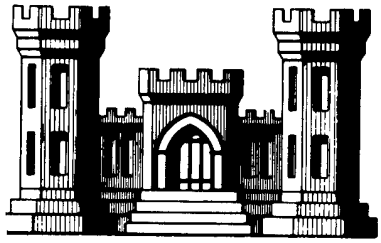
Basewide Energy Studies in Support of Energy Engineering Analysis Program

for

Kansas Army Ammunition Plant
Parsons, Kansas

Contract No.- DACA 41-81-C-0108

Final Submittal



Executive Summary

Prepared by

The Benham Group
Oklahoma City, Oklahoma

for
Department of the Army
Kansas City District
Corps of Engineers

July 1983

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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Marie Wakefield,
Librarian Engineering

VOLUME 1

EXECUTIVE SUMMARY

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1. PRELIMINARY SUBMITTAL

Volumes 1 through 12 - Dated February, 1982.

-Includes all survey data and lists energy conservation opportunities.

2. INTERIM SUBMITTAL

Volumes 1 through 7 - Dated August 1982.

-Contain ECM analysis and recommendations.

Volumes 8 through 17 -

-Contain computer analysis data (BLAST)

NOTE: Volume 8 through 17 available at Huntsville District and Kansas City District Offices only.

3. FINAL REPORT - Dated March, 1983 (Revised July, 1983)

Volume 1 - Executive Summary

Volume 2 - Programming documents for projects recommended for implementation - DD forms 1391, PDB and Appendix.

NOTE: Preliminary and interim submittal reports already submitted.

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INTRODUCTION

KANSAS ARMY AMMUNITION PLANT

PARSONS, KANSAS

The Kansas Army Ammunition Plant, a Government-owned Contractor-Operated military industrial installation under jurisdiction of Headquarters, U.S. Army Armament Material Readiness Command, is assigned responsibility to manufacture explosives (Lead Azide) and related products; and load, assemble, and pack ammunition items as directed; operation and maintenance of active facilities, and maintenance and/or layaway of standby facilities in such condition to permit rehabilitation and resumption of production within time limitations prescribed; procurement, receipt, storage, and issue of necessary supplies, equipment, components, and materials; receipt, surveillance, maintenance, renovation, demilitarization, salvage, storage, inventory, and issue of Field Service Stocks as directed; Industrial Preparedness Planning and Emergency Mobilization Planning.

The present population at Kansas AAP consists of 830 Contractor personnel and 30 Government personnel. Under full mobilization the population would increase to 4,477 Contractor personnel and 115 Government personnel.

The basic survey data for this energy engineering analysis was gathered during November, 1981, and furnished as an appendix to the preliminary submittal. An executive summary is included as a part of this report. It summarizes and explains the conclusions reached on energy conservation measures that were analyzed under Phase II of the Energy Engineering Analysis Program.

Under Phase II we have analyzed both the technical and economic feasibility of the energy conservation opportunities outlined in the preliminary report. BLAST runs were utilized to determine both the baseline energy consumption for applicable buildings as well as the energy savings generated if a particular energy conservation measure is implemented.

Estimates for implementing each energy conservation measure were generated utilizing the 1982 Means Cost Data and the 1982-83 Richardson Estimating Standards.

Both the energy savings generated and the cost to implement it were utilized to run an economic analysis to determine an E/C ratio to be utilized in ranking these ECMs. This analysis was performed on a building basis for each ECM in the Phase II Interim Submittal Report.

In Phase III the ECIP Life Cycle Cost Analysis was used and the results of this analysis were tabulated on matrix form showing the SIR Discount Savings Ratio for each ECM or ECIP project that qualified or was selected.

Also, a list of all buildings included in this survey along with pertinent data is furnished as part of the executive summary.

All energy conservation measures that qualify under ECIP criteria have been grouped under Increment "A" projects. The ones that did not meet the minimum project dollar requirements but are still economically feasible are listed under Increment "G".

All energy saving measures resulting from maintenance and operational changes are grouped under Increment "F". Increment "F" also includes a list of energy conservation measures implemented since 1975.

