.25	106.25	91.13	0	0	0	0
12.0	0.50	80%	125.00	118.75	87.50	64.00	547,500	520,125	383,250	280,320
0.0	0.00	70%	125.00	112.50	81.25	42.87	0	0	0	0
0.0	0.00	60%	125.00	106.25	75.00	27.00	0	0	0	0
0.0	0.00	50%	125.00	100.00	68.75	15.63	0	0	0	0
0.0	0.00	40%	125.00	93.75	62.50	8.00	0	0	0	0
24.0	1.00		Totals				1,095,000	1,067,625	930,750	827,820

N/C = No Control

DMPR = Outlet Damper

VIV = Vari. Inlet Vane

VFD = Vari. Freq. Drive

Energy Use

Energy Cost

878,355	kWh/Yr	\$22,837	/Yr
856,396	kWh/Yr	\$22,266	/Yr
746,602	kWh/Yr	\$19,412	/Yr
664,036	kWh/Yr	\$17,265	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	214,319	kWh/Year
Cost Savings =	\$5,572	/Year

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis
 Filename: ECOHS13b.WB2
 Application: Fort Gordon Hospital, 4th Floor

03/01/96

Motor bhp : 30 bhp
 Motor Eff.: 89.5 %
 Oper Hours: 8760 Hours/Year
 Elec. Rate: \$0.026 /kWh
 Exist. Control : N/C
 New Control: VFD

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
12.0	0.50	100%	30.00	30.00	30.00	30.00	131,400	131,400	131,400	131,400
0.0	0.00	90%	30.00	29.10	25.50	21.87	0	0	0	0
12.0	0.50	80%	30.00	28.50	21.00	15.36	131,400	124,830	91,980	67,277
0.0	0.00	70%	30.00	27.00	19.50	10.29	0	0	0	0
0.0	0.00	60%	30.00	25.50	18.00	6.48	0	0	0	0
0.0	0.00	50%	30.00	24.00	16.50	3.75	0	0	0	0
0.0	0.00	40%	30.00	22.50	15.00	1.92	0	0	0	0
24.0	1.00		Totals				262,800	256,230	223,380	198,677

	Energy Use		Energy Cost	
N/C = No Control	219,049	kWh/Yr	\$5,695	/Yr
DMPR = Outlet Damper	213,573	kWh/Yr	\$5,553	/Yr
VIV = Vari. Inlet Vane	186,192	kWh/Yr	\$4,841	/Yr
VFD = Vari. Freq. Drive	165,601	kWh/Yr	\$4,306	/Yr

Annual Savings for:	VFD	vs	N/C
Energy Savings =	53,448		kWh/Year
Cost Savings =	\$1,390		/Year

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis
 Filename: ECOHS13c.WB2
 Application: Fort Gordon Hospital, 4th Floor

03/01/96

Motor bhp : 7.5 bhp
 Motor Eff.: 85.5 %
 Oper Hours: 8760 Hours/Year
 Elec. Rate: \$0.026 /kWh
 Exist. Control : N/C
 New Control: VFD

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
12.0	0.50	100%	7.50	7.50	7.50	7.50	32,850	32,850	32,850	32,850
12.0	0.50	90%	7.50	7.28	6.38	5.47	32,850	31,864	27,923	23,948
0.0	0.00	80%	7.50	7.13	5.25	3.84	0	0	0	0
0.0	0.00	70%	7.50	6.75	4.88	2.57	0	0	0	0
0.0	0.00	60%	7.50	6.38	4.50	1.62	0	0	0	0
0.0	0.00	50%	7.50	6.00	4.13	0.94	0	0	0	0
0.0	0.00	40%	7.50	5.63	3.75	0.48	0	0	0	0
24.0	1.00		Totals				65,700	64,715	60,773	56,798

	Energy Use	Energy Cost
N/C = No Control	57,324 kWh/Yr	\$1,490 /Yr
DMPR = Outlet Damper	56,464 kWh/Yr	\$1,468 /Yr
VIV = Vari. Inlet Vane	53,025 kWh/Yr	\$1,379 /Yr
VFD = Vari. Freq. Drive	49,557 kWh/Yr	\$1,288 /Yr

Annual Savings for: VFD vs N/C

Energy Savings = 7,767 kWh/Year
 Cost Savings = \$202 /Year

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis
 Filename: ECOHS13d.WB2
 Application: Fort Gordon Hospital, 4th Floor

03/01/96

Motor bhp : 5 bhp Exist. Control : N/C
 Motor Eff.: 84.0 % New Control: VFD
 Oper Hours: 8760 Hours/Year
 Elec. Rate: \$0.026 /kWh

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
12.0	0.50	100%	5.00	5.00	5.00	5.00	21,900	21,900	21,900	21,900
12.0	0.50	90%	5.00	4.85	4.25	3.65	21,900	21,243	18,615	15,965
0.0	0.00	80%	5.00	4.75	3.50	2.56	0	0	0	0
0.0	0.00	70%	5.00	4.50	3.25	1.71	0	0	0	0
0.0	0.00	60%	5.00	4.25	3.00	1.08	0	0	0	0
0.0	0.00	50%	5.00	4.00	2.75	0.63	0	0	0	0
0.0	0.00	40%	5.00	3.75	2.50	0.32	0	0	0	0
24.0	1.00		Totals				43,800	43,143	40,515	37,865

	Energy Use	Energy Cost
N/C = No Control	38,899 kWh/Yr	\$1,011 /Yr
DMPR = Outlet Damper	38,315 kWh/Yr	\$996 /Yr
VIV = Vari. Inlet Vane	35,981 kWh/Yr	\$936 /Yr
VFD = Vari. Freq. Drive	33,628 kWh/Yr	\$874 /Yr

Annual Savings for:	VFD	vs	N/C
Energy Savings =	5,271 kWh/Year		
Cost Savings =	\$137 /Year		

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

Motor HP	Variable Frequency Drive Bare Cost, \$ (1)			Estim. KVA (2)	Trans. KVA	Isolating Transformer Bare Cost, \$ (3)			VFD & Isolating Trans. Total Bare Cost, \$		
	Material	Labor	Total			Material	Labor	Total	Material	Labor	Total
3	3150	420	3570	3	3	380	167	547	3530	587	4117
5	3450	420	3870	4	5	485	195	680	3935	615	4550
7.5	3575	500	4075	7	7.5	645	213	858	4220	713	4933
10	3675	500	4175	9	10	800	293	1093	4475	793	5268
15	4025	755	4780	13	15	1200	390	1590	5225	1145	6370
20	4825	755	5580	17	20 *	1313	430	1743	6138	1185	7323
25	5475	995	6470	21	25	1425	470	1895	6900	1465	8365
30	6575	995	7570	25	25	1425	470	1895	8000	1465	9465
40	7275	995	8270	33	37.5	1550	585	2135	8825	1580	10405
50	8300	1275	9575	41	45 *	1725	612	2337	10025	1887	11912
60	9650	1752	11402	49	60 *	2075	666	2741	11725	2418	14143
75	11900	1752	13652	60	75	2425	720	3145	14325	2472	16797
100	13800	1960	15760	80	94 *	2913	743	3655	16713	2703	19415
125	15600	1960	17560	100	112.5	3400	765	4165	19000	2725	21725
150	19200	1960	21160	119	150	4375	807	5182	23575	2767	26342
200	22200	2375	24575	158	188 *	5113	932	6044	27313	3307	30619
250 *	25200	2790	27990	196	225	5850	1056	6906	31050	3846	34896

NOTES:

1. Costs for VFD's from Means Electrical Cost Data, 1996, pages 178 & 179.
 2. Assumes motor efficiency for GE, standard efficiency, 3 phase, ODP motor.
 3. Costs for isolating transformers from Means Electrical Cost Data, 1996, page 202.
- * Size not listed in Means, costs estimated by interpolation or extrapolation.



SUBJECT ECOH S13
DESIGNER B. Todd
CHECKER T. Todd

AEP NO _____
SHEET _____ OF _____
DATE 3-1-96
DATE _____

4th Floor Duct Sizes and Damper Costs

	<u>Actual Size</u>	<u>Qty</u>	<u>Replacement Size</u>	<u>VAV Damper w/ motor</u>	
	<u>Actual Size</u>		<u>Size</u>	<u>\$ MAT (ea)</u>	<u>\$ LABOR (ea)</u>
Supply ↓	22" ϕ	2	24" x 12"	144	29
	22" ϕ	2	24" x 12"	144	29
	18" x 18"	1	18" x 18"	139	29
	20" x 20"	2	24" x 12"	144	29
RETURN ↓	54" x 20"	3	18" x 20"	151	33
	52" x 20"	3	18" x 20"	151	33
	52" x 16"	2	28" x 16"	256	38.5
	62" x 18"	2	30" x 24"	305	61
EXHAUST ↓	10" x 8"	1	10" x 10"	117	17.8
	14" x 8"	1	16" x 10"	121	19.3
	20" x 14"	1	20" x 14"	142	29
	26" x 12"	1	16" x 12"	126	21
		1	12" x 12"	120	19.3

Source (MATERIALS & LABOR): 1996 Means Mechanical p. 328.

CONSTRUCTION COST ESTIMATE

Project: ECO-HS13, VFD w/Dampers, 4th Floor
 Location: Fort Gordon, GA
 Basis: Schematic Design
 Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
 Date: 03/05/96
 Estimator: W. T. Todd
 Filename: est-hs13.wb2

ITEM DESCRIPTION	QUANTITY		MATERIAL		LABOR		TOTAL COST	SOURCE	
	No.	Unit	\$/Unit	Total	\$/Unit	Total		Material	Labor
VFD w/ Iso Trans, 125 hp	2	Ea	19000	38000	2725	5450	43,450	(1)	(1)
VFD w/ Iso Trans, 30 hp	2	Ea	8000	16000	1465	2930	18,930	(1)	(1)
VFD w/ Iso Trans, 7.5 hp	1	Ea	4220	4220	713	713	4,933	(1)	(1)
VFD w/ Iso Trans, 5 hp	1	Ea	3935	3935	615	615	4,550	(1)	(1)
VAV Damper w/ motor									
NW supply, 22" rnd	1	Ea	288	288	58	58	346	MMp328	MMp328
NW return, 54x20	1	Ea	453	453	99	99	552	MMp328	MMp328
NW Exh., 10x8	1	Ea	117	117	17.8	18	135	MMp328	MMp328
SW supply, 22" rnd	1	Ea	288	288	58	58	346	MMp328	MMp328
SW return, 52x20	1	Ea	453	453	99	99	552	MMp328	MMp328
SW Exh., 14x8	1	Ea	121	121	19.3	19	140	MMp328	MMp328
NE supply, 18x18	1	Ea	139	139	29	29	168	MMp328	MMp328
NE return, 52x16	1	Ea	512	512	77	77	589	MMp328	MMp328
NE Exh., 20x14	1	Ea	142	142	29	29	171	MMp328	MMp328
SE supply, 20X20	1	Ea	288	288	58	58	346	MMp328	MMp328
SE return, 62X18	1	Ea	610	610	122	122	732	MMp328	MMp328
SE Exh., 26X12	1	Ea	246	246	40.3	40	286	MMp328	MMp328
Transformer, 40VA	12	Ea	23.5	282	14.5	174	456	MMp328	MMp328
DDC Controller, 32 point	1	Ea		0	3269	3269	3,269		MMp317
AI, Static Press. Sensor	6	Ea		0	340	2040	2,040		MMp317
AO, Elec. Controller	6	Ea		0	229	1373	1,373		MMp317
DO, On/Off Control	12	Ea		0	360	4315	4,315		MMp317
#18-2 wire in 1/2" EMT	27	CLF	7.6	205	29.5	797	1,002	MEp140	MEp140
Conduit, 1/2" EMT	900	LF	0.3	270	0.54	486	756	MEp105	MEp105
Subtotal Bare Costs				66569		22868	\$89,437		
Retrofit Cost Factors			5%	3328	5%	1143	4,471	MMp6	MMp6
Subtotal				69897		24011	93,908		
City Cost Index (Aug. GA)			0%	0	-46%	-11045	(11,045)	MMp533	MMp533
Subtotal				69897		12966	82,863		
OH & Profit Markups			10%	6990	53%	6872	13,862	MMp7	MMp475
Subtotal				76887		19838	96,725		
Sales Taxes			6.0%	4613		NA	4,613	MMp476	
Subtotal				81500		19838	101,338		
Contingency			10%	8150	10%	1984	10,134	MEp6	MEp6
Total Construction Cost				89650		21822	111,472		
Design Fee				NA	6.0%	6688	6,688		
SIOH				NA	6.0%	6688	6,688		
Total Project Cost				89650		35198	\$124,848		

LEGEND:

- (1) See VFD cost sheet.
 MEp### 1996 Means Electrical Cost Data, page ###.
 MMp### 1996 Means Mechanical Cost Data, page ###.

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: HS13
 LCCID FY95 (92)
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
 PROJECT NO. & TITLE: ECO-HS13 SHUT OF AIR W/ DAMPER CONTROLS
 FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
 ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	111500.	
B. SIOH	\$	6690.	
C. DESIGN COST	\$	6690.	
D. TOTAL COST (1A+1B+1C)	\$	124880.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	124880.	

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	2041.	\$ 15552.	13.68	\$ 212757.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	1505.	\$ 4064.	17.25	\$ 70095.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		3546.	\$ 19616.		\$ 282853.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 19616.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.37 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 282853.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.26
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.96 %

HS13-12

Trane Air Conditioning Economics
By: C.D.S. MARKETING

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**
** TRACE 600 ANALYSIS **
**
** by C.D.S. MARKETING **
**

EISENHOWER ARMY MEDICAL CENTER
AUGUSTA, GA
SAVANNAH DISTRICT CORPS OF ENGINEERS
REYNOLDS, SMITH & HILLS
SCHEDULE AIR TO 4TH FLOOR

ECO # HS13 DAMPER Controls

Weather File Code: AUGUSTA
Location:
Latitude: 33.0 (deg)
Longitude: 82.0 (deg)
Time Zone: 5
Elevation: 143 (ft)
Barometric Pressure: 29.8 (in. Hg)

Summer Clearness Number: 0.90
Winter Clearness Number: 0.90
Summer Design Dry Bulb: 95 (F)
Summer Design Wet Bulb: 76 (F)
Winter Design Dry Bulb: 23 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0756 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 1.1094 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,883.6 (Btu-min./hr/cuft)
Enthalpy Factor: 4.5387 (Lb-min./hr/cuft)

Design Simulation Period: July To July
System Simulation Period: January To December
Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 14:30:42 6/27/96
Dataset Name: DAMPER .TM

ELC (kwh) NGKS (therms)
22,118,931 622,460
21,521,022 607,408
597,909 15,052

2041 MBTU 1505 MBTU

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Trane Air Conditioning Economics
By: C.D.S. MARKETING

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

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

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 G)	GAS DMND On Peak (Thrm/hr)
Jan	1,499,168	2,701	77,316	2,029	188
Feb	1,329,888	2,698	72,127	1,806	188
March	1,635,049	2,793	58,684	2,107	183
April	1,750,917	2,941	44,268	2,330	163
May	1,922,752	3,324	40,014	2,780	156
June	2,126,510	3,604	34,758	3,515	152
July	2,235,160	3,599	36,769	3,751	153
Aug	2,212,806	3,628	36,801	3,741	154
Sept	1,978,412	3,459	37,986	3,006	156
Oct	1,688,798	2,870	50,985	2,093	168
Nov	1,579,336	2,825	53,652	1,958	178
Dec	1,562,227	2,730	64,046	1,958	185
Total	21,521,022	3,628	607,408	31,072	188

Building Energy Consumption = 183,187 (Btu/Sq Ft/Year)
Source Energy Consumption = 388,119 (Btu/Sq Ft/Year)

Floor Area = 732,541 (Sq Ft)

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Trane Air Conditioning Economics
By: C.D.S. MARKETING

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

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

Utility ELECTRIC DEMAND

Peak Value 3,628.3 (kW)
Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

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

Cooling Equipment

1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	761.9	21.00
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	604.7	16.66
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER	26.8	0.74
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS	63.5	1.75

Sub Total			1,456.9	40.15
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Heating Equipment

1	EQ2002	GAS FIRED STEAM BOILER	56.0	1.54
---	--------	------------------------	------	------

Sub Total			56.0	1.54
-----------	--	--	------	------

Air Moving Equipment

1		SUMMATION OF FAN ELECTRICAL DEMAND	102.3	2.82
2		SUMMATION OF FAN ELECTRICAL DEMAND	102.1	2.81
3		SUMMATION OF FAN ELECTRICAL DEMAND	82.8	2.28
4		SUMMATION OF FAN ELECTRICAL DEMAND	94.9	2.62
5		SUMMATION OF FAN ELECTRICAL DEMAND	21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND	34.7	0.96
7		SUMMATION OF FAN ELECTRICAL DEMAND	88.1	2.43
8		SUMMATION OF FAN ELECTRICAL DEMAND	1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND	8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND	76.0	2.09

Sub Total			612.3	16.88
-----------	--	--	-------	-------

Sub Total			0.0	0.00
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Miscellaneous

Lights	732.6	20.19
Base Utilities	0.0	0.00
Misc Equipment	770.6	21.24
Sub Total	1,503.1	41.43

Grand Total	3,628.3	100.00
-------------	---------	--------

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Trane Air Conditioning Economics
By: C.D.S. MARKETING

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CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 1

----- CALIFORNIA TITLE 24 COMPLIANCE REPORT -----

Weather Name AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

----- ENERGY USE SUMMARY -----

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	33,801,960.0	378.8	25.6	37,034,640.0	51.8
Primary Cooling						
Compressor	2,668,985.2	0.0	0.0	6.8	27,330,472.0	38.2
Tower/Cond Fans	536,585.9	0.0	30,391.1	1.4	5,494,652.5	7.7
Condenser Pump	1,020,989.8	0.0	0.0	2.6	10,454,960.0	14.6
Other Accessories	815,059.0	0.0	0.0	2.1	8,346,223.5	11.7
Auxiliary						
Supply Fans	5,016,097.5	0.0	0.0	12.8	51,364,956.0	71.9
Circulation Pumps	677,818.1	0.0	0.0	1.7	6,940,873.0	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	5,693,915.5	0.0	0.0	14.5	58,305,828.0	81.6
Lighting	5,344,352.5	0.0	0.0	13.6	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.5	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,834.0	301.9	20.1	28,356,668.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	21,521,020.0	60,740,792.0	31,071.7	100.0	284313440.0	393.1

HS13-16

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
Location: AUGUSTA, GA
Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
Program User: REYNOLDS, SMITH & HILLS
Comments: SCHEDULE AIR TO 4TH FLOOR

Card 08----- Climatic Information -----
Weather Summer Winter Summer Summer Winter Summer Winter
Clearness Clearness Design Design Design Building Ground Ground
Code Number Number Dry Bulb Wet Bulb Dry Bulb Orientation Reflect Reflect
AUGUSTA

Card 09----- Load Simulation Periods -----
1st Month Last Month Peak 1st Month Last Month 1st Month Last Month
Cooling Cooling Cooling Summer Summer Daylight Daylight
Simulation Simulation Load Hr Period Period Savings Savings
JUL JUL

Card 10----- Load Simulation Parameters -----
Cooling Heating Airflow Airflow Room Put Wall
Load Load Ventilation Input Output Circulation RA Load
Method Method Method Units Units Rate to Room
CEC-DOE2 CEC-DOE2