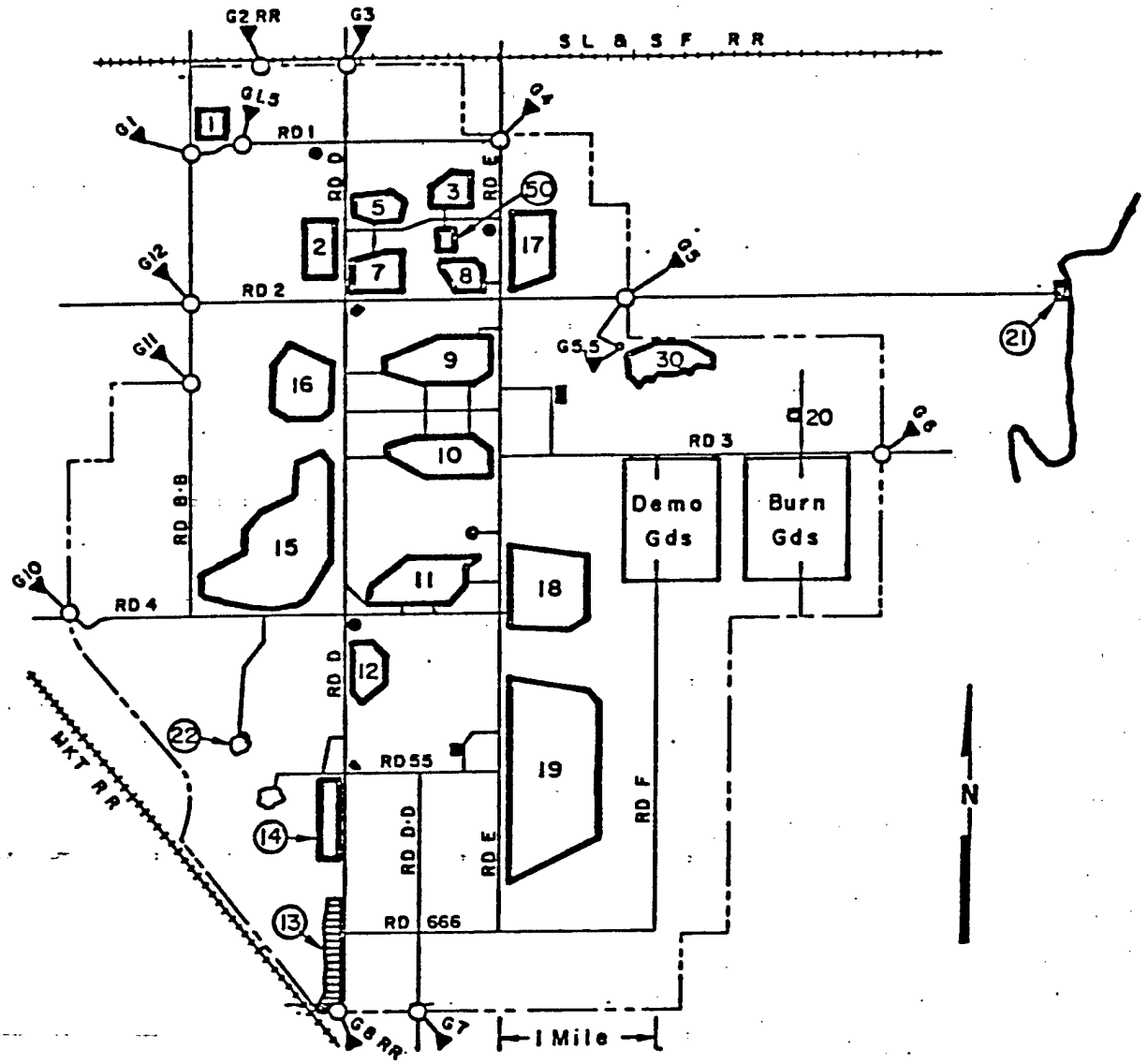
Total base energy usage for 1985 has been calculated, assuming that all energy conservation measures included in this project are implemented.

Under Phase III, programming documents have been prepared for all projects that met ECIP criteria. DD Form 1391 and Project Development Brochures (PDB) have been written for these projects.

The possibility of applying solar energy to heat water for laundry use in Building 112 and for wash down in the melt/pour loading Buildings 905, 1106 and 1109 was recommended for Increment "C" study.

The thrust of the energy conservation measures developed for this facility encompass areas of building envelope and heating/air conditioning, plumbing and electrical systems. No process systems were analyzed for possible savings. Also, only typical buildings were surveyed and analyzed and those results utilized in applying the same techniques to other buildings.

KANSAS ARMY AMMUNITION PLANT
PARSONS, KANSAS



Legend:

1 - 100 Area - Administration
2 - 200 Area - Maintenance/Operations
3 - 300 Area - M483/509
5 - 500 Area - Standby
7 - 700 Area - Production - Detonator
8 - 800 Area - Production - Primer
9 - 900 Area - Production - 81mm Mortar
10 - 1000 Area - Production - 105mm Artillery
11 - 1100 Area - Production - CBU
12 - 1200 Area - Standby
13 - Railroad Yard
14 - Inert Storage/Receiving Inspection
15 through 19 - Explosive Storage
20 - Test Area
21 - Water Plant
22 - Sewage Plant
30 - Lead Azide Area
50 - Buildings 57-58 QC Labs
● - Water Towers
▲ - Gates

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EXISTING ENERGY CONSUMPTION

During the site survey, quantitative lists of all raw energy and electric power consumed annually at the Kansas Army Ammunition Plant were compiled for fiscal year 1975, 1979, 1980, and 1981. Diesel fuel or gasoline for mobile operations or vehicle fleets is not included. These lists were used during Phase II to help analyze the energy consumption pattern of the Ammunition Plant from FY 1975 to FY 1981.

Basewide Consumption FY-1975:

The total energy consumed during FY 1975 by the Kansas Army Ammunition Plant was 341,674 MMBTU.

Source Energy Consumption FY-1975:

	Consumption	BTU
Electricity	8,733,000 KWH	$101,303 \times 10^6$
Fuel Oil No. 2	264,852 Gals	$36,733 \times 10^6$
Fuel Oil No. 5/6	1,156,533 Gals	$173,126 \times 10^6$
Propane	8,062 Gals	770×10^6
Coal	1,204 Tons	$29,597 \times 10^6$
Kerosene	1,092 Gals	145×10^6

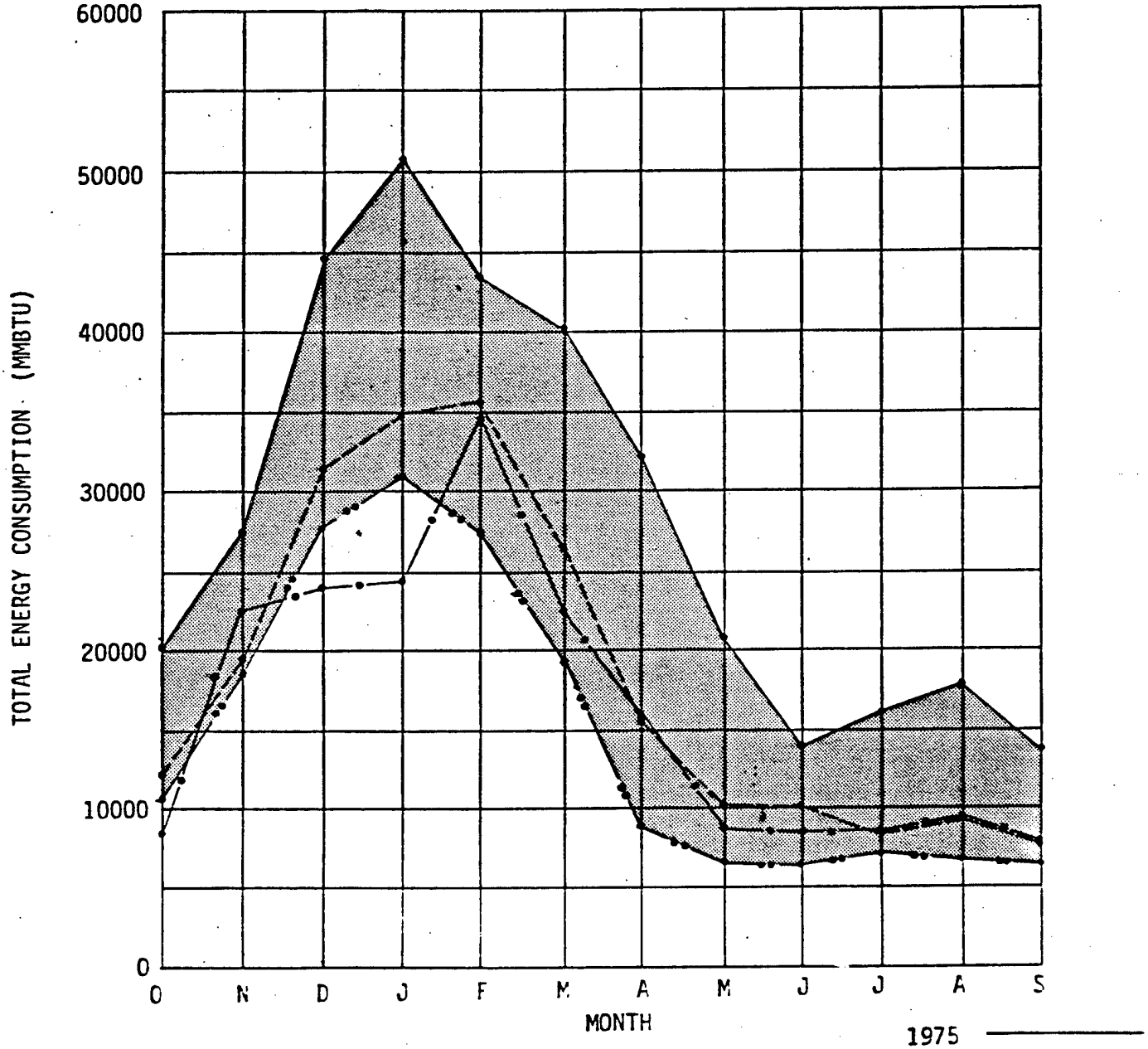
BASEWIDE TOTAL FY-1975.....$341,674 \times 10^6$

NOTE: During FY-1975 the plant had a total active building area of 475,945 square feet for an average energy consumption of 717,885 BTU per sq. ft/year.

SOURCE ENERGY CONSUMPTION FY-1981

	Consumption	Dollars	BTU
Electricity	5,473,000 KWH	$241,359	$63,487 \times 10^6$
Fuel Oil No. 2	231,966 Gals	$195,547	$32,171 \times 10^6$
Fuel Oil No. 5/6	459,732 Gals	$271,242	$68,822 \times 10^6$
Propane	2,942 Gals	$ 1,648	281×10^6
Coal	498 Tons	$ 20,916	$12,242 \times 10^6$
Kerosene	420 Gals	$ 303	57×10^6
BASEWIDE TOTAL FY-1981:		$731,015	$177,060 \times 10^6$ BTU

NOTE: During FY-1981 the plant had a total active building area of 410,086 square feet for an average energy consumption of 431,763 BTU per sq.ft/year. This amounts to a 40% savings for 1981 compared to 1975.