Card 11----- Energy Simulation Parameters -----
1st Month Last Month Level Building
Energy Energy Of Holiday Calendar Floor
Simulation Simulation Calculation Code Code Area
JAN DEC ZONE 2001

----- Load Section Alternative #1 -----

Card 19- Load Alternative -
Number Description
1 BASELINE

H313-17

Card 25-----

Wall/Glass Parameters

Room Number	Wall Number	Glass Length	Glass Width	Pct Glass or No. of Windows	Glass U-Value	Shading Coefficient	External Shading Type	Internal Shading Type	Percent Solar to Ret. Air	Visible Transmittance	Inside Visible Reflectance
534	1										
M610	1			10	1.04	0.9	3	3			
612	1										
614	1										
620	1										
622	1										
630	1										
632	1										
634	1										
710	1										
712	1										
714	1										
720	1										
722	1										
724	1										
M900	1			20	1.04	1.		3			
902	1										
904	1										
906	1										

Card 26-----

Schedules

Room Number	People	Lights	Ventilation	Infiltration	Reheat Minimum	Cooling Fans	Heating Fan	Auxiliary Fan	Room Exhaust	Daylighting Controls
M100	A-P8HPD	A-L8HPD	AVAIL	OFF		AVAIL	AVAIL	AVAIL	AVAIL	
160	AVAIL	AVAIL								
170	AVAIL	AVAIL								
180	AVAIL	AVAIL								
190	NONE	NONE	NONE	NONE		NONE	NONE			
M210	AVAIL	AVAIL	AVAIL	AVAIL		AVAIL	AVAIL	AVAIL	AVAIL	
240	NONE	NONE	NONE	NONE		NONE	NONE			
M300	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
302						A-MODSKF			A-MODSKF	
330	A-P8HPD	A-L8HPD								
332	A-P8HPD	A-L8HPD								
334	A-P8HPD	A-L8HPD								
350	NONE	NONE	NONE	NONE						
M400	A-P8HPD	A-L8HPD	AVAIL	AVAIL		NONE	NONE			
M510	AVAIL	AVAIL	AVAIL	OFF	A-DAMPER	AVAIL	AVAIL		AVAIL	
M610	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
800	NONE	NONE	NONE	NONE		NONE	NONE			
810	NONE	NONE	NONE	NONE		NONE	NONE			

schedules damper minimum position
4th floor only

Card 65----- Heating Load Assignment -----

Load	All Coil										
Assignment	Loads To	-Group 1-	-Group 2-	-Group 3-	-Group 4-	-Group 5-	-Group 6-	-Group 7-	-Group 8-	-Group 9-	
Reference	Heating Ref	Begin End	Begin End	Begin End	Begin End	Begin End	Begin End	Begin End	Begin End	Begin End	
1	1	1	11								

Card 67----- Heating Equipment Parameters -----

Heat Ref	Equip Code	Number Of	HW Pmp Full Ld	Cap'y	Energy Rate	Seq Order	Switch over	Hot Strg	Misc. Acc.	Demand Limit
Number	Name	Units	Value	Units	Value	Units	Value	Units	Number	Control
1	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF		
2	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF		
3	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF		

Card 69----- Fan Equipment Parameters -----

System Set Number	Cooling Fan	Heating Fan	Return Fan	Exhaust Fan	Auxiliary Supply	Room Exhaust	Optional Ventilation
1	EQ4001		EQ4004			SAMPLE-F	
2	EQ4001		EQ4004			SAMPLE-F	
3	EQ4001					SAMPLE-F	
4	EQ4280		EQ4904			SAMPLE-F	
5	EQ4001					SAMPLE-F	
6	EQ4001					SAMPLE-F	
7	EQ4280		EQ4904			SAMPLE-F	
8	EQ4001					SAMPLE-F	
9	EQ4001					SAMPLE-F	
10	EQ4001					SAMPLE-F	
11	EQ4000					EQ4000	

↑ VSD's on AHUs 4, 5, 7 (4E, 4W) and return fans

Card 70----- Fan Equipment KW Overrides -----

System Set Number	MAIN SYSTEM				OTHER SYSTEM			DEMAND LIMIT PRIORITY				
	Cool Fan	Heat Fan	Ret Fan	Exh Fan	Aux Sup	Room Exh	Opt Vent	Cool Fan	Heat Fan	Aux Fan	Room Exh	Opt Vent
	KW	KW	KW	KW	KW	KW	KW					
1	80		25									
2	80		25									
3	80											
4	100		13									
5	17											
6	33											
7	100		13									
8												
9												
10	16						60					
11												

Utility Description Reference Table

Schedules:

A-DAMPER 4TH FLOOR DAMPER SCHEDULE
A-L8HPD LIGHTS 8HR/DA
A-MOOSKF KIT FAN MOD SCH
A-P8HPD PEOPLE 8HR/DA
AVAIL AVAILABLE (100%)
BLGBASE2 HOSPITAL BLG TEMPLATE HOT WATER SCHEDULE
CL_76 COOLING TSTAT - CONST 76F
HOTRLGT HOTEL ROOMS LIGHTS
HT_75 HEATING TSTAT - CONST 75F
NONE ANY PROJECT
OFF ALWAYS OFF

System:

FC FAN COIL
FPVAV FAN POWERED VAV
PTAC PACKAGED TERMINAL AIR COND.
UV UNIT VENTILATOR
VRH VARIABLE VOLUME REHEAT

Equipment:

Cooling:

EQ1001L 2-STG CENTRIFUGAL CHILLER >550 TONS
EQ1120L AIR-CLD RECIPROCATING > 22 TONS
EQ1307 PACKAGED TERMINAL AIR CONDITIONER
THRMCHHE TRANE DIRECT FIRED ABSORBER, 1.07 COP

Heating:

EQ2002 GAS FIRED STEAM BOILER

Fan:

EQ4000 PREVENTS CONSUMPTION OF FAN ENERGY
EQ4001 AIR FOIL CENTRIFUGAL - CONSTANT VOLUME
EQ4004 AXIAL FLOW - CONSTANT VOLUME (MODEL Q)
EQ4280 AIR FOIL FAN W/VARIABLE SPEED DRIVE
EQ4904 VANE AXIAL FLOW FAN WITH VFD
SAMPLE-F SAMPLE GENERIC FAN

Tower:

EQ5100 COOLING TOWER FANS

Misc:

EQ5003 CHILLED WATER PUMP-VAV(SAME AS EQ5007)

TRACE 600 input file C:\CDS\JOBS\FTG\DAMPER.TH by C.D.S. MARKETING

Page #16

Schedule Name: A-DAMPER

Project: 4TH FLOOR DAMPER SCHEDULE

FOR MIN. POSITION

Location: EISENHOWER AMC

Client:

Program User:

Comments:

Starting Month: JAN Ending Month: DEC

Starting Day Type: DSGN Ending Day Type: WKDY

Hour Util Percent

0	10
6	100
17	10
24	

Starting Month: JAN Ending Month: DEC

Starting Day Type: SAT Ending Day Type: SUN

Hour Util Percent

0	10
24	

HSI3-21



SUBJECT _____
DESIGNER Hutchins
CHECKER _____

AEP NO _____
SHEET _____
DATE 3/8/96
DATE _____

ECO # HS18 Reduce Heated or Cooled Outside Air

Measured

	<u>Supply</u>	<u>OSA</u>	<u>% OSA</u>	
4A	107,000	31,030	29	> avg. 33%
4B	102,000	37,740	37	

Required (keeping existing supply air flows)

4A	107,000	24,100	22.5	> avg. 23%
4B	102,000	24,100	23.6	

CONSTRUCTION COST ESTIMATE

Project: ECO # HS18 Reduce Heated or Cooled Outside Air
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 3/9/96
Estimator: P. HUTCHINS
Filename: EST_HS18.XLS

[illegible]

LEGEND:

Mmp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
 PROJECT NO. & TITLE: ECO-HS18 REDUCE HEATED & COOLED OUTSIDE AIR
 FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
 ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

STUDY: HS18
 LCCID FY95 (92)

1. INVESTMENT

A. CONSTRUCTION COST \$ 1100.
 B. SIOH \$ 66.
 C. DESIGN COST \$ 66.
 D. TOTAL COST (1A+1B+1C) \$ 1232.
 E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0.
 F. PUBLIC UTILITY COMPANY REBATE \$ 0.
 G. TOTAL INVESTMENT (1D - 1E - 1F) \$ 1232.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	136.	\$ 1036.	13.68	\$ 14177.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	32.	\$ 86.	17.25	\$ 1490.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		168.	\$ 1123.		\$ 15667.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)
 (1) DISCOUNT FACTOR (TABLE A) 12.90
 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
------	------------------------------	-----------------	------------------------	---

d. TOTAL \$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 1123.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.10 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 15667.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 12.72
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 18.78 %

 **
 ** TRACE 600 ANALYSIS **
 **
 ** by C.D.S. MARKETING **
 **

EISENHOWER ARMY MEDICAL CENTER
 AUGUSTA, GA
 SAVANNAH DISTRICT CORPS OF ENGINEERS
 REYNOLDS, SMITH & HILLS

OSA REDUCTION

ECO # HS18

Weather File Code: AUGUSTA
 Location:
 Latitude: 33.0 (deg)
 Longitude: 82.0 (deg)
 Time Zone: 5
 Elevation: 143 (ft)
 Barometric Pressure: 29.8 (in. Hg)

Summer Clearness Number: 0.90
 Winter Clearness Number: 0.90
 Summer Design Dry Bulb: 95 (F)
 Summer Design Wet Bulb: 76 (F)
 Winter Design Dry Bulb: 23 (F)
 Summer Ground Relectance: 0.20
 Winter Ground Relectance: 0.20

Air Density: 0.0756 (Lbm/cuft)
 Air Specific Heat: 0.2444 (Btu/lbm/F)
 Density-Specific Heat Prod: 1.1094 (Btu-min./hr/cuft/F)
 Latent Heat Factor: 4,883.6 (Btu-min./hr/cuft)
 Enthalpy Factor: 4.5387 (Lb-min./hr/cuft)

Design Simulation Period: July To July
 System Simulation Period: January To December
 Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 19:10:44 6/26/96
 Dataset Name: OSA .TH

ENERGY SAVINGS

ELC (kwh)

NGAS (therms)

22,118,931

622,460

22,078,960

622,137

39,971

323

136 MBTU

32 MBTU

Trane Air Conditioning Economics

By: C.D.S. MARKETING

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

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

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 G)	GAS DMND On Peak (Thrm/hr)
Jan	1,552,783	2,740	78,233	2,094	188
Feb	1,377,334	2,738	73,339	1,865	188
March	1,691,412	2,829	60,151	2,212	184
April	1,807,434	2,969	45,542	2,451	164
May	1,974,632	3,376	41,192	2,855	158
June	2,160,054	3,620	35,747	3,503	152
July	2,261,782	3,615	37,878	3,738	154
Aug	2,243,318	3,661	37,848	3,722	155
Sept	2,014,967	3,506	39,112	3,053	157
Oct	1,744,879	2,901	52,382	2,200	169
Nov	1,633,376	2,876	55,065	2,051	180
Dec	1,616,987	2,767	65,648	2,055	187
Total	22,078,960	3,661	622,137	31,800	188

Building Energy Consumption = 187,797 (Btu/Sq Ft/Year)
 Source Energy Consumption = 398,035 (Btu/Sq Ft/Year)

Floor Area = 732,541 (Sq Ft)

HS18-5

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

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

Utility ELECTRIC DEMAND

Peak Value 3,661.3 (kW)

Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

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

Cooling Equipment

1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	753.4	20.58
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	596.0	16.28
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER	26.8	0.73
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS	63.5	1.74

Sub Total			1,439.6	39.32
-----------	--	--	---------	-------

Heating Equipment

1	EQ2002	GAS FIRED STEAM BOILER	56.0	1.53
---	--------	------------------------	------	------

Sub Total			56.0	1.53
-----------	--	--	------	------

Air Moving Equipment

1		SUMMATION OF FAN ELECTRICAL DEMAND	102.3	2.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	102.1	2.79
3		SUMMATION OF FAN ELECTRICAL DEMAND	82.8	2.26
4		SUMMATION OF FAN ELECTRICAL DEMAND	115.9	3.16
5		SUMMATION OF FAN ELECTRICAL DEMAND	21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND	34.7	0.95
7		SUMMATION OF FAN ELECTRICAL DEMAND	117.4	3.21
8		SUMMATION OF FAN ELECTRICAL DEMAND	1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND	8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND	76.0	2.08

Sub Total			662.6	18.10
-----------	--	--	-------	-------

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

Miscellaneous

Lights			732.6	20.01
Base Utilities			0.0	0.00
Misc Equipment			770.6	21.05
Sub Total			1,503.1	41.05

Grand Total			3,661.3	100.00
-------------	--	--	---------	--------

HS18-6

Trane Air Conditioning Economics
By: C.D.S. MARKETING

V.600
PAGE 3

CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 1

CALIFORNIA TITLE 24 COMPLIANCE REPORT

Weather Name AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

ENERGY USE SUMMARY

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	35,274,828.0	385.9	26.0	38,585,028.0	54.0
Primary Cooling						
Compressor	2,713,409.7	0.0	0.0	6.7	27,785,380.0	38.9
Tower/Cond Fans	536,170.3	0.0	31,119.7	1.3	5,490,396.0	7.7
Condenser Pump	1,005,827.2	0.0	0.0	2.5	10,299,695.0	14.4
Other Accessories	814,772.4	0.0	0.0	2.0	8,343,289.0	11.7
Auxiliary						
Supply Fans	5,549,719.5	0.0	0.0	13.8	56,829,260.0	79.5
Circulation Pumps	673,572.5	0.0	0.0	1.7	6,897,398.5	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	6,223,292.0	0.0	0.0	15.4	63,726,656.0	89.2
Lighting	5,344,352.5	0.0	0.0	13.3	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.1	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,826.0	294.7	19.6	28,356,660.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	22,078,956.0	62,213,656.0	31,800.3	100.0	291577088.0	403.3

HS18-7

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
 Location: AUGUSTA, GA
 Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
 Program User: REYNOLDS, SMITH & HILLS
 Comments: OSA REDUCTION

Card 08----- Climatic Information -----

Weather	Summer	Winter	Summer	Summer	Winter	Building	Summer	Winter
Code	Clearness	Clearness	Design	Design	Design	Orientation	Ground	Ground
	Number	Number	Dry Bulb	Wet Bulb	Dry Bulb		Reflect	Reflect
AUGUSTA								

Card 09----- Load Simulation Periods -----

1st Month	Last Month	Peak	1st Month	Last Month	1st Month	Last Month
Cooling	Cooling	Cooling	Summer	Summer	Daylight	Daylight
Simulation	Simulation	Load Hr	Period	Period	Savings	Savings
JUL	JUL					

Card 10----- Load Simulation Parameters -----

Cooling	Heating		Airflow	Airflow	Room	Put Wall
Load	Load	Ventilation	Input	Output	Circulation	RA Load
Method	Method	Method	Units	Units	Rate	to Room
CEC-DOE2	CEC-DOE2					

Card 11----- Energy Simulation Parameters -----

1st Month	Last Month	Level			Building
Energy	Energy	Of	Holiday	Calendar	Floor
Simulation	Simulation	Calculation	Code	Code	Area
JAN	DEC	ZONE		2001	

----- Load Section Alternative #1 -----

Card 19- Load Alternative -

Number	Description
1	BASELINE

Card 27----- People and Lights -----

Room Number	People Value	People Units	People Sensible	People Latent	Lighting Value	Lighting Units	Lighting Fixture Type	Ballast Factor	Percent Lights to Ret. Air	--- Daylighting --- Reference Point 1	Reference Point 2
M	309	SF-PERS	250	200	1.125	WATT-SF	RECFL-RS		75		
160					2.625						
170					2.625						
180					2.625						
190	0	SF-PERS									
240	0	SF-PERS									
350	0	SF-PERS									
400	200	SF-PERS			2.025	WATT-SF					
410	200	SF-PERS			2.025	WATT-SF					
420	200	SF-PERS			2.025	WATT-SF					
430	200	SF-PERS			2.025	WATT-SF					
440	200	SF-PERS			2.025	WATT-SF					
800	0	SF-PERS									
810	0	SF-PERS									
M900	150	SF-PERS			0	WATT-SF					

Card 28----- Miscellaneous Equipment -----

Room Number	Misc Equipment Number	Equipment Descrip	Energy Consump Value	Energy Consump Units	Schedule Code	Energy Meter Code	Percent of Load Sensible	Percent Misc. Load to Room	Percent Misc. Sens to Ret. Air	Radiant Fraction Air
M	1	MISC EQUIP	1.08	WATT-SF	A-L8HPD	ELEC				
160	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC				
170	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC				
180	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC				
250	1	MISC EQUIP	3.00	WATT-SF	A-L8HPD	ELEC				
M900	1	MISC ELEC	1.	WATT-SF	HOTRLGT	NONE				

Card 29----- Room Airflows -----

Room Number	Ventilation				Infiltration				Reheat Minimum	
	Cooling		Heating		Cooling		Heating		Value	Units
M100	19	PCT-MCLG	19	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
M210	19	PCT-MCLG	19	PCT-MCLG	0.75	ACH-HR	0.75	ACH-HR	100	PCT-MCLG
302	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
330	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
332	100	PCT-MCLG	100	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
334	100	PCT-MCLG	100	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
M400	23	PCT-MCLG	23	PCT-MCLG	0.25	ACH-HR	0.25	ACH-HR	100	PCT-MCLG
M510	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
M620	23	PCT-MCLG	23	PCT-MCLG	0.25	ACH-HR	0.25	ACH-HR	100	PCT-MCLG
800	0	CFM	0	CFM	0	CFM	0	CFM		
810	0	CFM	0	CFM	0	CFM	0	CFM		
M900	15	PCT-MCLG	15	PCT-MCLG	0.50	ACH-HR	0.50	ACH-HR	100	PCT-MCLG

OSA reduced on all levels except
kitchen make up, OR & ICU



SUBJECT _____
DESIGNER _____
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE _____
DATE _____

ASHRAE 62-89 Calculation

<u>Requirements</u>	<u>cfm</u> <u>person</u>
Patient Rooms	25
Medical Procedure	15
Operating Rooms	30
Recovery and ICU	15
Offices	20

Peak hospital occupancy is 2000
Nighttime 400

Assume 300 in-room patients

<u>SF</u>	<u>AREA</u>	<u>PEOPLE</u>	<u>IN-ROOM</u> <u>PATIENTS</u>	<u>OSA</u>
1	88,400	240		4800
2	120,000	340		6800
3	97,000	260		5200
4A	128,525	350	150	10,750
4B	129,295	350	150	10,750
5	14,730	20	10	450
6	20,000	20	30	1500
MRI	2940	10		200
FAM. PRT.	25,976	70		1400
TOTAL	626,866	1660	340	



SUBJECT FORT GORDON - EAMC
SCHEDULED SETBACK FOR OR
DESIGNER W. TODD
CHECKER _____

AEP NO 694 1268 005
SHEET _____ OF _____
DATE 3-7-96
DATE _____

ECO-HS24 SETBACK SUPPLY AIR TO SURGICAL SUITE

The surgical suite is not typically utilized at night and on weekends. This project will allow the supply and exhaust fans to operate at a reduced capacity during unoccupied times.

This area is served by: (Info from design dwgs.)