MONTHLY TOTAL ENERGY CONSUMPTION

FY 1975,1979,1980,1981

MM = MILLION

NOTE: Shaded area indicates energy reduction from 1975 to 1981

PROJECT: EEAP - KANSAS ARMY AMMUNITION PLANT

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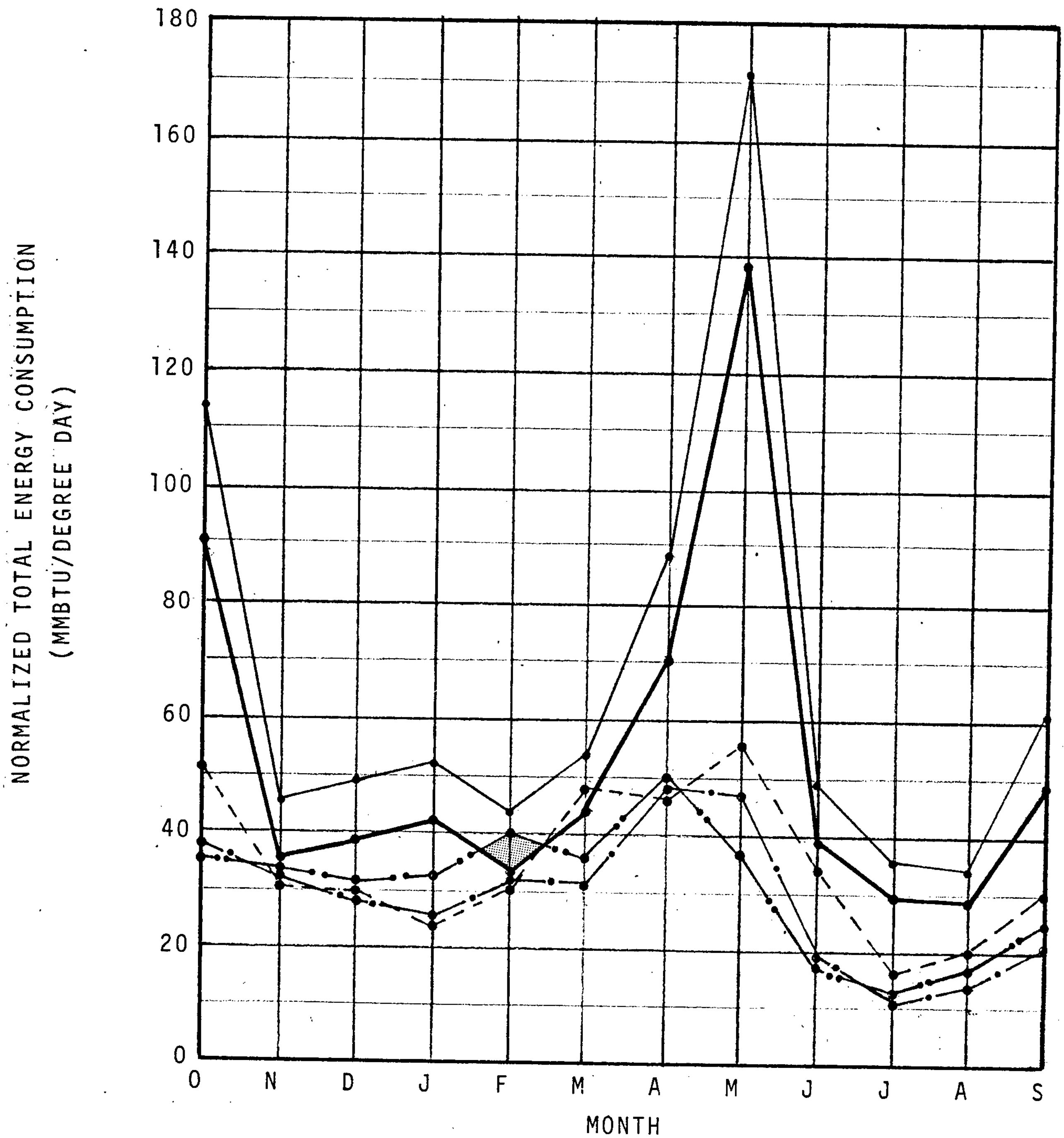

TOTAL DEGREE DAYS VS MONTHLY TOTAL ENERGY CONSUMPTION
FY 1975,1979,1980,1981

DESCRIPTION: The shaded area indicates the amount of effort required to reduce present energy consumption to the established goal. Spring and fall peaks indicate times when energy use cannot be directly related to the weather.

PROJECT	DATE	REF. FROM	INT.
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ENERGY CONSERVATION MEASURES DEVELOPED

All energy conservation opportunities that were investigated can be grouped under the following categories:

ECIP PROJECTS

1. Installation of automatic control valves and traps for steam radiators and replacement of traps on high pressure steam distribution systems were investigated and recommendations for upgrading have been made at a total cost of $133,500. This is projected to generate annual energy savings of 30,170 million BTU.

2. Insulation of piping and mechanical equipment was investigated and several buildings have been recommended for upgrading at a total cost of $257,800 for an annual energy savings of 31,236 million BTU.

3. Weatherstripping and caulking was found to be desirable for a total of 45 buildings at an estimated cost of $115,500. This is estimated to produce an annual energy savings of 9,611 million BTU.

4. Utilization of waste heat from air compressors to heat occupied buildings was investigated and is recommended at a total cost of $163,200. The projected annual energy savings are 3,084 million BTU.

5. An investigation of a basewide installation of an EMCS System indicated an opportunity to save 26,125 million BTU annually at an estimated cost of $2,068,800.

INCREMENT "G" PROJECTS

These are projects that are within the funding authority of the facility engineer. The following projects are recommended for implementation:

1. Reduction of re-circulated air volumes for 6 buildings is recommended at a total cost of $2,280. This is projected to save 1567.5 MM BTU and reduce KW demand by 38.1 KW.

2. Installation of loading dock seals for three buildings was investigated and recommended at a total cost of $1,920. This will generate annual energy savings of 135.2 MM BTU.

3. Installation of economizers for existing boilers in buildings 314 and 1105W is recommended at a total cost of $44,000. Annual energy savings are estimated at 1,798.4 MM BTU.

4. The installation of more efficient lighting sources for 10 buildings is recommended at a total cost of $22,161. Annual energy savings generated are 838.5 MM BTU.

5. Installation of ramp doors in Building 315 is recommended at a total cost of $6,000. Annual energy savings are estimated at 93.9 MM BTU.

INCREMENT "F" PROJECTS

The initial site survey for this increment was performed along with a follow-up survey for the other increments of this project. The heating and cooling systems of each building on the building list were checked to insure that they were operating properly. Inefficiencies of operation and needed building maintenance were noted and brought out at the exit interview on November 6, 1981. The follow-up visit to the site revealed that many of the items had been corrected.

In both of the surveys it was found that in general the existing HVAC equipment on the plant is being operated as efficiently as possible for the given situation. The equipment is turned off when buildings are inactive, lights are turned off in unoccupied areas, and the personnel as a rule are very conscious of energy conservation.

Three specific alteration projects have been included under this increment and the results of the economic analysis should be considered as typical among all the buildings with similar operating conditions.

1. Reduction of lighting levels for areas in three different buildings are recommended at a total cost of $2,203. The annual energy savings are estimated at 219.9 million BTU.

2. Installation of water flow restrictors in 20 buildings is recommended at a total cost of $3,060. Annual energy savings are estimated at 263.4 million BTU.

3. Repair of steam piping leaks in three buildings is recommended at a total cost of $1,171. Annual energy savings are estimated at 34.9 million BTU.

The following item was to be recommended for implementation but the Facility Engineer has incorporated it already:

1. Lowering of the domestic hot water temperature.
2. Provide more efficient oil burners for the boilers in Building 314.

The following items were analyzied but did not meet criteria:

1. Addition of solar films to existing east and west windows to minimize air conditioning loads.
2. Blanket replacement of equipment motors with energy efficient motors. This item is recommended only when motors burn out and need to be replaced. See policy recommendations.
3. Replace inefficient HVAC systems in Buildings 52 and 208.
4. Installation of building envelope insulation for Buildings 52, 53, 208, 737 and 1139 (X-ray).
5. Addition of entry vestibules for Buildings 52, 106 and 2106.
6. Installation of lower ceilings in Buildings 53, 208, 715, 716 and 717.

POLICY CHANGES - RECOMMENDATIONS

The following items should be considered for implementation.