SF-6, 27900 cfm supply, 40 hp motor

EF-6, 22900 cfm exhaust, 5 hp motor

Funded Renovation Includes:

- VFD's on SF-6 and EF-6 motors
- Day/night setback software
- Speed control for fans
- Start/stop for fans, time control
- Current transformers on fan motors
- Alarm for fan status

OR Design Requirements: (see pages HS24-6, 7, 8 & 9)

- 15 Air changes per hour supply air (occupied)
- 5 " " " " outside " "
- 68 to 76 °F, 50-60% RH
- 3 Air changes per hour supply air (unoccupied)

Existing estimated supply air = 8.25 AC/HR



SUBJECT FORT GORDON - EAMC
SCHEDULED SETBACK FOR OR
DESIGNER W. TODD
CHECKER _____

AEP NO 694 1331 005
SHEET _____ OF _____
DATE 3-7-96
DATE _____

Eco-HS24 (Continued)

$$\text{Design pos. pressure} = \frac{27900 - 22900}{27900} = 0.179$$

Minimum Supply Air = 3 AC per hour

$$\text{Minimum Flow required} = \frac{3 \text{ AC/hr}}{8.25 \text{ AC/hr}} = 0.36 \Rightarrow \text{say } 40\%$$

Fan operating hours:

- Assume surgical suite is occupied from 6am to 9pm, 5 days/week.
- Assume Fans will operate at 100% for a total of 1 hour from 9pm - 6am, M-F.
- Assume Fans will operate at 100% for 12 hours/day during weekends.

$$100\% \text{ op. hrs} = (15+1) \frac{\text{hr}}{\text{day}} \times 5 \frac{\text{day}}{\text{wk}} + 12 \frac{\text{hr}}{\text{day}} \times 2 \frac{\text{day}}{\text{wk}} = 104 \text{ hr/wk}$$

$$40\% \text{ op. hrs} = 8 \frac{\text{hr}}{\text{day}} \times 5 \frac{\text{day}}{\text{wk}} + 12 \frac{\text{hr}}{\text{day}} \times 2 \frac{\text{day}}{\text{wk}} = 64 \text{ hr/wk}$$

Energy Savings: See pages HS24-3 and HS24-4

$$\text{Elec. Savings} = 102426 \frac{\text{kwh}}{\text{YR}} + 13018 \frac{\text{kwh}}{\text{YR}} = 115444 \frac{\text{kwh}}{\text{YR}}$$

$$115444 \frac{\text{kwh}}{\text{YR}} \times 3413 \frac{\text{Btu}}{\text{kwh}} \times \frac{1 \text{ MBtu}}{10^6 \text{ Btu}} = 394 \text{ MBtu/YR}$$

This is a simple hand calc. Computer simulation results are used for final analysis (p. HS24-11).

Variable Frequency Drive Preliminary Analysis
 Filename: ECO-HSX.WB2
 Application: Fort Gordon Hospital, 4th Floor

03/06/96

Motor bhp : 40 bhp Exist. Control : N/C
 Motor Eff.: 91.0 % New Control: VFD
 Oper Hours: 8760 Hours/Year
 Elec. Rate: \$0.026 /kWh

Oper Hr/Wk	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
104.0	0.62	100%	40.00	40.00	40.00	40.00	216,914	216,914	216,914	216,914
0.0	0.00	90%	40.00	38.80	34.00	29.16	0	0	0	0
0.0	0.00	80%	40.00	38.00	28.00	20.48	0	0	0	0
0.0	0.00	70%	40.00	36.00	26.00	13.72	0	0	0	0
0.0	0.00	60%	40.00	34.00	24.00	8.64	0	0	0	0
0.0	0.00	50%	40.00	32.00	22.00	5.00	0	0	0	0
64.0	0.38	40%	40.00	30.00	20.00	2.56	133,486	100,114	66,743	8,543
168.0	1.00		Totals				350,400	317,029	283,657	225,457

	Energy Use		Energy Cost	
N/C = No Control	287,251	kWh/Yr	\$7,469	/Yr
DMPR = Outlet Damper	259,894	kWh/Yr	\$6,757	/Yr
VIV = Vari. Inlet Vane	232,537	kWh/Yr	\$6,046	/Yr
VFD = Vari. Freq. Drive	184,825	kWh/Yr	\$4,805	/Yr

Annual Savings for:	VFD	vs	N/C
Energy Savings =	102,426		kWh/Year
Cost Savings =	\$2,663		/Year

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis
 Filename: ECO-HSX.WB2
 Application: Fort Gordon Hospital, 4th Floor

03/06/96

Motor bhp: 5 bhp
 Motor Eff.: 89.5 %
 Oper Hours: 8760 Hours/Year
 Elec. Rate: \$0.026 /kWh
 Exist. Control: N/C
 New Control: VFD

Oper Hr/Wk	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER				HORSEPOWER * HOURS			
			N/C	DMPR	VIV	VFD	N/C	DMPR	VIV	VFD
104.0	0.62	100%	5.00	5.00	5.00	5.00	27,114	27,114	27,114	27,114
0.0	0.00	90%	5.00	4.85	4.25	3.65	0	0	0	0
0.0	0.00	80%	5.00	4.75	3.50	2.56	0	0	0	0
0.0	0.00	70%	5.00	4.50	3.25	1.71	0	0	0	0
0.0	0.00	60%	5.00	4.25	3.00	1.08	0	0	0	0
0.0	0.00	50%	5.00	4.00	2.75	0.63	0	0	0	0
64.0	0.38	40%	5.00	3.75	2.50	0.32	16,686	12,514	8,343	1,068
168.0	1.00		Totals				43,800	39,629	35,457	28,182

	Energy Use		Energy Cost	
N/C = No Control	36,508	kWh/Yr	\$949	/Yr
DMPR = Outlet Damper	33,031	kWh/Yr	\$859	/Yr
VIV = Vari. Inlet Vane	29,554	kWh/Yr	\$768	/Yr
VFD = Vari. Freq. Drive	23,490	kWh/Yr	\$611	/Yr

Annual Savings for:	VFD	vs	N/C
Energy Savings =	13,018	kWh/Year	
Cost Savings =	\$338	/Year	

Notes:

- Equation for VFD HP is: $HP2 = (Q2/Q1)^3 \times HP1$
- Q = volume air flow, cfm

CONSTRUCTION COST ESTIMATE

Project: ECO-HS24, Scheduling Controls for SF-6 & EF-5
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 03/06/96
Estimator: W. T. Todd
Filename: est-hs24.wb2

[illegible]

LEGEND:

MEp### 1996 Means Electrical Cost Data, page ###.

MMp### 1996 Means Mechanical Cost Data, page ###.

MIL-HDBK-1191
15 OCTOBER 1991

MILITARY HANDBOOK

DEPARTMENT OF DEFENSE

MEDICAL AND DENTAL TREATMENT FACILITIES

DESIGN AND CONSTRUCTION CRITERIA

AMSC N/A

AREA FACR

DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE: DISTRIBUTION IS
UNLIMITED

APPENDIX A ARCHITECTURAL AND ENGINEERING DESIGN REQUIREMENTS

ROOM CODE	ROOM NAME	ARCHITECTURAL FINISHES				DOORS	ACOUSTICAL		ELECTRICAL			
		FLOOR	BASE WALL	CEILING	C'LG HT		SIZES	NOISE		PSP	ILL	EMERG
								LEVEL	STC			
								IN RM	STC			
OPST1	OUTPAT STRESS TESTING	VCT	R	GWP	ACT1	9'-0" 2750mm	3'-6" 1050mm	35-40	50	60	50	***
OPSW1	OPTICAL SVC WORK AREA	VCT	R	GWP	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60	100	***
OPTM1	OUTPAT TREADMILL ROOM	VCT	R	GWP	ACT1	9'-0" 2750mm	3'-6" 1050mm	35-40	50	60	50	***
OPVC1	OUTPAT VECTORCARDIO	VCT	R	GWP	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60	50	***
OPVL1	OUTPAT VASCULAR LAB	SV	R	GWL	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60	50G	***
ORCH1	OR CARDIAC MONITORING	SV	IV	GWL	ACT1	10'-0" 3000mm	4'-0" 1200mm	30-35	40	60	200	LB;RA
ORCS1	OR CYSTOSCOPIC SURGERY	ET/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60	200	LB;RA
ORCT1	OR CARDIOTHORACIC SURG	ET/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60	200	LB;RA
ORCW1	OR CLEAN WORK	ET/ SV	CT/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-0" 900mm	30-35	45	60	100	L;R
ORDA1	OR DECONTAMINATION	CT/ SV	CT/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-0" 900mm	30-35	45	60	30	L;R
OREC1	OR EQUIPMENT CLEANUP	VCT/ SV	R/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-6" 1050mm	30-35	45	60	30	L;R
ORGS1	OR GENERAL SURGERY	ET/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60	200	LB;RA
ORHL1	OR HEART LUNG PUMP	ET/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	***	***	60	20	LS
ORNE1	OR NEUROSURG EQ STOR	SV	IV	GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	***	***	125	20	LS

MIL-HDEK-1191

APPENDIX A
ARCHITECTURAL AND ENGINEERING DESIGN REQUIREMENTS

I. CASES				INTERIOR MECHANICAL DESIGN CONDITIONS											
Oxygen	MV-Med Vac	MA-Med Air	NO-Nitrous Oxide	1	2	3	4	5	6	7					
Nitrogen	GA-Gas	DA-Dental Air	OK-Oral Evac	AIR		AIR	MIN	TEMP	REL	FILTRATION					
Lab Air	PA-Process Air	LV-Lab Vac		NOTES	REL	CHG	OA	SUM	MIN	NUM	PRE	FIN	EQ	NOTES	
1HV 1MA				3	0	4	2	78F	70F	***	25%	***	***		
								26C	21C						
					0	4	1	78F	68F	***	25%	***	***		
								26C	20C						
1HV 1MA				3	0	4	2	78F	70F	***	25%	***	***		
								26C	21C						
1HV 1MA				3	0	4	2	78F	68F	***	25%	***	***		
								26C	20C						
1HV 1MA				3	-	4	2	78F	70F	***	25%	***	***		
								26C	21C						
1HV 2MA				3	0	6	2	78F	70F	***	25%	90%	***		
								24C	20C						
1HV 1MA 1NO				5	++	15	5	68-76F	50-60	25%	90%			8	
								20-24C						21	
1HV 4MA 2NO 2NI				5,7	++	15	5	68-76F	50-60	25%	99.97%			8	
								20-24C						21	
					+	6	2	75F	---	***	25%	90%	***		
								24C							
1HV 1MA 1NI				10	--	10	2.5	75F	---	***	25%	90%	YES	17	
								24C							
1HV 1MA 1NI				10	+	6	2	75F	---	***	25%	***	YES		
								24C							
1HV 4MA 2NO 2NI				5,7	++	15	5	68-76F	50-60	25%	90%			8	
								20-24C						21	
					++	15	5	68-76F	50-60	25%	99.97%			8	
								20-24C						21	
					+	6	1.5	75F	---	***	25%	90%	***		
								24C							

Appendix A-47

APPENDIX A ARCHITECTURAL AND ENGINEERING DESIGN REQUIREMENTS

INTERIOR MECHANICAL DESIGN CONDITIONS

FOR SPECIFIC AREAS, MEDICAL AND DENTAL TREATMENT FACILITIES (continued):

Relative Humidity (RH). This is the relative humidity to be maintained in a space as part of the designed conditions. The humidity may vary from 30 percent to 60 percent except where other design values are given or where there is no requirement for humidity control. Specific summer RH control is not required except for those areas provided under specific notes. Winter RH control is not required except as provided under notes.

Filtration. Up to three filter types may be required. The Orthopedic Operating Room requires a 25 percent prefilter, a 90 percent intermediate filter, and a 99.97 percent final filter. The values for the first two filters (see Appendix A) are by the atmospheric dust spot efficiency test. The atmospheric dust spot efficiencies are the minimum average and are based on ASHRAE Standard 52-76. The third filter where required is a HEPA filter which uses the DOP (Dy-Octyl Phthalate, or bis(2-ethylhexyl phthalate) test method. The DOP test efficiency is based on MIL-STD 282. All filters should be installed to prevent leakage between the filter segments and between the filter and its supporting frame.

Exhaust Outside. This column lists areas that require 100% exhaust directly to the outside.

Air supply shall be 15 air changes per hour unless a higher rate is required to meet cooling requirement and may be totally exhausted when the room is in use. The option as whether to utilize recirculated air during an operation is left to the discretion of the individual Military Departments. Should recirculated air be utilized the minimum outside air requirements would apply. During period of non-use, either (1) 75% of the air may be recirculated or (2) the air volume may be reduced to 3 air changes per hour, while maintaining the required air balance. All systems shall, if cost effective, use exhaust air energy recovery to precondition the incoming outside air.

2. Room exhaust directly over patient stations.

10. For negative isolation, room shall be negative to anteroom and positive to toilet. For positive isolation, room shall be positive to both anteroom and toilet. Anteroom shall be negative to corridor at all times. For isolation room used for patients with a high susceptibility to infection from leukemia, burns, bone marrow transplant, organ transplant, or Acquired Immunodeficiency Syndrome, HEPA should be used on air supply system.

11. Exhaust all to outside applicable to process only.

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: HS24
 LCCID FY95 (92)
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
 PROJECT NO. & TITLE: ECO-HS24 SURGICAL SUITE SUPPLY AIR RESET
 FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
 ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST \$ 1400.
 B. SIOH \$ 84.
 C. DESIGN COST \$ 84.
 D. TOTAL COST (1A+1B+1C) \$ 1568.
 E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0.
 F. PUBLIC UTILITY COMPANY REBATE \$ 0.
 G. TOTAL INVESTMENT (1D - 1E - 1F) \$ 1568.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	738.	\$ 5624.	13.68	\$ 76930.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	1984.	\$ 5357.	17.25	\$ 92405.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		2722.	\$ 10980.		\$ 169335.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)
 (1) DISCOUNT FACTOR (TABLE A) 12.90
 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
------	------------------------------	-----------------	------------------------	---

d. TOTAL \$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 10980.

5. SIMPLE PAYBACK PERIOD (1G/4) .14 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 169335.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 107.99
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 32.19 %

Trane Air Conditioning Economics

By: C.D.S. MARKETING

V 60

PAGE 1

**
** TRACE 600 ANALYSIS **
**
** by C.D.S. MARKETING **
**

EISENHOWER ARMY MEDICAL CENTER

AUGUSTA, GA

SAVANNAH DISTRICT CORPS OF ENGINEERS

REYNOLDS, SMITH & HILLS

(SCHEDULE OR AHU)

ECO # HS24

Reset Surgical Suite
Supply Air

ENERGY SAVINGS

Weather File Code: AUGUSTA
Location:
Latitude: 33.0 (deg)
Longitude: 82.0 (deg)
Time Zone: 5
Elevation: 143 (ft)
Barometric Pressure: 29.8 (in. Hg)

Summer Clearness Number: 0.90
Winter Clearness Number: 0.90
Summer Design Dry Bulb: 95 (F)
Summer Design Wet Bulb: 76 (F)
Winter Design Dry Bulb: 23 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0756 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 1.1094 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,883.6 (Btu-min./hr/cuft)
Enthalpy Factor: 4.5387 (Lb-min./hr/cuft)

Design Simulation Period: July To July

System Simulation Period: January To December

Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 22:21:39 6/26/96

Dataset Name: SSFSCH .TM

ELC (kwh) NGAs (therms)

22,118,931

622,460

21,902,632

602,620

216,299

19,840

738 MBtu

1984 MBtu

HS24-11

Trane Air Conditioning Economics

By: C.D.S. MARKETING

V 60

PAGE 1

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

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

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 G)	GAS DMND On Peak (Thrm/hr)
Jan	1,534,644	2,727	73,603	1,961	188
Feb	1,361,771	2,724	69,495	1,760	188
March	1,671,263	2,818	58,066	2,122	183
April	1,786,361	2,967	44,747	2,381	164
May	1,956,230	3,359	40,719	2,821	157
June	2,152,261	3,629	35,426	3,524	152
July	2,256,475	3,624	37,535	3,765	154
Aug	2,238,842	3,649	37,508	3,744	155
Sept	2,009,003	3,491	38,731	3,040	157
Oct	1,724,218	2,895	50,823	2,120	169
Nov	1,614,096	2,851	53,252	1,976	179
Dec	1,597,469	2,755	62,715	1,949	186
Total	21,902,632	3,649	602,620	31,164	188

Building Energy Consumption = 184,311 (Btu/Sq Ft/Year)

Floor Area = 732,541 (Sq Ft)

Source Energy Consumption = 392,766 (Btu/Sq Ft/Year)

HS24-12

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

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

Utility ELECTRIC DEMAND

Peak Value 3,648.6 (kW)
Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percent Of Tot (%)
----------------------	------------------------	-----------------------	---------------------------	--------------------------

Cooling Equipment

1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	758.0	20.77
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	600.6	16.46
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER	26.8	0.73
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS	63.5	1.74

Sub Total			1,448.9	39.71
-----------	--	--	---------	-------

Heating Equipment

1	EQ2002	GAS FIRED STEAM BOILER	56.0	1.53
---	--------	------------------------	------	------

Sub Total			56.0	1.53
-----------	--	--	------	------

Air Moving Equipment

1		SUMMATION OF FAN ELECTRICAL DEMAND	102.3	2.80
2		SUMMATION OF FAN ELECTRICAL DEMAND	102.1	2.80
3		SUMMATION OF FAN ELECTRICAL DEMAND	82.8	2.27
4		SUMMATION OF FAN ELECTRICAL DEMAND	115.9	3.18
5		SUMMATION OF FAN ELECTRICAL DEMAND	21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND	12.8	0.35
7		SUMMATION OF FAN ELECTRICAL DEMAND	117.4	3.22
8		SUMMATION OF FAN ELECTRICAL DEMAND	1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND	8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND	76.0	2.08

Sub Total			640.6	17.56
-----------	--	--	-------	-------

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

Miscellaneous

Lights			732.6	20.08
Base Utilities			0.0	0.00
Misc Equipment			770.6	21.12
Sub Total			1,503.1	41.20

Grand Total			3,648.6	100.00
-------------	--	--	---------	--------

HS24-13

Trans Air Conditioning Economics
By: C.D.S. MARKETING

V 600
PAGE 3

CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 1

----- CALIFORNIA TITLE 24 COMPLIANCE REPORT -----

Weather Name AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

----- ENERGY USE SUMMARY -----

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	33,323,140.0	376.4	25.0	36,530,620.0	51.1
Primary Cooling						
Compressor	2,690,901.3	0.0	0.0	6.8	27,554,892.0	38.6
Tower/Cond Fans	537,923.1	0.0	30,483.0	1.4	5,508,345.5	7.7
Condenser Pump	1,017,137.0	0.0	0.0	2.6	10,415,507.0	14.6
Other Accessories	815,767.1	0.0	0.0	2.1	8,353,474.0	11.7
Auxiliary						
Supply Fans	5,378,677.0	0.0	0.0	13.6	55,077,780.0	77.1
Circulation Pumps	676,739.2	0.0	0.0	1.7	6,929,826.0	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	6,055,416.0	0.0	0.0	15.3	62,007,604.0	86.8
Lighting	5,344,352.5	0.0	0.0	13.5	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.4	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,838.0	304.3	20.0	28,356,672.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	21,902,628.0	60,261,976.0	31,163.7	100.0	287717088.0	397.9

HS24-14

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
 Location: AUGUSTA, GA
 Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
 Program User: REYNOLDS, SMITH & HILLS
 Comments: SCHEDULE OR AHU