1. When electric motors need to be replaced, use high efficiency motors.

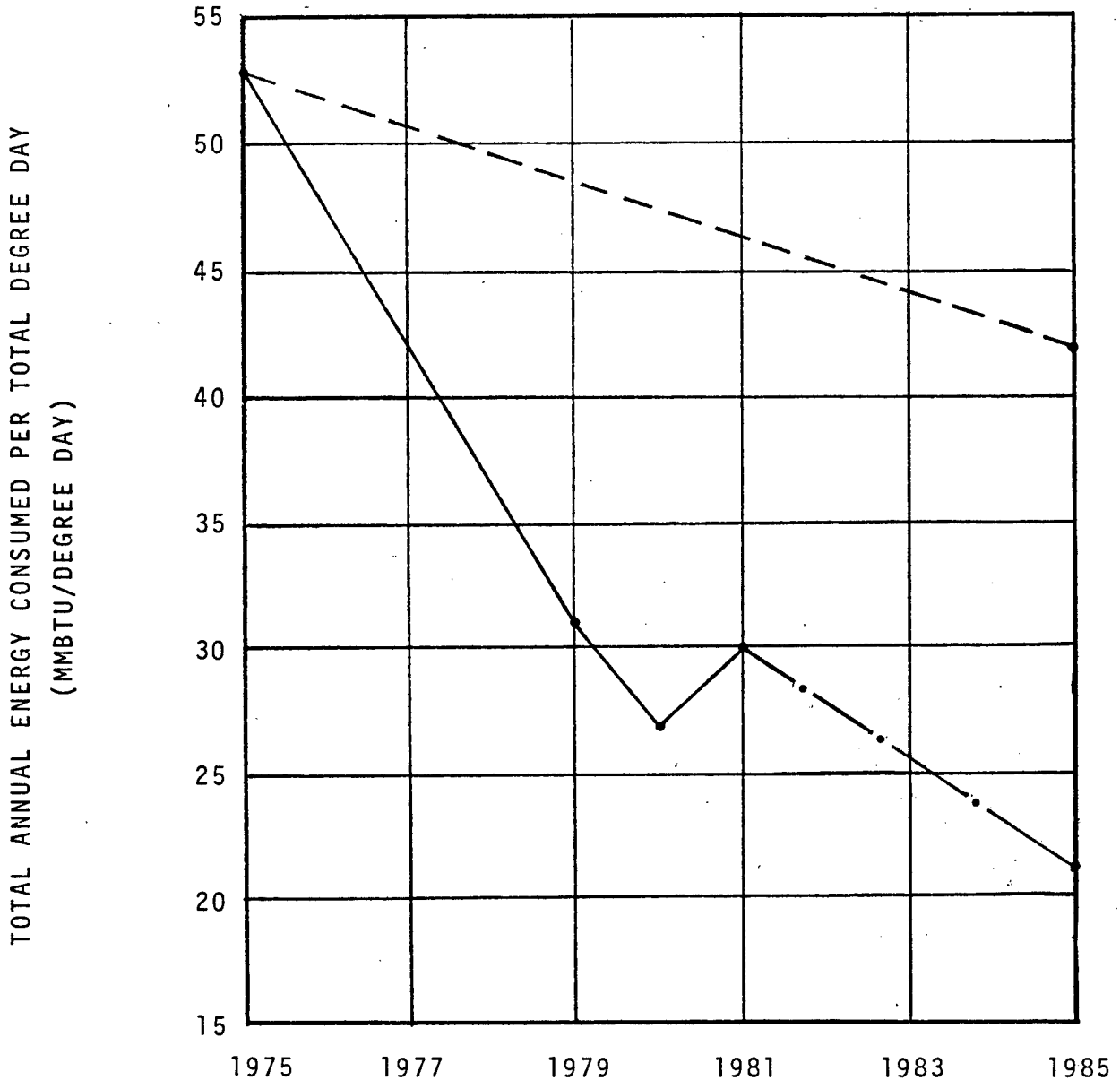
2. As lights and ballasts burn out, replace with energy saving lamps and ballasts.

3. Occupants should be encouraged to turn off lights when leaving their area.

4. Implementation of an energy management campaign to make base personnel aware of energy saving opportunities at home, as well as on the job, will definitely contribute to the overall energy savings.

5. Whenever building areas are no longer required, they should be isolated and energy systems de-activated.

6. When replacing any equipment, energy efficient replacements need to be specified..



PROJECTED ANNUAL ENERGY CONSUMPTION TREND

PROJECT		DATE	REF. FROM	INIT.
EEAP - KANSAS ARMY AMMUNITION PLANT		31 Jan 83		FJM
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PROJECTED ENERGY COSTS

ENERGY SOURCE	ENERGY COSTS (DOLLARS/MMBTU)				
	FY-1981	FY-1982	FY-1983	FY-1984	FY-1985
Coal	1.71	1.88	2.07	2.27	2.50
Fuel Oil No. 2	6.08	6.93	7.90	9.00	10.27
Fuel Oil No. 5/6	3.94	4.49	5.12	5.84	6.65
L.P. Gas	5.86	6.68	7.62	8.68	9.90
Electricity*	3.80	4.52	5.11	5.77	6.52
Demand Charge	3.60/KW	5.94/KW	6.71/KW	7.58/KW	8.57/KW
Electricity**	12.92	15.37	17.37	19.62	22.17

*For calculating energy savings for ECIPs, based on 11,600 BTU/KWH.

**For revenue studies and design energy budgets, based on 3413 BTU/KWH.

PRIOR ENERGY CONSERVATION ACTION

The following energy conservation measures have already been implemented to reduce energy consumption at the KAAP. Management and maintenance personnel are to be highly commended as both have demonstrated extreme dedication to the conservation of energy at this plant.

1. Insulated 36,960 gallon #6 fuel oil tank at Building 1002.
2. Replaced leaking oil storage tanks below ground at Building 209.
3. Replaced steam line expansion joints with loops in 700 Area to prevent leaks.
4. Installed plastic film on selected windows to reduce solar heat gain in the summer months.
5. Removed perimeter lighting circuits and de-energized transformers in 1300, 1500, 1600, 1700, 1800, and 1900 Areas where security regulations did not require the lights.
6. Shut off heater in MC-800 road oil storage tank during winter months. Tank located in NW section of Area 200.
7. Replace failed flourescent bulbs with energy efficient type bulbs wherever possible.
8. Replace all incandescent floor lights in general area with mercury vapor type fixtures.
9. Install photocell detectors to turn off lights at 200 Area and at gas pumps during daylight hours.
10. Installed vestibules around south doors at Building 106.
11. Installed two insulated garage doors at Building 202.
12. Installed dampers in exhaust hoods at Buildings 202 and 102.
13. Weatherstrip and caulk around windows and doors in the general area.
14. Lowered ceilings and insulated ceilings of the upper level of Buildings 52, 58, 208, 312, 325, 726, 1014 and 1015.
15. Purchased and installed electric meters at 300, 700 and 100 Areas.
16. Budgeted miles driven by each department and monitored performance.
17. Installed wall thermometers in active individual offices to enable occupant to control temperature per Army and Department of Energy Regulations.