Card 08----- Climatic Information -----

Weather	Summer	Winter	Summer	Summer	Winter	Building	Summer	Winter
Code	Clearness	Clearness	Design	Design	Design	Orientation	Ground	Ground
	Number	Number	Dry Bulb	Wet Bulb	Dry Bulb		Reflect	Reflect
AUGUSTA								

Card 09----- Load Simulation Periods -----

1st Month	Last Month	Peak	1st Month	Last Month	1st Month	Last Month
Cooling	Cooling	Cooling	Summer	Summer	Daylight	Daylight
Simulation	Simulation	Load Hr	Period	Period	Savings	Savings
JUL	JUL					

Card 10----- Load Simulation Parameters -----

Cooling	Heating		Airflow	Airflow	Room	Put Wall
Load	Load	Ventilation	Input	Output	Circulation	RA Load
Method	Method	Method	Units	Units	Rate	to Room
CEC-DOE2	CEC-DOE2					

Card 11----- Energy Simulation Parameters -----

1st Month	Last Month	Level		Holiday	Calendar	Building
Energy	Energy	Of		Code	Code	Floor
Simulation	Simulation	Calculation				Area
JAN	DEC	ZONE			2001	

----- Load Section Alternative #1 -----

Card 19- Load Alternative -

Number	Description
1	BASELINE

Card 25-----

Wall/Glass Parameters-----

Room Number	Wall Number	Glass Length	Glass Width	Pct Glass or No. of Windows	Glass U-Value	Shading Coefficient	External Shading Type	Internal Shading Type	Percent Solar to Ret. Air	Visible Transmittance	Inside Visible Reflectance
534	1										
M610	1			10	1.04	0.9	3	3			
612	1										
614	1										
620	1										
622	1										
630	1										
632	1										
634	1										
710	1										
712	1										
714	1										
720	1										
722	1										
724	1										
M900	1			20	1.04	1.		3			
902	1										
904	1										
906	1										

Card 26-----

Schedules-----

Room Number	People	Lights	Ventilation	Infiltration	Reheat Minimum	Cooling Fans	Heating Fan	Auxiliary Fan	Room Exhaust	Daylighting Controls
M100	A-P8HPD	A-L8HPD	AVAIL	OFF		AVAIL	AVAIL	AVAIL	AVAIL	
160	AVAIL	AVAIL								
170	AVAIL	AVAIL								
180	AVAIL	AVAIL								
190	NONE	NONE	NONE	NONE		NONE	NONE			
M210	AVAIL	AVAIL	AVAIL	AVAIL		AVAIL	AVAIL	AVAIL	AVAIL	
240	NONE	NONE	NONE	NONE		NONE	NONE			
M300	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
302						A-MODSKF			A-MODSKF	
330	A-P8HPD	A-L8HPD			A-ORSCH					
332	A-P8HPD	A-L8HPD			A-ORSCH					
334	A-P8HPD	A-L8HPD			A-ORSCH					
350	NONE	NONE	NONE	NONE		NONE	NONE			
M510	AVAIL	AVAIL	AVAIL	OFF		AVAIL	AVAIL		AVAIL	
M610	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
800	NONE	NONE	NONE	NONE		NONE	NONE			
810	NONE	NONE	NONE	NONE		NONE	NONE			

SCHEDULES FANS MINIMUMS
OR only

Card 65----- Heating Load Assignment -----

Load	All Coil										
Assignment	Loads To	-Group 1-	-Group 2-	-Group 3-	-Group 4-	-Group 5-	-Group 6-	-Group 7-	-Group 8-	-Group 9-	
Reference	Heating Ref	Begin	End	Begin	End	Begin	End	Begin	End	Begin	End
1	1	1	11								

Card 67----- Heating Equipment Parameters -----

Heat Ref	Equip Code	Number Of	HW Pmp Full Ld	Cap'y	Energy Rate	Seq Order	Switch over	Hot Strg	Misc. Acc.	Cogen	Demand Limit
Number	Name	Units	Value	Units	Value	Units	Units				Number
1	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF			
2	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF			
3	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF			

Card 69----- Fan Equipment Parameters -----

System Set	Cooling Fan	Heating Fan	Return Fan	Exhaust Fan	Auxiliary Supply	Room Exhaust	Optional Ventilation
1	EQ4001		EQ4004			SAMPLE-F	
2	EQ4001		EQ4004			SAMPLE-F	
3	EQ4001					SAMPLE-F	
4	EQ4001		EQ4004			SAMPLE-F	
5	EQ4001					SAMPLE-F	
6	EQ4280					SAMPLE-F	
7	EQ4001		EQ4004			SAMPLE-F	
8	EQ4001					SAMPLE-F	
9	EQ4001					SAMPLE-F	
10	EQ4001					SAMPLE-F	
11	EQ4000					EQ4000	

VSD on OR fan

Card 70----- Fan Equipment KW Overrides -----

System Set	---MAIN SYSTEM---				---OTHER SYSTEM---			---DEMAND LIMIT PRIORITY---				
	Cool Fan	Heat Fan	Ret Fan	Exh Fan	Aux Sup	Room Exh	Opt Vent	Cool Fan	Heat Fan	Aux Fan	Room Exh	Opt Vent
Number	KW	KW	KW	KW	KW	KW	KW					
1	80		25									
2	80		25									
3	80											
4	100		13									
5	17											
6	33											
7	100		13									
8												
9												
10	16						60					
11												

Utility Description Reference Table

Schedules:

A-L8HPD LIGHTS 8HR/DA
A-MODSKF KIT FAN MOD SCH
A-ORSCH OR FAN SCHEDULE
A-P8HPD PEOPLE 8HR/DA
AVAIL AVAILABLE (100%)
BLGBASE2 HOSPITAL BLG TEMPLATE HOT WATER SCHEDULE
CL_76 COOLING TSTAT - CONST 76F
HOTRLGT HOTEL ROOMS LIGHTS
HT_75 HEATING TSTAT - CONST 75F
NONE ANY PROJECT
OFF ALWAYS OFF

System:

FC FAN COIL
FPVAV FAN POWERED VAV
PTAC PACKAGED TERMINAL AIR COND.
UV UNIT VENTILATOR
VRH VARIABLE VOLUME REHEAT

Equipment:

Cooling:

EQ1001L 2-STG CENTRIFUGAL CHILLER >550 TONS
EQ1120L AIR-CLD RECIPROCATING > 22 TONS
EQ1307 PACKAGED TERMINAL AIR CONDITIONER
THRMCHHE TRANE DIRECT FIRED ABSORBER, 1.07 COP

Heating:

EQ2002 GAS FIRED STEAM BOILER

Fan:

EQ4000 PREVENTS CONSUMPTION OF FAN ENERGY
EQ4001 AIR FOIL CENTRIFUGAL - CONSTANT VOLUME
EQ4004 AXIAL FLOW - CONSTANT VOLUME (MODEL Q)
EQ4280 AIR FOIL FAN W/VARIABLE SPEED DRIVE
SAMPLE-F SAMPLE GENERIC FAN

Tower:

EQ5100 COOLING TOWER FANS

Misc:

EQ5003 CHILLED WATER PUMP-VAV(SAME AS EQ5007)

Schedule Name: LA-ORSCH
Project: OR FAM SCHEDULE
Location: EISENHOWER AMC
Client:
Program User:
Comments:

for min. position

Starting Month: JAN Ending Month: DEC
Starting Day Type: DSGN Ending Day Type: WKDY

Hour	Util	Percent
0	40	
6	100	
17	40	
24		

Starting Month: JAN Ending Month: DEC
Starting Day Type: SAT Ending Day Type: SUN

Hour	Util	Percent
0	40	
24		



SUBJECT _____
DESIGNER Hutchins
CHECKER _____

AEP NO _____
SHEET _____
DATE 3/11/96
DATE _____

ECD # LT 2 Reduce Lighting Levels

Delamp Hallway Light Fixtures (2x4 2L)

Area	#
1A -	11
1B -	29
1C -	25
1D -	32
1E -	15
1F -	14
1G -	14
1H -	22
1J -	21
1K -	20
1L -	<u>27</u>
	230

Area	#
2A -	0
2B -	17
2C -	4
2D -	32
2E -	19
2F -	23
2G -	28
2H -	12
2I -	13
2J -	14
2K -	11
2L -	23
2M -	12
2N -	11
2O -	29
2P -	21
2Q -	18
2R -	<u>22</u>
	281

Area	#
3A -	0
3B -	0
3C -	7
3D -	20
3E -	8
3F -	19
3G -	3
3H -	19
3I -	0
3J -	0
3K -	29
3L -	7
3M -	0
3N -	0
3O -	2
3P -	<u>15</u>
	129

4A -	15
4B -	4
4C -	<u>15</u>
	34

5A -	16
5B -	35
5C -	<u>16</u>
	67

6A
6B
6C

7-13A	25
7-13B	42
7-13C	<u>24</u>
	91

TOTAL = 230 + 281 + 129 + 34 + 67 + 91 * 8 = 1469 fixtures

Energy savings assuming all are TB's (2L → 1L) (58w → 32w)
$$1469 \times \frac{26w}{1000} \times 8760 = 334,579 \text{ kwh} = \underline{\underline{1142 \text{ MBTU/yr.}}}$$

LT2-1

Delamping Library (4th FLR)

42 4L Fluorescents

Current light level readings range from 100 to 190

Removing 2 lamps and disconnecting one ballast
 saves half the fixture energy

Assume they will be converted to T8's (58w - 32w)

$$\text{Savings} = \frac{26 \text{ watt}}{\text{fixture}} \times 42 \times \frac{5 \text{ da}}{\text{wk}} \times \frac{52 \text{ wk}}{\text{yr}} \times \frac{10 \text{ hr}}{\text{da}}$$

$$= \frac{2839 \text{ kwh}}{\text{yr}} = \frac{10 \text{ MBtu}}{\text{yr}}$$

Switching half of Family Practice Medical Records area
 lights off save

$$\text{Savings} = \frac{26 \text{ w}}{\text{fixt}} \times \frac{24 \times 5 \times 52 \times 10}{1000} = \frac{1622 \text{ kwh}}{\text{yr}}$$

$$= \frac{6 \text{ MBtu}}{\text{yr}}$$

$$\begin{aligned} \text{Total delamping savings} &= 1142 + 10 + 6 = 1158 \text{ MBtu / yr} \\ \text{Total fixtures} &= 1469 + 42 + 24 = 1535 \\ &\quad \text{(LT2-2)} \end{aligned}$$

FTGORDON Lumen Method

Reynolds, Smith & Hills, Inc.
4651 Salisbury Road
Jacksonville, FL 32256

EXISTING CONDITIONS
HALLWAY

Lumen Method Computation
Generated by LitePro V2.27E
Provided and supported by USI Lighting, Inc.
Filename: FTGORDON Type: Indoor

Lumen Method Computation	
Project name: EAMC Energy Audit	Project #
Prepared for: Savannah District COE	Date: 11-Mar-96
Prepared by: Paul Hutchins	

Area Name : HALLWAY No. Identical Areas = 1
Description: TYPICAL HALLWAY

DIMENSIONS:	(Ft)	REFLECTANCES:	(Dec. %)
Width (E-W) :	8.00	Ceiling :	0.80
Length (N-S) :	56.00	North Wall :	0.50
Ceiling Height :	9.00	East Wall :	0.50
Mounting Height :	9.00	South Wall :	0.50
Workplane Height :	2.50	West Wall :	0.50
Total Area :	448.00	Floor Cavity:	0.50
RCR (Room Ratio) :	4.64		

ENVIRONMENTAL CONDITION: Very Clean # OBSTRUCTIONS: 0

Type F2 : TEST #K10193, COLUMBIA, 2J240-HP, PATTERN-LITE
2'X4' 2L STATIC GRID TROFFER, HOLOPHANE #8224 LESS OVERLAY
LAMPS: (2) F40CW, Lumens= 3050
BALLAST: ESB, WATTS= 90
COEFFICIENT OF UTILIZATION: 55.6%

FACTORS:		PLACEMENT:	:	
Luminaire Dirt :	0.87	Total Number :		7
Lamp Lumen Loss :	0.88	Pattern :	0.0X	8.0
Ballast :	0.95	# Columns/Rows :		1/7
Lamp/ballast :	1.00	Start Column (X) :		4.00
Misc :	1.00	Start Row (Y) :		4.00
>> Total LLF :	0.73			

PERFORMANCE:
Ave. Footcandles : 38.51
Watts/Sq. Foot : 1.41

Uses IES procedures for Lumen Method. USI is not responsible for light output
of lamp/ballast, non-USI products, or design variables not shown.

FTGORDON Lumen Method

Reynolds, Smith & Hills, Inc.
4651 Salisbury Road
Jacksonville, FL 32256

PROPOSED DELAMP
TO ONE LAMP
PER FIXTURE

Lumen Method Computation
Generated by LitePro V2.27E
Provided and supported by USI Lighting, Inc.
Filename: FTGORDON Type: Indoor

Lumen Method Computation	
Project name: EAMC Energy Audit	Project #
Prepared for: Savannah District COE	Date: 11-Mar-96
Prepared by: Paul Hutchins	

Area Name : HALLWAY No. Identical Areas = 1
Description: TYPICAL HALLWAY

DIMENSIONS:	(Ft)	REFLECTANCES:	(Dec. %)
Width (E-W) :	8.00	Ceiling :	0.80
Length (N-S) :	56.00	North Wall :	0.50
Ceiling Height :	9.00	East Wall :	0.50
Mounting Height :	9.00	South Wall :	0.50
Workplane Height :	2.50	West Wall :	0.50
Total Area :	448.00	Floor Cavity:	0.50
RCR (Room Ratio) :	4.64		

ENVIRONMENTAL CONDITION: Very Clean # OBSTRUCTIONS: 0

Type F3 : TEST #10083, COLUMBIA, 5PA4*-52-141, 5PA
1X4 1L FLUSH AIRHANDLE TROFFER, LENS- .110" THK PRISMATIC A12
LAMPS: (1) F40WW, Lumens= 3050
BALLAST: ESB, WATTS= 45
COEFFICIENT OF UTILIZATION: 47.3%

FACTORS:		PLACEMENT:	:	
Luminaire Dirt :	0.87	Total Number :		7
Lamp Lumen Loss :	0.88	Pattern :	0.0X	8.0
Ballast :	0.95	# Columns/Rows :		1/7
Lamp/ballast :	1.00	Start Column (X) :		4.00
Misc :	1.00	Start Row (Y) :		4.00
>> Total LLF :	0.73			

PERFORMANCE:
Ave. Footcandles : 16.38
Watts/Sq. Foot : 0.70

Uses IES procedures for Lumen Method. USI is not responsible for light output of lamp/ballast, non-USI products, or design variables not shown.

CONSTRUCTION COST ESTIMATE

Project: ECO # LT2-1 Reduce Lighting Levels (Delamp Fixtures)
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 3/12/96
Estimator: P. HUTCHINS
Filename: EST_LT2.XLS

[illegible]

LEGEND:

Mmp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: LT2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-LT2 REDUCE LIGHTING LEVELS

FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A

ANALYSIS DATE: 03-12-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	5500.		
B. SIOH	\$	330.		
C. DESIGN COST	\$	330.		
D. TOTAL COST (1A+1B+1C)	\$	6160.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	6160.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	1158.	\$ 8824.	13.68	\$ 120712.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		1158.	\$ 8824.		\$ 120712.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)		12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 8824.

5. SIMPLE PAYBACK PERIOD (1G/4) .70 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 120712.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 19.60
(IF < 1 PROJECT DOES NOT QUALIFY)

SUBJECT _____
 DESIGNER Hutchins
 CHECKER _____

AEP NO _____
 SHEET _____ OF _____
 DATE 2/14/96
 DATE _____

LT4C1 Compact Fluorescents in Restrooms

Replace existing 52-w incandescent with
 15 watt fluorescent

Bulb	watt	lumens	Life	Price
A19 (inc.)	52	800	1000	\$0.69 ⁽¹⁾
3L815 (fl.)	15	900	10,000	22.21 ⁽²⁾ (3-tube)

Restroom operations hours:

$$4 \text{ hrs/da}, 7 \text{ da/wk} = 1456 \text{ hrs/yr.}$$

$$\text{Savings} = \frac{(52-15) \times 1456 \times 1258}{1000} = 67,711 \text{ kwh/yr}$$

1258 lamps

$$\underline{\underline{231 \text{ MBtu/yr}}}$$

Replacement cost savings

$$\frac{1258 \times 1456 \text{ hr}}{1000 \text{ hr/yr}} \times \frac{\$7.57 \text{ (3) Lamp}}{10,000} - \frac{1258 \times 1456}{10,000} \times 29.09 = \underline{\underline{\$8537/\text{yr}}}$$

(1) Granger 1995 #386 p.845

(2) p.863

(3) Labor cost = $\frac{15 \text{ min/lamp}}{60 \text{ min/hr}} \times \$27.50 = \$6.88$
 SPOT RELAMP lamp.