18. Installed 150 storm windows in Building 102.

19. Heating ducts in Building 243 were modified and thermostat moved for better heat distribution and temperature control.

20. Portions of deteriorated condensate lines in the 100 and 200 Area were replaced.

21. A condensate return line was installed from Building 311. The condensate was previously dumped.

22. All major air conditioning systems of active areas were inspected and repaired to reduce downtime and improve efficiency.

23. Thermostatic zone control valves have been installed on a few finned tube radiators in various buildings.

24. An insulated garage door was installed in Building 243.

PROPOSED PROJECTS

Project Tile	Annual Energy Savings (MMBTUs)	CWE ($000)	SIR	Type
Install Automatic Valves and Traps on Steam Radiators and Replace Traps on HP Steam Distribution System	30,170	133.5	22.98	ECIP
Insulate Piping and Mechanical Equipment	31,236	257.8	11.88	ECIP
Weatherstripping and Caulking	9,611	115.5	7.76	ECIP
Heat Reclaim from Air Compressor Cooling Water	3,084	163.2	1.94	ECIP
Install A Basewide Energy Monitoring and Control System	26,125	2,068.8	1.05	ECIP
SUB TOTAL FOR ECIP PROJECTS:	100,226	2,738.8	-	ECIP
Reduced Air Volume	1567.5	2.3	52.08	Incr."G"
Load Dock Seals	135.2	1.9	5.34	Incr."G"
Boiler Economizers	1798.4	44.0	2.96	Incr."G"
Efficient Lighting Sources	838.5	22.2	2.29	Incr."G"
Ramp Doors	93.9	6.0	1.19	Incr."G"
SUB TOTAL FOR INCR."G" PROJECTS	4433.5	76.4	-	Incr."G"
Install Water Flow Restrictors	263.4	3.0	9.92	Incr."F"
Reduce Lighting Levels	219.9	2.2	7.39	Incr."F"
Repair Steam Piping Leaks	35.0	1.2	2.26	Incr."F"
SUB TOTAL FOR INCR."F" PROJECTS	518.3	6.4	-	Incr."F"
BASEWIDE TOTAL	105,177.8	2,821.6	-	All

July 83

PROJECT		DATE	REF. FROM	INIT
EEAP - KANSAS AREA AMMUNITION PLANT		31 Jan83		FJM
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NOTE: Total shown under annual energy savings column (105,177.8) indicates the sum of all individual items without considering synergistic effect.

A more realistic number for the basewide total would be approximately 60% of this figure or 63,107 MMBTU annually.

		ECIP PROJECTS					INCREMENT "G"		
BLDG. NO.	DESCRIPTION	INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS
52	FIRE STATION	239	349	70.6	-	17.1	-	-	-
53	RECEIVING AND INSPECTION	-	177.5	27.5	-	43.1	-	-	-
57	PHYSICAL TEST	537.7	967.8	254.8	-	-	-	-	-
58	METROLOGY AND CHEMICAL LAB	327.5	598.4	129.4	-	324.8	8.4	-	-
102	ADMINISTRATION BLDG.	-	-	-	-	-	-	-	-
105	HOSPITAL	-	-	-	-		-	-	-
106	GUARD HEADQUARTERS	-	-	-	-	-	-	-	-
107	ADP BLDG.	-	-	-	-	35.4	-	-	-
112	LAUNDRY	-	127.6	377.1	-	298.5	-	-	-
201	PROPERTY DISPOSAL	-	-	7.1	-	-	-	-	-
202	LOCOMOTIVE & AUTO REPAIR	226.4	1368.6	1260.7	-	872.2	-	-	-
203	MAINTENANCE & REPAIR	933.9	1734.1	735.9	-	1285.5	-	-	-
207	CARPENTER SHOP	65.2	223.8	74.6	-	-	-	-	-

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

INSTALL EMCS	INCREMENT "G" PROJECTS					INCREMENT "F" PROJECTS			CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION
	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS				
17.1	-	-	-	-	-	49.5	-	-	634	725	.5	27
43.1	-	-	-	-	-	3.1	-	-	430	251	.5	30
-	-	-	-	-	-	-	-	-	886	1760	.4	18
24.8	8.4	-	-	-	-	2.7	35.5	-	863	1427	.4	29
-	-	-	-	-	-	86.2	-	-	2292	86	.5	2249
	-	-	-	2.6	-	1.8	-	-	260	4	1	256
-	-	-	-	25.8		2.9	-	-	365	29	.5	351
35.4	-	-	-	-	-	5.9	157.8	-	645	199	.5	546
98.5	-	-	-	-	-	1.2	-	-	1027	804	.5	625
-	-	-	-	-	-	-	-	-	285	7	-	278
72.2	-	-	-	177.3	-	3.9	-	-	3208	3909	.5	1254
35.5	-	-	-	304	-	11.1	26.6	-	2966	5031	.4	954
-	-	-	-	-	-	-	-	-	414	364	.5	232