FT. GORDON EISENHOWER ARMY MEDICAL CENTER

SURVEY OF INCANDESCENT LAMPS FOR
REPLACEMENT WITH FLUORESCENT LAMPS

ROOM #	ROOM DESCRIPTION	# LAMPS
1D-02	REST ROOM	1
1D-03	REST ROOM	1
1D-44	REST ROOM	1
1G-02	REST ROOM	2
1G-03	REST ROOM	2
1J-23	REST ROOM	1
2B-32	REST ROOM	1
2C-18	REST ROOM	1
2C-19	JANITOR ROOM	1
2C-20	REST ROOM	1
2C-21	REST ROOM	1
2D-05	REST ROOM	1
2D-06	REST ROOM	1
2F-37	REST ROOM	1
2G-11	REST ROOM	1
2I-05	REST ROOM	1
2I-15	REST ROOM	1
2I-16	REST ROOM	1
2J-03	REST ROOM	1
2J-04	REST ROOM	1
2K-09	R/R & SHOWER	2
2K-11	R/R & SHOWER	2
2L-07	REST ROOM	1
2M-02	REST ROOM	1
2Q-06	REST ROOM	1
2Q-07	REST ROOM	1
2Q-38	REST ROOM	1
2R-22	REST ROOM	1
3F-12	REST ROOM	1
3F-13	REST ROOM	1
3G-04	JANITOR ROOM	1
3G-05	REST ROOM	1
3I-10	SHOWER ROOM	1
3K-06	REST ROOM	1
3K-28	REST ROOM	1
3K-30	REST ROOM	3
3K-38	REST ROOM	1
3L-07	JANITOR ROOM	1
4C-18	CONFERENCE ROOM	40
5A-03	REST ROOM	1
5A-04	REST ROOM	1
5A-16	REST ROOM	1
5A-17	REST ROOM	1
5A-20	SHOWER ROOM	2
5A-21	SHOWER ROOM	2
5A-22	SHOWER ROOM	2
5A-24	REST ROOM	1
5A-25	REST ROOM	1
5A-26	REST ROOM	1
5A-30	JANITOR ROOM	1
5A-33	REST ROOM	1
5A-34	REST ROOM	1
5B-02	REST ROOM	1
5B-07	REST ROOM	1
5B-10	REST ROOM	1
5B-11	PATIENT BED ROOM	2
5B-12	REST ROOM	1
5B-13	REST ROOM	1
5B-14	PATIENT BED ROOM	2
5B-15	PATIENT BED ROOM	2
5B-16	REST ROOM	1
5B-17	COMPUTER ROOM	2
5B-18	REST ROOM	1
5B-30	SHOWER ROOM	2
5B-33	SHOWER ROOM	2
5B-34	SHOWER ROOM	2
5B-37	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
5B-44	JANITOR ROOM	1
5B-45	PATIENT BED ROOM	2
5B-46	REST ROOM	1
5B-47	REST ROOM	1
5B-48	PATIENT BED ROOM	2
5B-49	PATIENT BED ROOM	2
5B-50	PATIENT BED ROOM	2
5B-51	PATIENT BED ROOM	2
5B-51	REST ROOM	1
5B-52	REST ROOM	1
5B-53	PATIENT BED ROOM	2
5B-54	REST ROOM	1
5B-55	REST ROOM	1
5B-57	REST ROOM	1
5C-01	PATIENT BED ROOM	2
5C-02	REST ROOM	1
5C-03	PATIENT BED ROOM	2
5C-04	REST ROOM	1
5C-05	PATIENT BED ROOM	2
5C-06	REST ROOM	1
5C-07	PATIENT BED ROOM	2
5C-12	REST ROOM	1
5C-13	PATIENT BED ROOM	2
5C-15	PATIENT BED ROOM	2
5C-16	REST ROOM	1
5C-18	REST ROOM	1
5C-20	REST ROOM	1
5C-22	REST ROOM	1
5C-23	PATIENT BED ROOM	2
5C-24	REST ROOM	1
5C-25	PATIENT BED ROOM	2
5C-26	REST ROOM	1
5C-27	PATIENT BED ROOM	2
5C-28	REST ROOM	1
6A-01	PATIENT BED ROOM	2
6A-02	REST ROOM	1
6A-03	PATIENT BED ROOM	2
6A-04	R/R AND SHOWER	2
6A-05	SHOWER ROOM	2
6A-06	PATIENT BED ROOM	2
6A-07	REST ROOM	1
6A-08	REST ROOM	1
6A-09	PATIENT BED ROOM	2
6A-10	PATIENT BED ROOM	2
6A-11	REST ROOM	1
6A-12	PATIENT BED ROOM	2
6A-13	R/R AND SHOWER	2
6A-15	PATIENT BED ROOM	2
6A-16	R/R AND SHOWER	2
6A-19	R/R AND SHOWER	2
6A-20	PATIENT BED ROOM	2
6A-22	REST ROOM	1
6A-23	REST ROOM	1
6A-24	PATIENT BED ROOM	2
6A-25	REST ROOM	1
6A-26	PATIENT BED ROOM	2
6A-34	SHOWER ROOM	2
6A-41	JANITOR ROOM	1
6A-48	KITCHEN	1
6B-01	PATIENT BED ROOM	2
6B-02	R/R AND SHOWER	2
6B-03	REST ROOM	1
6B-14	PATIENT BED ROOM	2
6B-15	REST ROOM	1
6B-16	MICROSCOPE ROOM	2
6B-17	REST ROOM	1
6B-18	PATIENT BED ROOM	2
6B-19	REST ROOM	1
6B-31	REST ROOM	2
6B-31	SHOWER	1
6B-36	R/R AND SHOWER	2

ROOM #	ROOM DESCRIPTION	# LAMPS
6B-36	SHOWER	1
6B-50	REST ROOM	1
6B-51	REST ROOM	1
6B-54	REST ROOM	1
6B-55	REST ROOM	1
6B-61	R/R AND SHOWER	2
6B-62	CLEAN LINEN ROOM	1
6B-63	PATIENT BED ROOM	2
6B-64	REST ROOM	1
6C-01	PATIENT BED ROOM	2
6C-02	REST ROOM	1
6C-03	PATIENT BED ROOM	2
6C-04	REST ROOM	1
6C-05	PATIENT BED ROOM	2
6C-06	REST ROOM	1
6C-07	PATIENT BED ROOM	2
6C-08	REST ROOM	1
6C-09	PATIENT BED ROOM	2
6C-10	R/R AND SHOWER	2
6C-11	SHOWER ROOM	2
6C-12	PATIENT BED ROOM	2
6C-13	R/R AND SHOWER	2
6C-14	CONFERENCE ROOM	2
6C-15	REST ROOM	1
6C-16	PATIENT BED ROOM	2
6C-17	REST ROOM	1
6C-20	SUPPLY ROOM	1
6C-30	R/R AND SHOWER	2
6C-31	PATIENT BED ROOM	2
6C-33	R/R AND SHOWER	2
6C-35	SHOWER ROOM	2
6C-36	REST ROOM	2
6C-37	PATIENT BED ROOM	2
6C-40	SHOWER ROOM	2
6C-41	R/R AND SHOWER	2
6C-42	PATIENT BED ROOM	2
6C-44	JANITOR ROOM	1
6C-45	SUPPLY ROOM	1
6C-48	PATIENT BED ROOM	2
6C-49	R/R AND SHOWER	2
6C-50	PATIENT BED ROOM	2
6C-51	REST ROOM	1
6C-52	PATIENT BED ROOM	2
6C-53	REST ROOM	1
7A-01	CONFERENCE ROOM	2
7A-02	PATIENT BED ROOM	2
7A-03	R/R AND SHOWER	2
7A-04	PATIENT BED ROOM	2
7A-05	R/R AND SHOWER	2
7A-07	PATIENT BED ROOM	2
7A-08	R/R AND SHOWER	2
7A-09	SHOWER ROOM	2
7A-11	R/R AND SHOWER	2
7A-12	SHOWER ROOM	2
7A-13	PATIENT BED ROOM	2
7A-14	R/R AND SHOWER	2
7A-16	PATIENT BED ROOM	2
7A-17	REST ROOM	1
7A-18	PATIENT BED ROOM	2
7A-19	REST ROOM	1
7A-21	PATIENT BED ROOM	2
7A-22	REST ROOM	1
7A-23	REST ROOM	1
7A-24	PATIENT BED ROOM	2
7A-29	SHOWER ROOM	2
7A-30	PATIENT BED ROOM	2
7A-31	R/R AND SHOWER	2
7A-32	SHOWER ROOM	2
7A-33	PATIENT BED ROOM	2
7A-34	R/R AND SHOWER	2
7A-35	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
7A-36	PATIENT BED ROOM	2
7A-37	R/R AND SHOWER	2
7A-39	PATIENT BED ROOM	2
7A-40	R/R AND SHOWER	2
7A-41	CLEAN LINEN ROOM	1
7A-50	NURSE'S LOUNGE	2
7B-01	PATIENT BED ROOM	2
7B-02	REST ROOM	1
7B-04	PATIENT BED ROOM	2
7B-05	REST ROOM	1
7B-07	REST ROOM	1
7B-08	REST ROOM	1
7B-09	PATIENT BED ROOM	2
7B-10	REST ROOM	1
7B-12	JANITOR ROOM	1
7B-13	REST ROOM	1
7B-25	REST ROOM	1
7B-26	REST ROOM	1
7B-33	HOUSE KEEPER RM	1
7B-34	R/R AND SHOWER	2
7B-35	PATIENT BED ROOM	2
7B-36	PATIENT BED ROOM	2
7B-37	R/R AND SHOWER	2
7B-38	PATIENT BED ROOM	2
7B-39	REST ROOM	1
7B-41	REST ROOM	1
7B-48	PATIENT BED ROOM	2
7B-49	REST ROOM	1
7B-50	PATIENT BED ROOM	2
7B-51	REST ROOM	1
7B-52	PATIENT BED ROOM	2
7B-53	REST ROOM	1
7C-01	PATIENT BED ROOM	2
7C-02	REST ROOM	1
7C-03	PATIENT BED ROOM	2
7C-04	R/R AND SHOWER	2
7C-06	PATIENT BED ROOM	2
7C-08	SHOWER ROOM	2
7C-09	PATIENT BED ROOM	2
7C-10	R/R AND SHOWER	2
7C-11	SHOWER ROOM	2
7C-12	PATIENT BED ROOM	2
7C-13	R/R AND SHOWER	2
7C-14	SHOWER ROOM	2
7C-15	PATIENT BED ROOM	2
7C-16	R/R AND SHOWER	2
7C-18	PATIENT BED ROOM	2
7C-19	REST ROOM	1
7C-20	REST ROOM	1
7C-21	PATIENT BED ROOM	2
7C-22	REST ROOM	1
7C-23	REST ROOM	1
7C-25	PATIENT BED ROOM	2
7C-26	R/R AND SHOWER	2
7C-27	PATIENT BED ROOM	2
7C-28	R/R AND SHOWER	2
7C-29	LINEN CLOSET	1
7C-30	PATIENT BED ROOM	2
7C-31	R/R AND SHOWER	2
7C-32	SHOWER ROOM	2
7C-33	PATIENT BED ROOM	2
7C-34	R/R AND SHOWER	2
7C-35	SHOWER ROOM	2
7C-36	PATIENT BED ROOM	2
7C-37	R/R AND SHOWER	2
7C-40	R/R AND SHOWER	2
7C-49	NURSE'S LOUNGE	1
7C-50	REST ROOM	1
8A-03	R/R AND SHOWER	2
8A-05	R/R AND SHOWER	2
8A-08	R/R AND SHOWER	2

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ROOM #	ROOM DESCRIPTION	# LAMPS
8A-09	SHOWER ROOM	2
8A-11	R/R & SHOWER	2
8A-12	SHOWER ROOM	2
8A-14	R/R & SHOWER	2
8A-17	REST ROOM	1
8A-19	REST ROOM	1
8A-22	REST ROOM	1
8A-23	REST ROOM	1
8A-29	SHOWER ROOM	2
8A-31	R/R & SHOWER	2
8A-32	SHOWER ROOM	2
8A-34	R/R & SHOWER	2
8A-35	SHOWER ROOM	2
8A-37	R/R & SHOWER	2
8A-40	R/R & SHOWER	2
8A-41	LINEN CLOSET	1
8A-50	NURSE'S LOUNGE	2
8B-02	REST ROOM	1
8B-03	JANITOR ROOM	1
8B-05	REST ROOM	1
8B-07	REST ROOM	1
8B-08	REST ROOM	1
8B-10	REST ROOM	1
8B-12	JANITOR ROOM	1
8B-13	REST ROOM	1
8B-25	REST ROOM	1
8B-26	REST ROOM	1
8B-34	R/R & SHOWER	2
8B-37	R/R & SHOWER	2
8B-39	REST ROOM	1
8B-41	REST ROOM	1
8B-47	R/R & SHOWER	2
8B-48	LOCKER ROOM	1
8B-50	R/R & SHOWER	2
8B-51	LOCKER ROOM	1
8B-53	REST ROOM	1
8B-55	REST ROOM	1
8B-56	TELEPHONE AREA	1
8C-02	REST ROOM	1
8C-04	R/R & SHOWER	2
8C-07	R/R & SHOWER	2
8C-08	SHOWER ROOM	2
8C-10	R/R & SHOWER	2
8C-11	SHOWER ROOM	2
8C-13	R/R & SHOWER	2
8C-14	SHOWER ROOM	2
8C-16	R/R & SHOWER	2
8C-19	REST ROOM	1
8C-20	REST ROOM	1
8C-22	REST ROOM	1
8C-23	REST ROOM	1
8C-26	R/R & SHOWER	2
8C-28	R/R & SHOWER	2
8C-29	LINEN CLOSET	1
8C-31	R/R & SHOWER	2
8C-32	SHOWER ROOM	2
8C-34	R/R & SHOWER	2
8C-35	SHOWER ROOM	2
8C-37	R/R & SHOWER	2
8C-40	R/R & SHOWER	2
8C-50	REST ROOM	1
9A-01	CONFERENCE ROOM	2
9A-02	PATIENT BED ROOM	2
9A-03	R/R & SHOWER	2
9A-04	PATIENT BED ROOM	2
9A-05	R/R & SHOWER	2
9A-07	PATIENT BED ROOM	2
9A-08	R/R & SHOWER	2
9A-09	SHOWER ROOM	2
9A-11	R/R & SHOWER	2
9A-12	SHOWER ROOM	2
9A-13	PATIENT BED ROOM	2
9A-14	R/R & SHOWER	2
9A-16	PATIENT BED ROOM	2
9A-17	REST ROOM	1
9A-18	PATIENT BED ROOM	2
9A-19	REST ROOM	1
9A-21	PATIENT BED ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
9A-22	REST ROOM	1
9A-23	REST ROOM	1
9A-24	PATIENT BED ROOM	2
9A-29	SHOWER ROOM	2
9A-30	PATIENT BED ROOM	2
9A-31	R/R & SHOWER	2
9A-32	SHOWER ROOM	2
9A-33	PATIENT BED ROOM	2
9A-34	R/R & SHOWER	2
9A-35	SHOWER ROOM	2
9A-36	PATIENT BED ROOM	2
9A-37	R/R & SHOWER	2
9A-39	PATIENT BED ROOM	2
9A-40	R/R & SHOWER	2
9A-41	CLEAN LINEN ROOM	1
9A-50	R, NURSE'S LAUNG	2
9B-01	PATIENT BED ROOM	2
9B-02	REST ROOM	1
9B-04	PATIENT BED ROOM	2
9B-05	REST ROOM	1
9B-07	REST ROOM	1
9B-08	REST ROOM	1
9B-09	PATIENT BED ROOM	2
9B-10	REST ROOM	1
9B-12	JANITOR ROOM	1
9B-13	REST ROOM	1
9B-25	REST ROOM	1
9B-26	REST ROOM	1
9B-33	HOUSE KEEPER RM	1
9B-34	R/R & SHOWER	2
9B-35	PATIENT BED ROOM	2
9B-36	PATIENT BED ROOM	2
9B-37	R/R & SHOWER	2
9B-38	PATIENT BED ROOM	2
9B-39	REST ROOM	1
9B-41	REST ROOM	1
9B-48	PATIENT BED ROOM	2
9B-49	REST ROOM	1
9B-50	PATIENT BED ROOM	2
9B-51	REST ROOM	1
9B-52	PATIENT BED ROOM	2
9B-53	REST ROOM	1
9C-01	PATIENT BED ROOM	2
9C-02	REST ROOM	1
9C-03	PATIENT BED ROOM	2
9C-04	R/R & SHOWER	2
9C-06	PATIENT BED ROOM	2
9C-08	SHOWER ROOM	2
9C-09	PATIENT BED ROOM	2
9C-10	R/R & SHOWER	2
9C-11	SHOWER ROOM	2
9C-12	PATIENT BED ROOM	2
9C-13	R/R & SHOWER	2
9C-14	SHOWER ROOM	2
9C-15	PATIENT BED ROOM	2
9C-16	R/R & SHOWER	2
9C-18	PATIENT BED ROOM	2
9C-19	REST ROOM	1
9C-20	REST ROOM	1
9C-21	PATIENT BED ROOM	2
9C-22	REST ROOM	1
9C-23	REST ROOM	1
9C-25	PATIENT BED ROOM	2
9C-27	PATIENT BED ROOM	2
9C-30	PATIENT BED ROOM	2
9C-32	SHOWER ROOM	2
9C-33	PATIENT BED ROOM	2
9C-35	SHOWER ROOM	2
9C-36	PATIENT BED ROOM	2
9C-37	R/R & SHOWER	2
9C-40	R/R & SHOWER	2
9C-50	REST ROOM	1
10A-01	CONFERENCE ROOM	2
10A-03	R/R & SHOWER	2
10A-05	R/R & SHOWER	2
10A-08	R/R & SHOWER	2
10A-09	SHOWER ROOM	2
10A-11	R/R & SHOWER	2

ROOM #	ROOM DESCRIPTION	# LAMPS
10A-12	SHOWER ROOM	2
10A-14	R/R & SHOWER	2
10A-17	REST ROOM	1
10A-19	REST ROOM	1
10A-22	REST ROOM	1
10A-23	REST ROOM	1
10A-29	SHOWER ROOM	2
10A-31	R/R & SHOWER	2
10A-32	SHOWER ROOM	2
10A-34	R/R & SHOWER	2
10A-35	SHOWER ROOM	2
10A-37	R/R & SHOWER	2
10A-40	R/R & SHOWER	2
10A-41	CLEAN LINEN ROOM	1
10A-50	NURSE'S LOUNGE	2
10B-02	REST ROOM	1
10B-03	JANITOR ROOM	1
10B-05	REST ROOM	1
10B-07	REST ROOM	1
10B-08	REST ROOM	1
10B-10	REST ROOM	1
10B-12	JANITOR ROOM	1
10B-13	REST ROOM	1
10B-25	REST ROOM	1
10B-26	REST ROOM	1
10B-34	R/R & SHOWER	2
10B-37	R/R & SHOWER	2
10B-39	REST ROOM	1
10B-41	REST ROOM	1
10B-47	R/R & SHOWER	2
10B-48	LOCKER ROOM	1
10B-50	R/R & SHOWER	2
10B-51	LOCKER ROOM	1
10B-53	REST ROOM	1
10B-55	REST ROOM	1
10B-56	TELEPHONE AREA	1
10C-02	REST ROOM	1
10C-04	R/R & SHOWER	2
10C-08	SHOWER ROOM	2
10C-10	R/R & SHOWER	2
10C-11	SHOWER ROOM	2
10C-13	R/R & SHOWER	2
10C-14	SHOWER ROOM	2
10C-16	R/R & SHOWER	2
10C-19	REST ROOM	1
10C-20	REST ROOM	1
10C-22	REST ROOM	1
10C-23	REST ROOM	1
10C-32	SHOWER ROOM	2
10C-35	SHOWER ROOM	2
10C-37	R/R & SHOWER	2
10C-40	R/R & SHOWER	2
10C-50	REST ROOM	1
11A-01	PATIENT BED ROOM	2
11A-02	PATIENT BED ROOM	2
11A-03	R/R & SHOWER	2
11A-04	PATIENT BED ROOM	2
11A-05	R/R & SHOWER	2
11A-06	LINEN ROOM	1
11A-07	PATIENT BED ROOM	2
11A-08	R/R & SHOWER	2
11A-09	SHOWER ROOM	2
11A-11	R/R & SHOWER	2
11A-12	SHOWER ROOM	2
11A-13	PATIENT BED ROOM	2
11A-14	R/R & SHOWER	2
11A-16	PATIENT BED ROOM	2
11A-17	REST ROOM	1
11A-18	PATIENT BED ROOM	2
11A-19	REST ROOM	1
11A-21	PATIENT BED ROOM	2
11A-22	REST ROOM	1
11A-23	REST ROOM	1
11A-24	PATIENT BED ROOM	2
11A-29	SHOWER ROOM	2
11A-30	PATIENT BED ROOM	2
11A-31	R/R & SHOWER	2
11A-32	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
11A-33	PATIENT BED ROOM	2
11A-34	R/R & SHOWER	2
11A-35	SHOWER ROOM	2
11A-36	PATIENT BED ROOM	2
11A-37	R/R & SHOWER	2
11A-39	PATIENT BED ROOM	2
11A-40	R/R & SHOWER	2
11A-41	CLEAN LINEN ROOM	1
11A-50	NURSE'S LOUNGE	2
11B-01	PATIENT BED ROOM	2
11B-02	REST ROOM	1
11B-03	JANITOR ROOM	1
11B-04	PATIENT BED ROOM	2
11B-05	REST ROOM	1
11B-07	REST ROOM	1
11B-08	REST ROOM	1
11B-09	PATIENT BED ROOM	2
11B-10	REST ROOM	1
11B-12	JANITOR ROOM	1
11B-13	REST ROOM	1
11B-25	REST ROOM	1
11B-26	REST ROOM	1
11B-33	HOUSE KEEPER RM	1
11B-34	R/R & SHOWER	2
11B-35	PATIENT BED ROOM	2
11B-36	PATIENT BED ROOM	2
11B-37	R/R & SHOWER	2
11B-38	PATIENT BED ROOM	2
11B-39	REST ROOM	1
11B-40	BREAK ROOM	2
11B-41	REST ROOM	1
11B-48	PATIENT BED ROOM	2
11B-49	REST ROOM	1
11B-50	PATIENT BED ROOM	2
11B-51	REST ROOM	1
11B-52	PATIENT BED ROOM	2
11B-53	REST ROOM	1
11C-01	OFFICE ROOM	2
11C-02	REST ROOM	1
11C-03	PATIENT BED ROOM	2
11C-04	R/R & SHOWER	2
11C-06	PATIENT BED ROOM	2
11C-08	SHOWER ROOM	2
11C-09	PATIENT BED ROOM	2
11C-10	R/R & SHOWER	2
11C-11	SHOWER ROOM	2
11C-12	PATIENT BED ROOM	2
11C-13	R/R & SHOWER	2
11C-14	SHOWER ROOM	2
11C-15	PATIENT BED ROOM	2
11C-16	R/R & SHOWER	2
11C-18	PATIENT BED ROOM	2
11C-19	REST ROOM	1
11C-20	REST ROOM	1
11C-21	CONFERENCE ROOM	2
11C-22	REST ROOM	1
11C-23	REST ROOM	1
11C-25	PATIENT BED ROOM	2
11C-27	PATIENT BED ROOM	2
11C-29	LINEN CLOSET	1
11C-30	PATIENT BED ROOM	2
11C-32	SHOWER ROOM	2
11C-33	PATIENT BED ROOM	2
11C-35	SHOWER ROOM	2
11C-36	PATIENT BED ROOM	2
11C-37	R/R & SHOWER	2
11C-40	R/R & SHOWER	2
11C-41	STORAGE ROOM	1
11C-50	REST ROOM	1
12A-01	PATIENT BED ROOM	2
12A-02	PATIENT BED ROOM	2
12A-03	R/R & SHOWER	2
12A-04	PATIENT BED ROOM	2
12A-05	R/R & SHOWER	2
12A-06	STORAGE ROOM	1
12A-07	PATIENT BED ROOM	2
12A-08	R/R & SHOWER	2
12A-09	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
12A-10	PATIENT BED ROOM	2
12A-11	R/R & SHOWER	2
12A-12	SHOWER ROOM	2
12A-13	PATIENT BED ROOM	2
12A-14	REST ROOM	1
12A-15	PATIENT BED ROOM	2
12A-16	REST ROOM	1
12A-17	PATIENT BED ROOM	2
12A-18	REST ROOM	1
12A-19	REST ROOM	1
12A-20	PATIENT BED ROOM	2
12A-21	REST ROOM	1
12A-22	REST ROOM	1
12A-23	PATIENT BED ROOM	2
12A-24	PATIENT BED ROOM	2
12A-25	R/R & SHOWER	2
12A-26	PATIENT BED ROOM	2
12A-27	R/R & SHOWER	2
12A-28	SHOWER ROOM	2
12A-29	PATIENT BED ROOM	2
12A-30	REST ROOM	1
12A-31	PATIENT BED ROOM	2
12A-32	REST ROOM	1
12A-33	PATIENT BED ROOM	2
12A-34	R/R & SHOWER	2
12A-35	STORAGE ROOM	1
12A-36	PATIENT BED ROOM	2
12A-37	REST ROOM	1
12A-45	REST ROOM	1
12A-46	NURSE'S LOUNGE	1
12A-51	REST ROOM	1
12A-51	SHOWER ROOM	2
12A-52	SHOWER ROOM	2
12B-01	PATIENT BED ROOM	2
12B-02	REST ROOM	1
12B-03	JANITOR ROOM	1
12B-05	REST ROOM	1
12B-06	REST ROOM	1
12B-07	OFFICE ROOM	2
12B-08	REST ROOM	1
12B-09	PATIENT BED ROOM	2
12B-10	REST ROOM	1
12B-11	PATIENT BED ROOM	2
12B-12	JANITOR ROOM	1
12B-13	REST ROOM	1
12B-22	STORAGE ROOM	1
12B-26	REST ROOM	1
12B-27	REST ROOM	1
12B-45	REST ROOM	1
12B-46	REST ROOM	1
12B-47	REST ROOM	1
12B-48	PATIENT BED ROOM	2
12B-49	PATIENT BED ROOM	2
12B-50	REST ROOM	1
12B-51	LINEN CLOSET	1
12B-52	OFFICE ROOM	2
12B-53	REST ROOM	1
12C-05	REST ROOM	1
12C-06	REST ROOM	1
12C-13	REST ROOM	1
12C-14	SHOWER ROOM	2
12C-15	PATIENT BED ROOM	2
12C-16	REST ROOM	1
12C-17	REST ROOM	1
12C-18	PATIENT BED ROOM	2
12C-19	REST ROOM	1
12C-25	REST ROOM	1
12C-26	REST ROOM	1
12C-32	SHOWER ROOM	2
12C-33	SHOWER ROOM	2
12C-34	SHOWER ROOM	2
12C-35	SHOWER ROOM	2
12C-41	REST ROOM	1
12C-42	NURSE'S LOUNGE	1
13A-01	PATIENT BED ROOM	2
13A-02	PATIENT BED ROOM	2
13A-03	R/R & SHOWER	2
13A-04	SUPPLY ROOM	1

ROOM #	ROOM DESCRIPTION	# LAMPS
13A-05	R/R & SHOWER	2
13A-06	PATIENT BED ROOM	2
13A-07	PATIENT BED ROOM	2
13A-08	R/R & SHOWER	2
13A-09	SHOWER ROOM	2
13A-10	PATIENT BED ROOM	2
13A-11	R/R & SHOWER	2
13A-12	SHOWER ROOM	2
13A-13	PATIENT BED ROOM	2
13A-14	REST ROOM	1
13A-15	PATIENT BED ROOM	2
13A-16	REST ROOM	1
13A-17	REST ROOM	1
13A-18	PATIENT BED ROOM	2
13A-19	REST ROOM	1
13A-20	REST ROOM	1
13A-21	PATIENT BED ROOM	2
13A-22	REST ROOM	1
13A-23	PATIENT BED ROOM	2
13A-24	PATIENT BED ROOM	2
13A-25	R/R & SHOWER	2
13A-26	SHOWER ROOM	2
13A-27	R/R & SHOWER	2
13A-28	PATIENT BED ROOM	2
13A-29	REST ROOM	1
13A-30	PATIENT BED ROOM	2
13A-31	PATIENT BED ROOM	2
13A-32	REST ROOM	1
13A-33	PATIENT BED ROOM	2
13A-34	R/R & SHOWER	2
13A-35	STORAGE ROOM	1
13A-36	PATIENT BED ROOM	2
13A-37	R/R & SHOWER	2
13A-38	LINEN CLOSET	1
13A-45	NURSE'S LOCKER	1
13A-46	REST ROOM	1
13A-52	SHOWER ROOM	2
13A-53	SHOWER ROOM	2
13B-01	PATIENT BED ROOM	2
13B-02	REST ROOM	1
13B-03	JANITOR ROOM	1
13B-05	REST ROOM	1
13B-06	REST ROOM	1
13B-07	PATIENT BED ROOM	2
13B-08	REST ROOM	1
13B-09	JANITOR ROOM	1
13B-10	PATIENT BED ROOM	2
13B-11	REST ROOM	1
13B-29	REST ROOM	1
13B-30	PATIENT BED ROOM	2
13B-32	REST ROOM	1
13B-33	PATIENT BED ROOM	2
13B-34	PATIENT BED ROOM	2
13B-35	REST ROOM	1
13B-42	PATIENT BED ROOM	2
13B-43	REST ROOM	1
13B-44	LINEN CLOSET	1
13B-45	PATIENT BED ROOM	2
13B-46	REST ROOM	1
13C-01	PATIENT BED ROOM	2
13C-02	REST ROOM	1
13C-03	REST ROOM	1
13C-04	PATIENT BED ROOM	2
13C-05	PATIENT BED ROOM	2
13C-06	R/R & SHOWER	2
13C-07	SHOWER ROOM	2
13C-08	SHOWER ROOM	2
13C-09	R/R & SHOWER	2
13C-10	PATIENT BED ROOM	2
13C-11	PATIENT BED ROOM	2
13C-12	R/R & SHOWER	2
13C-13	SHOWER ROOM	2
13C-14	PATIENT BED ROOM	2
13C-15	R/R & SHOWER	2
13C-16	PATIENT BED ROOM	2
13C-17	REST ROOM	1
13C-18	PATIENT BED ROOM	2
13C-19	REST ROOM	1
13C-20	REST ROOM	1

ROOM #	ROOM DESCRIPTION	# LAMPS
13C-21	PATIENT BED ROOM	2
13C-22	REST ROOM	1
13C-23	PATIENT BED ROOM	2
13C-24	PATIENT BED ROOM	2
13C-25	R/R & SHOWER	2
13C-26	STORAGE ROOM	1
13C-27	R/R & SHOWER	2
13C-28	PATIENT BED ROOM	2
13C-29	PATIENT BED ROOM	2
13C-30	R/R & SHOWER	2
13C-31	SHOWER ROOM	2
13C-32	PATIENT BED ROOM	2
13C-33	REST ROOM	1
13C-34	STORAGE ROOM	1
13C-35	R/R & SHOWER	2
13C-36	PATIENT BED ROOM	2
13C-37	PATIENT BED ROOM	2
13C-38	REST ROOM	1
13C-45	NURSE'S LOCKER	1
13C-46	REST ROOM	1
13C-52	SHOWER ROOM	2
TOTAL		1258

CONSTRUCTION COST ESTIMATE

Project: ECO #LT4C1 Retrofit Restroom Incandescents with Compact Fluorescents
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/1/96
Estimator: P. HUTCHINS
Filename: ESTLT4C1.XLS

[illegible]

LEGEND:

Mmp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LT4-14d

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: LT4C
 LCCID FY95 (92)
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
 PROJECT NO. & TITLE: ECO-LT4C RETROFIT WITH COMPACT FLUORESCENTS
 FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION 1 - RESTROOMS
 ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST \$ 36600.
 B. SIOH \$ 2196.
 C. DESIGN COST \$ 2196.
 D. TOTAL COST (1A+1B+1C) \$ 40992.
 E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0.
 F. PUBLIC UTILITY COMPANY REBATE \$ 0.
 G. TOTAL INVESTMENT (1D - 1E - 1F) \$ 40992.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	231.	\$ 1760.	13.68	\$ 24080.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		231.	\$ 1760.		\$ 24080.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)
 (1) DISCOUNT FACTOR (TABLE A) 12.90
 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 110127.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
------	------------------------------	-----------------	------------------------	---

d. TOTAL \$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 110127.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$ \$ 10297.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.98 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 134207.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 3.27
 (IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

SUBJECT _____
 DESIGNER Hutkins
 CHECKER _____

AEP NO _____
 SHEET _____
 DATE 2/14/96
 DATE _____

LT4C2 Compact Fluorescents in Lobby Area
 Downlights

Replace existing 52-w incandescent with
 18-watt compact with reflector

Bulb	watt	lumens	life	Price
A19 (inc)	52	800	1000	\$0.69 ⁽¹⁾
SL18/R40 (fl.)	18	800	10,000	\$27.22 ⁽²⁾

Annual operating hrs.

$$10 \text{ hrs/da} \times 7 \text{ da/wk} = 3640 \text{ hrs/yr}$$

Savings:
$$\frac{(52-18) \times 3640 \times 31}{1000} = 3837 \text{ kwh/yr}$$

31 lamps
$$= 13 \text{ MBSM/yr.}$$

Replacement cost savings for 31 lamps

$$\frac{31 \times 3640 \times 7.57}{1000} - \frac{31 \times 3640 \times 29.09}{10,000} = \$525/\text{yr.}$$

(1) Granger p. 345

(2) Gp 863

(3) Labor cost =
$$\frac{45 \text{ min/lamps} \times 3 \times \$27.50}{60 \text{ min/hr}} = \$6.88/\text{lamp}$$

 Spot relamp
 3 at a time

CONSTRUCTION COST ESTIMATE

Project: ECO #LT4C2 Retrofit Downlight Incandescents with Compact Fluorescents
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/1/96
Estimator: P. HUTCHINS
Filename: ESTLT4C2.XLS

[illegible]

LEGEND:

Mmp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LT4-~~5~~7

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: LT4C

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-LT4C RETROFIT WITH COMPACT FLUORESCENTS

FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION 2 - LOBBY DOWNLIGHTS

ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	1100.		
B. SIOH	\$	66.		
C. DESIGN COST	\$	66.		
D. TOTAL COST (1A+1B+1C)	\$	1232.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		1232.	

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	13.	\$ 99.	13.68	\$ 1355.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		13.	\$ 99.		\$ 1355.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)

12.90 \$ 525.

(2) DISCOUNTED SAVING/COST (3A X 3A1)

\$ 6773.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
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d. TOTAL \$ 0. 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 6773.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 624.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.97 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 8128.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 6.60
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 14.95 %



SUBJECT _____
DESIGNER _____
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE _____
DATE _____

ECO MI3B Occupancy Sensors in Breakrooms

Other similar rooms include:

lounges, kitchens, conference rooms, utility rooms,
janitor's closet, etc.

Total Load	=	38.3 kW (see spreadsheet)
Operating hours	=	168 hrs/wk
Proposed op hrs	=	21 hrs/wk

$$\begin{aligned}\text{Savings} &= (168 - 21) \text{ hr/wk} \times \frac{52 \text{ wk}}{\text{yr}} \times 38.3 \text{ kW} = \underline{292,765 \text{ kWh}} \\ &= \underline{999 \text{ MBtu/yr.}}\end{aligned}$$

FT GORDON EISENHOWER ARMY MEDICAL CENTER

SURVEY OF LIGHTS FOR INSTALLING OCCUPANCY SENSORS

ROOM #	ROOM DESCRIPTION	# FLUOR. 'U' L FIX	# FLUOR. 8 L FIX	# FLUOR. 4 L FIX	# FLUOR. 2 L FIX	# FLUOR. 1 L FIX	# SWITCHES
1B-03	EXAMINATION ROOM			2			1
1B-06	EXAMINATION ROOM			2			1
1B-08	EXAMINATION ROOM			2			1
1B-10	EXAMINATION ROOM			2			1
1B-13	EXAMINATION ROOM			2			1
1B-15	EXAMINATION ROOM			2			1
1B-17	EXAMINATION ROOM			2			1
1B-19	EXAMINATION ROOM			2			1
1B-21	EXAMINATION ROOM			2			1
1B-27	EXAMINATION ROOM			2			1
1B-30	EXAMINATION ROOM			2			1
1B-33	EXAMINATION ROOM			2			1
1B-44	EXAMINATION ROOM			2			1
1B-51	EXAMINATION ROOM				4		1
1B-54	EXAMINATION ROOM				2		1
1D-04	EXAMINATION ROOM			2			1
1D-08	EXAMINATION ROOM			2			1
1D-11	EXAMINATION ROOM			2			1
1D-12	EXAMINATION ROOM			2			1
1D-15	EXAMINATION ROOM			2			1
1D-18	EXAMINATION ROOM			2			1
1D-20	EXAMINATION ROOM			2			1
1D-21	X-RAY EXAM RM			2			1
1D-22	EXAMINATION ROOM			2			1
1D-24	EXAMINATION ROOM			2			1
1D-27	EXAMINATION ROOM			2			1
1D-29	EXAMINATION ROOM			2			1
1D-31	EXAMINATION ROOM			2			1
1D-35	EXAMINATION ROOM			2			1
1D-57	EXAMINATION ROOM			2			1
1D-59	EXAMINATION ROOM			2			1
1D-68	EXAMINATION ROOM			2			1
1E-05	EXAMINATION ROOM			2			1
1J-24	BREAK ROOM				1		1
1L-17	BREAK ROOM		3				1
FP003	EXAMINATION ROOM			2			1
FP005	EXAMINATION ROOM			2			1
FP006	EXAMINATION ROOM			2			1
FP007	EXAMINATION ROOM			2			1
FP008	EXAMINATION ROOM			2			1
FP009	EXAMINATION ROOM			2			1
FP010	EXAMINATION ROOM			2			1
FP018	EXAMINATION ROOM			2			1
FP019	EXAMINATION ROOM			2			1
FP020	EXAMINATION ROOM			2			1
FP021	EXAMINATION ROOM			2			1
FP022	EXAMINATION ROOM			2			1
FP023	EXAMINATION ROOM			2			1
FP029	EXAMINATION ROOM			2			1
FP030	EXAMINATION ROOM			2			1
FP031	EXAMINATION ROOM			2			1
FP032	EXAMINATION ROOM			2			1
FP033	EXAMINATION ROOM			2			1
FP034	EXAMINATION ROOM			2			1
FP043	EXAMINATION ROOM			2			1
FP044	EXAMINATION ROOM			2			1
FP045	EXAMINATION ROOM			2			1
FP046	EXAMINATION ROOM			2			1
FP047	EXAMINATION ROOM			2			1
FP048	EXAMINATION ROOM			2			1
FP056	SOILED UTILITY RM				2		1
FP059	EXAMINATION ROOM			2			1
FP060	EXAMINATION ROOM			2			1
FP061	EXAMINATION ROOM			2			1
FP062	EXAMINATION ROOM			2			1
FP063	EXAMINATION ROOM			2			1
FP064	EXAMINATION ROOM			2			1
FP069	EQ ST LINEN/C L U				3		1
FP075	EXAMINATION ROOM			2			1
FP076	EXAMINATION ROOM			2			1
FP077	EXAMINATION ROOM			2			1
FP078	EXAMINATION ROOM			2			1
FP079	EXAMINATION ROOM			2			1
FP080	EXAMINATION ROOM			2			1
FP116	CONFERENCE ROOM				8		1
FP118	R/R & LOCKER RM				4		1
FP119	R/R & LOCKER RM				4		1
FP121	STAFF LOUNGE				2		1
FP129	STUDENT ROOM				6		1