PROJECT: EEAP - KANSAS ARMY AMMUNITION PLANT

The Benham Group — architects / engineers, planners / consultants

JOB NO. 1 0 8 1 0 1 3 3 0

	INCREMENT "F" PROJECTS									
RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	49.5	-	-	634	725	.5	271	7784	34815	57
-	3.1	-	-	430	251	.5	304	3345	90882	29
-	-	-	-	886	1760	.4	182	6561	27740	79
-	2.7	35.5	-	863	1427	.4	292	6391	45689	66
-	86.2	-	-	2292	86	.5	2249	42809	52536	2
-	1.8	-	-	260	4	1	256	7870	32529	2
	2.9	-	-	365	29	.5	351	5279	66490	4
-	5.9	157.8	-	645	199	.5	546	4775	114346	15
-	1.2	-	-	1027	804	.5	625	5718	109304	39
-	-	-	-	285	7	-	278	4080	68137	3
-	3.9	-	-	3208	3909	.5	1254	20608	60850	61
-	11.1	26.6	-	2966	5031	.4	954	21047	45327	68
-	-	-	-	414	364	.5	232	5922	39176	44

EEAP - KANSAS ARMY AMMUNITION PLANT

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architects / engineers
planners / consultants (3)

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BLDG. NO.	DESCRIPTION	ECIP PROJECTS					INCREMENT "G"		
		INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS
208	OFFICES & CHANGE HOUSE	178	165.7	21.5	-	238.3	-	-	-
243	WAREHOUSE & OFFICES	304.7	998.1	425.7	-	965.3	5.7	-	-
302	BOX OPENING & INSPECTION	-	-	-	-	-	-	33.8	-
304	PROCESS HOLD	-	-	-	-	39.8	-	-	-
304A	PROCESS HOLD	-	-	-	-	39.8	-	-	-
304B	PROCESS HOLD	-	-	-	-	39.8	-	-	-
311	MAGAZINE	-	279.1	15	-	106.2	-	67.6	-
312	CHANGE HOUSE	-	414.5	21.2	-	535.9	-	-	-
315	ASSEMBLY BLDG.	-	4038.7	394.4	-	1310.2	96.3	33.8	-
322	GROUP OFFICE	-	192.1	2.8	-	-	-	-	-
324	ASSEMBLY BLDG.	-	12.1	38.1	-	990.9	-	-	-
325	CHANGE HOUSE	-	464.1	21.1	-	630.3	-	-	-
701	PELLETING	-	966.9	213.0	-	644.8	114.1	-	-

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

S		INCREMENT "G" PROJECTS					INCREMENT "F" PROJECTS					
HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	
-	238.3	-	-	-	-	-	4.0	-	-	306	608	.
-	965.3	5.7	-	-	-	-	4.5	-	-	2825	2704	.
-	-	-	33.8	-	-	-	-	-	-	102	34	.
-	39.8	-	-	-	69.5	-	-	-	-	584	109	.:
-	39.8	-	-	-	-	-	-	-	-	584	40	1
-	39.8	-	-	-	-	-	-	-	-	584	40	1
-	106.2	-	67.6	-	-	-	-	-	-	551	468	.5
-	535.9	-	-	-	-	-	-	-	-	747	972	.5
-	1310.2	96.3	33.8	-	160.2	93.9	-	-	-	3650	6128	.4
-	-	-	-	-	-	-	-	-	-	568	195	.4
-	990.9	-	-	-	-	-	7.9	-	-	743	1049	.4
-	630.3	-	-	-	24.8	-	23.9	-	-	897	1164	.4
-	644.8	114.1	-	-	3.9	-	1.3	-	-	1100	1944	.4

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(2)

PROJECT

EEAP - KANSAS ARMY AMMUNITION PLANT

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	INCREMENT "F" PROJECTS									
RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	4.0	-	-	306	608	.4	63	4274	14740	79
-	4.5	-	-	2825	2704	.5	1473	40459	36407	48
-	-	-	-	102	34	.5	85	1138	74692	17
-	-	-	-	584	109	.5	529	2305	229501	9
-	-	-	-	584	40	1	544	2305	236008	7
-	-	-	-	584	40	1	544	2305	236008	7
-	-	-	-	551	468	.5	317	6151	51536	42
-	-	-	-	747	972	.5	261	8330	31333	65
93.9	-	-	-	3650	6128	.4	1200	52269	22958	67
-	-	-	-	568	195	.4	490	1500	326667	14
-	7.9	-	-	743	1049	.4	323	18542	17420	56
-	23.9	-	-	897	1164	.4	431	10009	43061	52
-	1.3	-	-	1100	1944	.4	322	3720	86559	71

		ECIP PROJECTS					INCREMENT "G		
BLDG. NO.	DESCRIPTION	INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS
703	HEATER HOUSE	-	-	-	-	27.9	-	-	-
705	POWDER PREPARATION AREA	-	95.5	7.9	-	196.4	-	-	-
708	HEATER HOUSE	-	-	-	-	27.9	-	-	-
715	DETONATOR LOADING	-	86.7	522	-	1124.2	668.1	-	-
716	DETONATOR LOADING	-	39.3	778.8	1542	1882.9	668.1	-	-
717	DETONATOR LOADING	-	39.3	778.8	1542	1874.1	-	-	-
722	DETONATOR LOADING	112.5	90.9	121.2	-	34.5	-	-	-
723	FINAL INSPECTION & PACK	-	76.9	99.7	-	28.3	-	-	