MI 3-3a

ROOM #	ROOM DESCRIPTION	# FLUOR U L FIX	# FLUOR B L FIX	# FLUOR 4 L FIX	# FLUOR 2 L FIX	# FLUOR 1 L FIX	# SWITCHES
2B-02	EXAMINATION ROOM			2			1
2B-04	EXAMINATION ROOM			2			1
2B-06	EXAMINATION ROOM			2			1
2B-08	EXAMINATION ROOM			2			1
2B-10	EXAMINATION ROOM			2			1
2B-13	STAFF LOUNGE			2			1
2B-19	EXAMINATION ROOM			2			1
2B-21	EXAMINATION ROOM			2			1
2B-22	UTILITY ROOM				2		1
2B-23	EQUIPMENT ROOM				2		1
2B-24	EXAMINATION ROOM			2			1
2B-26	EXAMINATION ROOM			2			1
2B-27	EXAMINATION ROOM			2			1
2B-29	EXAMINATION ROOM			2			1
2B-36	EXAMINATION ROOM			2			1
2B-40	KITCHEN			2			1
2B-XX	BREAK RM				2		1
2D-18	BREAK ROOM			1			1
2D-23	EXAMINATION ROOM			2			1
2D-26	EXAMINATION ROOM			2			1
2D-28	EXAMINATION ROOM			2			1
2D-30	EXAMINATION ROOM			2			1
2D-33	EXAMINATION ROOM			2			1
2D-35	EXAMINATION ROOM			2			1
2D-36	EXAMINATION ROOM			2			1
2D-38	EXAMINATION ROOM			2			1
2D-40	EXAMINATION ROOM			2			1
2D-41	EXAMINATION ROOM			2			1
2D-43	EXAMINATION ROOM			2			1
2D-45	EXAMINATION ROOM			2			1
2D-48	EXAMINATION ROOM			2			1
2D-50	EXAMINATION ROOM			2			1
2D-58	EXAMINATION ROOM			2			1
2D-60	EXAMINATION ROOM			2			1
2D-62	EXAMINATION ROOM			2			1
2E-07	EXAMINATION ROOM			3			1
2E-08	EXAMINATION ROOM			3			1
2E-09	EXAMINATION ROOM			3			1
2E-11	EXAMINATION ROOM			3			1
2E-12	BREAK ROOM				2		1
2E-21	EXAMINATION ROOM			3			1
2E-22	EXAMINATION ROOM			3			1
2E-23	EXAMINATION ROOM			3			1
2E-24	EXAMINATION ROOM			3			1
2F-12	EXAMINATION ROOM			2			1
2F-14	EXAMINATION ROOM			2			1
2F-17	EXAMINATION ROOM			2			1
2F-20	EXAMINATION ROOM			2			1
2F-21	EXAMINATION ROOM			2			1
2F-24	EXAMINATION ROOM			2			1
2F-25	EXAMINATION ROOM			2			1
2F-28	EXAMINATION ROOM			2			1
2F-29	EXAMINATION ROOM			2			1
2F-32	EXAMINATION ROOM			2			1
2F-33	EXAMINATION ROOM			2			1
2F-38	EXAMINATION ROOM			2			1
2F-39	EXAMINATION ROOM			2			1
2F-40	EXAMINATION ROOM			2			1
2G-06	EXAMINATION ROOM			2			1
2I-08	EXAMINATION ROOM			2			1
2I-10	EXAMINATION ROOM			2			1
2I-18	EXAMINATION ROOM			2			1
2I-20	EXAMINATION ROOM			2			1
2I-22	EXAMINATION ROOM			2			1
2J-05	EXAMINATION ROOM			2			1
2J-07	EXAMINATION ROOM			2			1
2J-12	EXAMINATION ROOM			2			1
2J-13	EXAMINATION ROOM			2			1
2J-15	EXAMINATION ROOM			2			1
2K-01	LOCKER ROOM	3					1
2K-05	LOUNGE				7		1
2N-05	EXAMINATION ROOM			2			1
2N-07	EXAMINATION ROOM			2			1
2N-08	EXAMINATION ROOM			2			1
2O-19	SUPPLY ROOM				2		1
2O-23	EXAMINATION ROOM			2			1
2O-25	EXAMINATION ROOM			2			1
2O-27	EXAMINATION ROOM			2			1
2O-34	BREAK ROOM				1		1
2O-50	CONFERENCE ROOM			6			1
2P-05	EXAMINATION ROOM			2			1
2P-07	EXAMINATION ROOM			2			1
2P-09	EXAMINATION ROOM			2			1
2P-11	EXAMINATION ROOM			2			1
2P-34	EXAMINATION ROOM			2			1
2P-36	EXAMINATION ROOM			2			1
2P-40	EXAMINATION ROOM			2			1
2P-42	EXAMINATION ROOM			2			1
2P-44	EXAMINATION ROOM			2			1
2Q-01	CONFERENCE ROOM				2		1
2R-25	PRINTER ROOM				4		1

MI 3-36

ROOM #	ROOM DESCRIPTION	# FLUOR 'U' L FIX	# FLUOR 8 L FIX	# FLUOR 4 L FIX	# FLUOR 2 L FIX	# FLUOR 1 L FIX	# SWITCHES
3B-14	LOCKER ROOM				3		1
3B-17	LOCKER ROOM					8	1
3E-08	LOCKER ROOM				1		1
3F-03	LOCKER ROOM				1		1
3I-08	R/R & LOCKER RM				1		1
3I-11	PASSAGE TO LK RM				4		1
3I-12	LOCKER ROOM				2		1
3K-05	LOCKER ROOM				1		1
3K-23	LOCKER ROOM				1		1
3K-24	PASSAGE TO LOCKER				3		1
3K-25	LOUNGE				3		1
3K-26	LOCKER RM & SHOWER				3		1
3K-27	LOCKER ROOM				1		1
3K-29	PASSAGE TO LOCKER				3		1
3L-04	UTILITY RM				1		1
4C-12	BREAK ROOM				1		1
4C-18	CONFERENCE ROOM				10		1
5A-13	SOILED UTILITY ROOM				2		1
5A-14	CLEAN UTILITY ROOM				2		1
5A-18	MONIT. STORAGE RM				2		1
5A-19	UTILITY/EQUIP. STOR.				2		1
5B-17	COMPUTER ROOM				2		1
5B-40	CONFERENCE ROOM			4			1
5B-41	LOCKER ROOM				2		1
5C-37	KITCHEN			1			1
5C-38	SUPPLY ROOM			1			1
5C-44	KITCHEN			1			1
5B-03	WAITING AREA	2			4		1
6A-30	CONF./CLASS ROOM				4		1
6A-31	CONTROL ACCESS				6		1
6A-35	BREAK ROOM				6		1
6A-40	SCRUB				2		1
6A-49	SOILED UTILITY ROOM	3					1
6A-50	CLEAN UTILITY ROOM	3					1
6A-53	CLEAN UTILITY ROOM				2		1
6B-16	MICROSCOPE ROOM				4		1
6B-41	EXAMINATION ROOM				2		1
6B-43	LOCKER ROOM				3		2
6B-46	SUPPLY ROOM				2		1
6C-14	CONFERENCE ROOM				4		1
6C-21	UV LIGHT ROOM			1			1
6C-27	SOILED UTILITY ROOM				2		1
6C-28	CLEAN UTILITY ROOM				1		1
6C-39	KITCHEN			1			1
7A-01	CONFERENCE ROOM				4		1
7A-46	KITCHEN			1			1
7A-53	SOILED UTILITY ROOM				3		1
7A-54	STAFF LOUNGE				3		1
7B-06	WAITING AREA	2			8		2
7B-11	BREAK ROOM/LOUNGE			1	4		2
7C-45	SOILED UTILITY ROOM				3		1
7C-46	CLEAN UTILITY ROOM				3		1
7C-53	KITCHEN			1			1
8A-01	CONFERENCE ROOM				4		1
8A-46	KITCHEN			1			1
8A-53	SOILED UTILITY ROOM				3		1
8A-54	CLEAN UTILITY ROOM				3		1
8B-06	VISITORS' WAITING ROOM				6		2
8B-45	BREAK ROOM/LOUNGE			2			1
8C-45	SOILED UTILITY ROOM				3		1
8C-46	CLEAN UTILITY ROOM				3		1
8C-53	KITCHEN			1			1
9A-46	KITCHEN			1			1
9A-53	SOILED UTILITY ROOM				3		1
9A-54	CLEAN UTILITY ROOM				3		1
9B-06	VISITORS' WAITING ROOM				12		2
9B-40	BREAK RM/LOCKER				2		1
9C-45	SOILED UTILITY ROOM				3		1
9C-46	CLEAN UTILITY ROOM				3		1
9C-53	KITCHEN			1			1
10A-01	CONFERENCE ROOM				4		1
10A-46	KITCHEN			1			1
10A-53	SOILED UTILITY ROOM				3		1
10A-54	CLEAN UTILITY ROOM				3		1
10B-06	VISITORS' WAITING ROOM				6		2
10C-45	SOILED UTILITY ROOM				3		1
10C-46	BREAK ROOM				3		1
10C-51	PRINTER ROOM	2					1
10C-53	KITCHEN			1			1

ROOM #	ROOM DESCRIPTION	# FLUOR. 'U' L FIX.	# FLUOR. 8 L FIX.	# FLUOR. 4 L FIX.	# FLUOR. 2 L FIX.	# FLUOR. 1 L FIX.	# SWITCHES	# LIGHTS ALWAYS ON	PICTURE #
11A-46	KITCHEN			1			1		
11A-47	STORAGE ROOM				1		1		
11A-53	SOILED UTILITY ROOM				3		1		
11A-54	CLEAN UTILITY ROOM				3		1		
11B-06	VISITORS' WAITING ROOM				8		2		
11B-16	SUPPLY ROOM				2		1		
11B-40	BREAK ROOM				2		1		
11C-21	CONFERENCE ROOM				4		1		
11C-45	SOILED UTILITY ROOM				3		1		
11C-46	CLEAN UTILITY ROOM				3		1		
11C-53	KITCHEN			1			1		
12A-42	KITCHEN				1		1		
12A-49	SOILED UTILITY ROOM				3		1		
12A-50	CHART ROOM				3		1		
12B-04	GROUP THERAPY ROOM				12		1		
12B-17	EXAMINATION ROOM			2			1		
12B-40	GROUP THERAPY ROOM				3		1		33
12C-44	KITCHEN			1			1		
12C-44	KITCHEN			1			1		
13A-43	KITCHEN			1			1		
13A-50	SOILED UTILITY ROOM				3		1		
13A-51	CLEAN UTILITY ROOM				3		1		
13B-04	WAITING AREA				11		1		
13B-14	EXAMINATION ROOM			2			1		
13C-43	KITCHEN			1			1		
13C-50	CLEAN UTILITY ROOM				2		1		
13C-52	SOILED UTILITY ROOM				2		1		

TOTAL		15	3	339	323	8	283	
Totals	watts/fixture	90	360	180	90	45		
	kW	1.4	1.1	61.0	29.1	0.4		92.9
Exam Rooms								
	Fixtures	0	0	300	6	0	150	
	kW	0	0	54	0.54	0		54.5
	Breakrooms, kit, util, etc	15	3	39	317	8	127	
	kW	1.35	1.08	7.02	28.53	0.36		38.3

CONSTRUCTION COST ESTIMATE

Project: ECO # MI3B Install Occupancy Sensors in Breakrooms
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/1/96
Estimator: P. HUTCHINS
Filename: ESTMI3B.XLS

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LEGEND:

MMp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

MI 3-3d

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MI3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS

FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION B - BREAKROOMS

ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	19000.	
B. SIOH	\$	1140.	
C. DESIGN COST	\$	1140.	
D. TOTAL COST (1A+1B+1C)	\$	21280.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		21280.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	999.	\$ 7612.	13.68	\$ 104137.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		999.	\$ 7612.		\$ 104137.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$ \$ 7612.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.80 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 104137.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.89
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 13.24 %

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MI3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS

FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION C - OFFICES

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	6700.		
B. SIOH	\$	402.		
C. DESIGN COST	\$	402.		
D. TOTAL COST (1A+1B+1C)	\$	7504.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		7504.	

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	28.	\$ 213.	13.68	\$ 2919.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		28.	\$ 213.		\$ 2919.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 213.

5. SIMPLE PAYBACK PERIOD (1G/4) 35.17 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 2919.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .39
(IF < 1 PROJECT DOES NOT QUALIFY)

CONSTRUCTION COST ESTIMATE

Project: ECO # MI3D Install Wall Switch Occupancy Sensors - Exam Rms
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/1/96
Estimator: P. HUTCHINS
Filename: ESTMI3D.XLS

[illegible]

LEGEND:

MMp### 1996 Means Mechanical Cost Data, page ###
MEp### 1996 Means Electrical Cost Data, page ###
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: MI3
 LCCID FY95 (92)
 INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
 PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS
 FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION D - EXAM ROOMS
 ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	6600.	
B. SIOH	\$	396.	
C. DESIGN COST	\$	396.	
D. TOTAL COST (1A+1B+1C)	\$	7392.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		7392.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	62.	\$ 472.	13.68	\$ 6463.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		62.	\$ 472.		\$ 6463.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 472.

5. SIMPLE PAYBACK PERIOD (1G/4) 15.65 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 6463.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .87
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.90 %

**MOTOROLA**
Motorola Lighting Inc.

B TECHNICAL BULLETIN

**VOLUME 5
NUMBER 1**

HIGH FREQUENCY FLUORESCENT BALLASTS AND INRUSH CURRENT

This technical bulletin discusses the operation of electronic fluorescent ballasts and the generation of inrush or backrush currents in the AC power distribution system. Information presented explains the cause of inrush or backrush current. A properly designed system is able to accommodate inrush or backrush currents. A chart of system component selection guidelines is provided at the end of this document.

Every electrical or electronic device uses power in order to function. This power is obtained from the AC power distribution system and is referred to as a specific amount of current in amperes or amps, at the power line voltage of 120 volts or 277 volts. The current which is required during constant-on operation is called "steady state current" and does not change once the device has reached level operation.

During the start-up period, some electronic devices such as personal computers, fax machines, or electronic ballasts, require a momentary, higher level of current in order to charge a capacitor. This short, increase in current level lasts up to five one-thousandths of a second (0.005sec) and is called "inrush current". Capacitors are needed in the device's power supply to provide energy to the load when the line voltage is near or at zero (which occurs 120 times a second).

Some electronic ballasts use an inductor at the front end of their power supply to control performance characteristics. If an inductor is used, a condition called "backrush, or, "back Electro-Magnetic Force (EMF)", may occur. Back EMF may cause a large spike of current to occur when the electronic device is turned off.

Electronic ballasts typically contain capacitors or inductors in the front end of their power supplies. This will increase the likelihood of either inrush or backrush occurring. If either condition occurs, and the auxiliary equipment has not been designed to withstand either inrush or backrush, then the auxiliary equipment's life or function may be impaired. Auxiliary equipment includes circuit breakers, energy management control relays, occupancy sensors, and wall switches.

In addition, some ballasts which are advertised as having low inrush do so by using a negative resistance component called a thermistor to limit initial current. As the thermistor heats up, its resistance decreases and it assumes a passive role in the operation of the ballast. However if for any reason the power to the ballast circuit is momentarily interrupted, the thermistor will still be at its hot, low resistance level and will be ineffective in limiting inrush current.

Peak circuit inrush is less than the sum of the inrush of all the ballasts in the circuit because of the limiting effect of line impedance (line sag). Each ballast has a typical inrush time of about 0.5 to 1.0 milliseconds (0.0005 to 0.001 seconds), and the total circuit in-rush time is about 2.5 milliseconds.

Since inrush varies model by model even for a given ballast manufacturer, contrary to what some have been led to believe, selecting an electronic ballast with a higher percentage value for total harmonic distortion (THD) will not insure that the selected ballast has a low inrush value. For example, the Motorola Lighting Inc. M2-IN-T8-277 ballast model (less than 10% THD) has a very low inrush of less than 5 amps, while the measured inrush current of most other instant start 277 volt ballasts in the marketplace (THD between 10% and 20%) is higher.

Each ballast manufacturer should be consulted for quantitative inrush and backrush information regarding their specific products and the lighting system designer should take these characteristics into account during the design phase of the system.

Inrush or backrush current, if not considered during system design, could possibly, in some isolated situations, cause false tripping of circuit breakers or welding of contacts in relays, sensors or switches. However, an industrial series circuit breaker can withstand 500 amps for a time interval up to one cycle, or 16.667 milliseconds, and therefore, will not be affected by inrush. Use of relays having industrial ratings addressed in the attached chart will eliminate the possibility of relay contacts welding due to inrush.

The only appropriate way in which to address inrush or backrush current is to do so at a system level by selecting components which are designed to function reliably with these loads. The following system or component design guidelines should be followed in order to provide a reliable system.

System Component Guidelines

COMPONENT OR CHARACTERISTIC	DESCRIPTION
Wire Size	Number 12 AWG, 600 volt insulation, wire should be used between the luminaire and the energy management control relays, occupancy sensors, or wall switches. Number 18 AWG solid copper wire should always be used within the luminaire for all ballast connections.
Max. Input Power Level	The continuous load must not exceed 16 amperes (80% of the typical component rating of 20 amperes)
Circuit Breaker	Use a heavy-duty industrial grade breaker that can withstand a peak of 50 to 100 times its ampere rating for 1/4 of a cycle
Control Relay	Mechanical relays must be industrial grade rated for 20 amperes resistive and inductive lighting loads at 120 and 277 volts. The relay should be rated for a minimum of 30,000 operations, and shall be UL listed and CSA certified. The relay must withstand 1000 ampere in-rush. Relay contacts must be silver alloy material and contain bifurcated coil to prevent damage from continuous on and off signals.
Wall Switch or Wallbox Dimmers	Switches of dimmers must be industrial grade and rated for 20 amperes at 120 and 277 volts alternating current, and 1 HP at 120 volts and 2 HP at 240 volts. Switches must have silver alloy contacts. Switches must be UL Listed, CSA Certified, comply with UL 20, and meet Federal specification WS-896.

Always consult your ballast manufacturer for more specific instructions and design requirements prior to installation. For additional information on inrush currents of Motorola Lighting Inc. electronic ballasts, please call 1-800-MLI-0089.

[Return to...](#)

[The Lighting Resource - Homepage](#)

[Return to...](#)

[The Lighting Resource - Archives](#)

Inrush Current

There has been much discussion in the last few months regarding high inrush currents being associated with high frequency electronic ballasts. Following is a technical overview of the subject.

What is it?

Devices with solid state power supplies, such as computers, copiers, and electronic ballasts, as well as many magnetic devices such as motors, drives, and core & coil ballasts, have an input current during initial start-up that can be several times greater than their operating or steady-state current. This current during start-up is generally referred to as *Inrush Current*. For High Frequency Electronic Ballasts, this current during start-up typically lasts for much less than 1/2 of a 60 Hz cycle (<8 msec).

What are the effects?

High current conditions can affect electrical system components. The main area of concern is the tripping of circuit breakers and fuses. If the circuit breaker or fuse is not designed to handle the amount of inrush current that is present, the device could trip upon energizing the circuit or during circuit operation.

It has been suggested that during turn-on, momentary contact bouncing in the switch or relay may cause the contacts to become pitted due to arcing between the contacts points. This can be present in all systems, and is not a direct result of inrush current. However, the higher the overall system current, the faster contact deterioration may occur.

Since inrush current is only present during initial system energization, it is not a factor during system turn-off.

What amount is present in your lighting system?

Inrush current is present in both magnetic and electronic ballasts. The amount of ballast inrush current varies across manufacturers, ballast types, and ballast brands. In addition, the inrush current of a complete lighting circuit is affected by the total source impedance of the entire distribution system. A system with a low impedance can deliver a greater amount of inrush current to the ballast(s) than a circuit with a high impedance.

The system impedance is determined by several electrical distribution system variables. These variables include the impedance of the main transformer; the distance of the lighting circuit to the main transformer; the type and size of wire between the branch circuit and transformer; the wire size and wire type of the lighting branch circuit, and the length of the wires in the lighting branch circuit. These variables determine the maximum amount of current that can be delivered to the ballast(s) at the moment of turn-on.

Electronic ballasts are generally characterized into two groups, those with an *active* front-end, and those with a *passive* front-end. The term *front-end* refers to the power input section of the ballast.

Generally, electronic ballasts with *active* front ends have Total Harmonic Distortion below 10%, and *passive* front ends typically have THD below 20%. However, due to multiple circuit designs, and the continuous design changes that are evolving, this may not always be the case.

The *active* ballasts typically have low impedance during start-up, due to the need to charge the system circuitry. Many *passive* ballasts typically have an inductive choke on the front-end, which has a higher impedance, resulting in a lower inrush current. *Active* electronic ballasts can have inrush currents as high as 100 times or more its operating current, with a duration of up to .8 milliseconds. *Passive* electronic ballasts with an input choke can have an inrush current of up to 30 times operating current, with a duration up to 5 milliseconds. This is compared to magnetic ballasts that have an inrush current of up to 10 times the operating current, with a duration of under 10 milliseconds.

Based on the assumption of inrush current being 100 times the magnitude of the steady state current, a 20 amp circuit loaded to 16 amps could have an inrush current as high as 1600 amps (16×100). However, due to system impedances the total system inrush will probably not reach the theoretical maximum calculated.

Previous laboratory testing of sample ballasts has shown an inrush current of 75 amps on a 120V, 20 amp system loaded to 16 amps with two-lamp *active* electronic ballasts. Total duration was approx. 5 milliseconds.

These lab results show a significantly lower circuit inrush current, with a greater duration, than the theoretical calculations for a single ballast predict. These results are only valid for one type of ballast in a controlled environment, and extrapolation to any other location is not possible without first investigating all system parameters. All things considered, the likelihood of achieving the maximum inrush is probably very slight.

What can you do?

When planning a new or retrofit ballast installation, take the following steps in order to reduce potential inrush current problems.

- **First**, determine the inrush current drawn by the ballast you have selected. A range may be supplied by the manufacturer due to the various system impedances encountered in laboratory testing.
- **Second**, calculate the theoretical maximum inrush current for the circuit based on the circuit values for your specific installation (wire size, length, etc.).
- **Third**, select a fuse or circuit breaker that is capable of handling the inrush current for the duration of the inrush. Typically, fuses and breakers are rated to handle inrush currents that are several multiples of their steady-state ratings.
- **Fourth**, select switches and contacts that are able to withstand the inrush current. All switches and contacts in the circuit, both locally and at the electrical or lighting panel, should be properly sized. Contact your switch manufacturer to determine the proper unit. If occupancy sensors or other control devices are to be used on the circuit, contact the sensor manufacturer to ensure compatibility with the type and number of ballasts being controlled.

For further information on the inrush current present in Advance electronic ballasts, please call Advance Technical Service at 1-800-372-3331.

Always follow the National Electric Code and state and local codes when designing and installing any lighting or electrical system.

This publication is intended to provide general educational and background information on the issue of inrush currents, and not definitive solutions to specific installation issues.

Michael J. Ostaffe

Electronic Product Manager

ADVANCE
TRANSFORMER CO.



Telephone Call Confirmation

Project Number

(800) 654-0089

Local

L.D.

✓

Placed

Rec'd

Date

2/12/96

Conversed with

Robert Payne of Motorola Customer Service

Regarding

In-rush current on low THD ballasts

Rob will send fax on this subject

Distribution:

~~MI 3-17~~ MI 3-17

EISENHOWER AMC
FT. GORDON, GA

SCREENING CALCULATIONS
OCCUPANCY SENSORS
FILENAME: OSENS.WK4

— ECO # MI3

RESTROOMS

ECO MI3A

#	2L FIXTS	KW	ENERGY USE (KWH)		ANNUAL SAVINGS		SIMPLE PAYBACK (YRS)
			CURR	PROPD	(KWH)	(\$)	
1		0.058	507	253	253	\$6.59	25.2
2		0.116	1,013	507	507	\$13.17	12.6
3		0.174	1,520	760	760	\$19.76	8.4
4		0.232	2,027	1,013	1,013	\$26.35	6.3
5		0.290	2,533	1,267	1,267	\$32.93	5.0
6		0.348	3,040	1,520	1,520	\$39.52	4.2

Assumptions:

Electricity avg. rate= \$0.026 c/kwh
Cost= \$166
Operating hrs= 168 hrs/wk
Proposed op hrs = 84.0 hrs/wk
Percent savings = 50%

BREAKROOMS

MI3B

#	2L FIXTS	KW	ENERGY USE (KWH)		ANNUAL SAVINGS		SIMPLE PAYBACK (YRS)
			CURR	PROPD	(KWH)	(\$)	
1		0.058	507	63	443	\$11.53	14.4
2		0.116	1,013	127	887	\$23.05	7.2
3		0.174	1,520	190	1,330	\$34.58	4.8
4		0.232	2,027	253	1,773	\$46.11	3.6
5		0.290	2,533	317	2,217	\$57.64	2.9
6		0.348	3,040	380	2,660	\$69.16	2.4

Assumptions:

Electricity avg. rate= \$0.026 c/kwh
Cost= \$166
Operating hrs= 168 hrs/wk
Proposed op hrs = 21.0 hrs/wk
Percent savings = 88%

OFFICES

MI3C

#	2L FIXTS	KW	ENERGY USE (KWH)		ANNUAL SAVINGS		SIMPLE PAYBACK (YRS)
			CURR	PROPD	(KWH)	(\$)	
1		0.058	151	124	27	\$0.71	80.8
2		0.116	302	247	54	\$1.41	40.4
3		0.174	452	371	81	\$2.12	26.9
4		0.232	603	495	109	\$2.82	20.2
5		0.290	754	618	136	\$3.53	16.2
6		0.348	905	742	163	\$4.23	13.5

Assumptions:

Electricity avg. rate= \$0.026 c/kwh
Cost= \$57
Operating hrs= 50 hrs/wk
Proposed op hrs = 41.0 hrs/wk
Percent savings = 18%

EXAM ROOMS

MI3D

#	2L FIXTS	KW	ENERGY USE (KWH)		ANNUAL SAVINGS		SIMPLE PAYBACK (YRS)
			CURR	PROPD	(KWH)	(\$)	
1		0.058	151	60	90	\$2.35	24.2
2		0.116	302	121	181	\$4.70	12.1
3		0.174	452	181	271	\$7.06	8.1
4		0.232	603	241	362	\$9.41	6.1
5		0.290	754	302	452	\$11.76	4.8
6		0.348	905	362	543	\$14.11	4.0

Assumptions:

Electricity avg. rate= \$0.026 c/kwh
Cost= \$57
Operating hrs= 50 hrs/wk
Proposed op hrs = 20.0 hrs/wk
Percent savings = 60%

MI3-1

CONSTRUCTION COST ESTIMATE

Project: ECO # M13A Install Occupancy Sensors in Restrooms
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 3/8/96
Estimator: P. HUTCHINS
Filename: ESTM13A.XLS

[illegible]

LEGEND:

MMp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MI3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS

FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION A - RESTROOMS

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	14900.	
B. SIOH	\$	894.	
C. DESIGN COST	\$	894.	
D. TOTAL COST (1A+1B+1C)	\$	16688.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	16688.	

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	259.	\$ 1974.	13.68	\$ 26999.
B. DIST	\$.00	0.	\$ 0.	14.64	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	15.38	\$ 0.
N. TOTAL		259.	\$ 1974.		\$ 26999.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	12.90		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$ \$ 1974.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.46 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 26999.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.62
 (IF < 1 PROJECT DOES NOT QUALIFY)

ENERGY PROJECT

PROGRAMMING DOCUMENTATION

Project Number and Title

FEMP2 - Emergency Generator Paralleling

Project Funding Category

Federal Energy Management Program (FEMP)

Contents

Attachment 1 - Description of Work

Attachment 2 - Life Cycle Cost Analysis Summary

Attachment 3 - Calculations, Cost Estimate and Back-up Data

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 1

DESCRIPTION OF WORK

FEMP 2

EMERGENCY GENERATOR PARALLELING

Description

The hospital currently uses two generators to reduce the electrical demand when requested by the local utility, Georgia Power and Light. One is 800 kW and the other is 2,100 kW. To meet the requirements of the Supplemental Energy (SE) rider, the hospital must reduce its demand below 2,960 kW during curtailment hours. The EAMC peak is about 4,200 kW. Even though the 2,100 kW generator cannot be fully loaded, the two generators easily meet the maximum reduction request. If the 2,100 kW generator was paralleled with utility grid, it could be fully utilized. Under the existing rate, the demand charge is only \$0.80/kW for four months of the year and this would be of little benefit. However, the EAMC could apply for additional credits using the Interruptible Service (IS) rider.

Analysis

The IS rider credits the customer \$45/kW annually for the contract amount. The EAMC would be required to reduce their demand by that amount. Using both generators (a total of 2,900 kW), the EAMC could reduce their demand 1,660 kW below their current billing demand. If the EAMC contracted for 1,500 kW, this would be worth \$67,500 each year.

IS customers are called after SE and have only been called once in the eight plus years it has been offered. This occurred in 1995, required a total of 20 hours and overlapped SE calls except for one-half hour. Also, four hours of missed curtailments are allowed each year.

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 2

LIFE CYCLE COST ANALYSIS SUMMARY

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: F 2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: FEMP2 EMERGENCY GENERATOR PARALLELING

FISCAL YEAR 95 DISCRETE PORTION NAME: N/A

ANALYSIS DATE: 07-09-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	\$	182400.	
B. SIOH	\$	10944.	
C. DESIGN COST	\$	10944.	
D. TOTAL COST (1A+1B+1C)	\$	204288.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		204288.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 7.62	15.	\$ 117.	13.68	\$ 1605.
B. DIST	\$ 5.41	-416.	\$ -2251.	14.64	\$ -32948.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 4800.	15.38	\$ 73824.
N. TOTAL		-401.	\$ 2667.		\$ 42481.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 65200.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 841080.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
------	------------------------------	-----------------	------------------------	--

d. TOTAL	\$ 0.			0.
----------	-------	--	--	----

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 841080.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 67867.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.01 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 883561.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.33
(IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 3

CALCULATIONS, COST ESTIMATE AND BACK-UP DATA



SUBJECT _____
DESIGNER Hutchins
CHECKER _____

AEP NO _____
SHEET _____
DATE 7/8/96
DATE _____

ECO EL4. Use Emergency Generator
to Reduce Demand

The ETMC can add the Interruptible Service (IS) Rider and receive annual credit of \$45/kw. The minimum is 200 kw and the maximum is 95% of their billing demand - this is 95% of 2960 kw = 2812 kw.

Calculate amount for IS Rider.

Current all time peak = 4200 kw
Billing demand (SE Rider) = 2960
Current needs = 1240 kw

Under the existing Supplemental Energy rider the ETMC needs at least 1240 kw to meet the contract requirement at peak load.

With full paralleling of 2100 kw the ETMC will have a generating capacity =
 $2100 + 800 = \underline{2900 \text{ kw}}$

Excess for IS = $2900 - 1240 = \underline{1660 \text{ kw}}$

Contracting for 90% of this yields

90% of 1660 kw = 1500 kw

Savings = $1500 \text{ kw} \times \$45/\text{kw} = \underline{\underline{\$67,500/\text{yr.}}}$

(EL4-1)

Calculate additional maintenance and fuel costs -

Fuel costs -

Performance is 15 kw / gal fuel oil

$$\frac{1500 \text{ kw}}{15 \text{ kw/gal}} = 100 \text{ gal/hr}$$

Assume it runs 30 hrs/yr.

$$\text{Fuel cost} = 100 \frac{\text{gal}}{\text{hr}} \times \frac{30 \text{ hr}}{\text{yr}} \times \$ \frac{0.75}{\text{gal}} = \$ 2250/\text{yr}$$

$$\text{Maintenance} \approx \text{fuel costs} \approx \$ 2300/\text{yr}$$

$$\text{Electricity savings} = 1500 \text{ kw} \times 30 \text{ hrs} = 4500 \text{ kwh} \\ = 15.4 \text{ MBtu}$$

$$\text{Demand Savings} = \$ 0.80/\text{kw} \times \$ 1500/\text{kw/month} \times 4 \text{ mos/yr} \\ = \$ 4800$$

$$\text{Fuel use} = 100 \times 30 = 3000 \text{ gal} \\ = 416.1 \text{ MBtu} (138,700 \text{ Btu/gal})$$

Convert fuel oil costs to MBtu

$$\$ \frac{0.75}{\text{gal}} \times \frac{\text{gal}}{138,700 \text{ Btu}} \times \frac{1 \text{ MBtu}}{1000 \text{ Btu}} = \$ 5.41/\text{MBtu}$$

CONSTRUCTION COST ESTIMATE

Project: ECO #EL4 Use Emergency Generator to Reduce Demand
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/8/96
Estimator: P. HUTCHINS
Filename: EST_EL4.XLS

[illegible]

LEGEND:

LEARN#
 Mmp### 1996 Means Mechanical Cost Data, page ###.
 MEp### 1996 Means Electrical Cost Data, page ###.
 Gp### 1995 Grainger, page ###
 Dp### 2/94 DGSC Energy Efficient Lighting, page ###

EL4-3

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: E EL4

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO EL4 USE EMERGENCY GENERATOR TO REDUCE DEMAND

FISCAL YEAR 95 DISCRETE PORTION NAME: N/A

ANALYSIS DATE: 07-08-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	\$	182400.	
B. SIOH	\$	10944.	
C. DESIGN COST	\$	10944.	
D. TOTAL COST (1A+1B+1C)	\$	204288.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		204288.

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

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
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B. DIST	\$ 5.41	-416.	\$ -2251.	14.64	\$ -32948.
C. RESID	\$.00	0.	\$ 0.	16.00	\$ 0.
D. NAT G	\$ 2.70	0.	\$ 0.	17.25	\$ 0.
E. COAL	\$.00	0.	\$ 0.	15.38	\$ 0.
M. DEMAND SAVINGS			\$ 4800.	15.38	\$ 73824.
N. TOTAL		-401.	\$ 2667.		\$ 42481.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 65200.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 841080.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 841080.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$ \$ 67867.

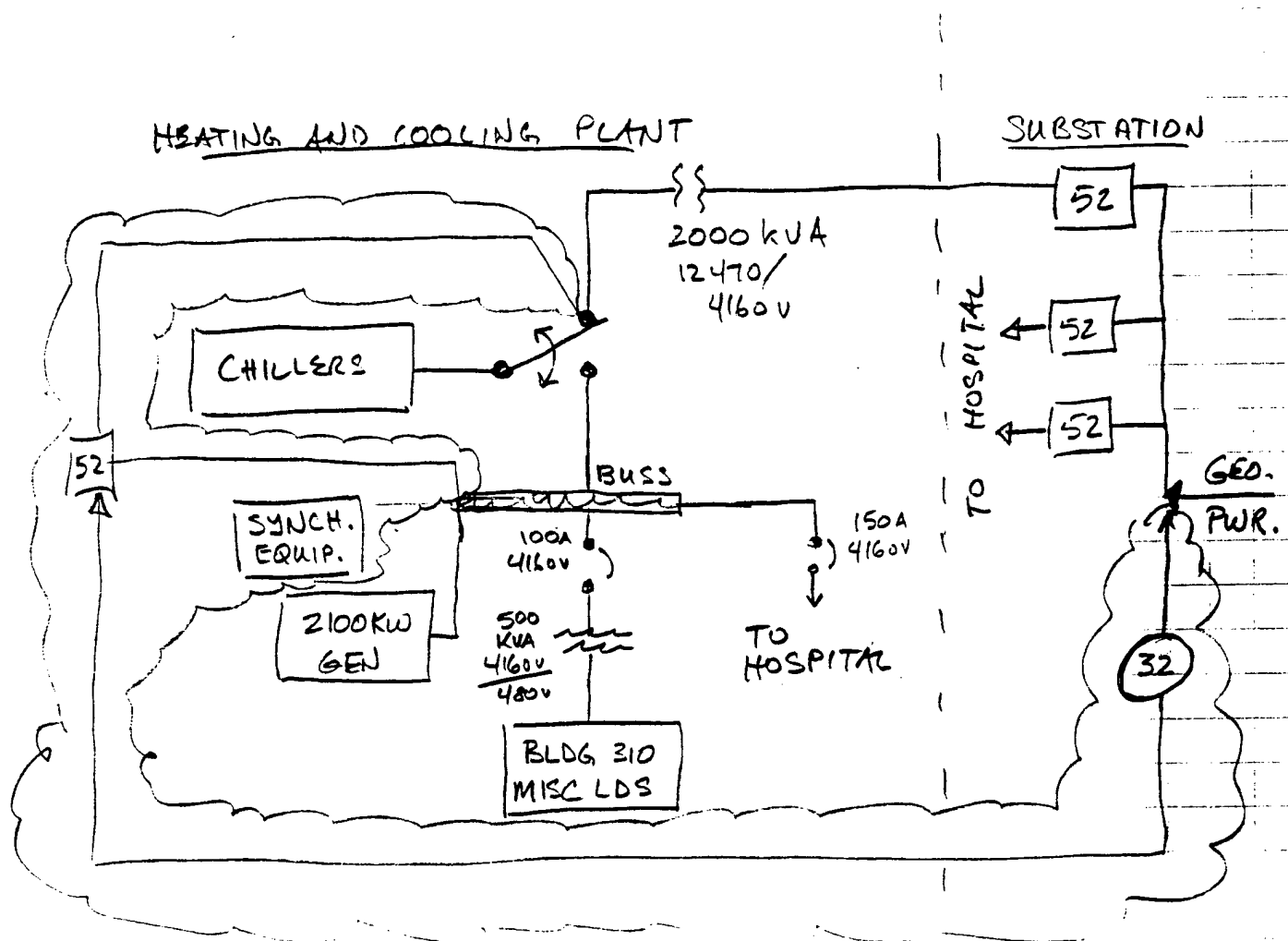
5. SIMPLE PAYBACK PERIOD (1G/4) 3.01 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 883561.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.33
(IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A



GEN. 140 gal/hr at max ld.
 (15 KW/gal fuel)

Maint. cost is about the same
 as fuel cost

DISTANCE BETWEEN SUBSTATION AND GENERATOR IS ~100 yds.

- (52) Air Breaker
- (32) Reverse current sensing relay



POWER SPECIALISTS

FAX COVER

Title : MR. First Name : PAUL Last Name : HUTCHINS

Company : REYNOLDS, SMITH AND HILLS, INC.

Subject : FT. GORDON

From : DAVID CURRY

Company : STEWART & STEVENSON, INC.

Fax Number : 713-671-6118

Voice : 713-671-6111

NOTES:

Pages : 1

Date : 7/3/96

Time : 12:16:40

PARALLELING SWITCHGEAR	\$85,000.00
2100 KW HARDWARE & SOFTWARE	\$5,000.00
PROTECTIVE RELAYING	\$5,500.00
ELECTRICAL CONTRACTOR	\$14,500.00
LABOR	\$40,000.00

EL 4-6



Telephone Call Confirmation

Project Number _____

(113) 671-6111
- 6118 (fax)

Local _____ L.D. ☒ Placed ☒ Rec'd _____ Date 6/26/96

Conversed with David Curry or Stewart & Stevenson Houston, TX

Regarding Synchronizing 2100kw Gen. & Power Factor Correction

Other names - Richard Harris & Rodney Taylor
(113) 671-6100

DC said he could get budget estimates on both
subjects in a short time.

PH fixed schematic diagram of site drawn by
Bob Calhoun

Distribution:

EL4-7



Telephone Call Confirmation

Project Number _____

Local _____ LD. ☒ Placed ☒ Rec'd _____ Date 6/17/96

Conversed with Michael Richardson of Georgia Power & Light

Regarding Interruptible Service Rider (IS)

The IS Rider calls for the user to reduce its demand by the contracted amount. Currently, the credit is \$45/kw and is paid once a year.
~~on an annual~~

The minimum is 200kw. IS curtailments are called after SE.

Cannot use IS and Day Ahead RTP rates (This is the RTP rate the hospital would use since the other RTP rate, Hour Ahead, requires a minimum ^{demand} of 5000kw. Day Ahead requires 1000 kw minimum.

The IS requires a 3-year contract that "rolls over" each year. In other words you must stay on it for three years after notification to leave.

The hospital could contract up to 95% of their Billing Demand (2960kw) or 2812 kw

Distribution: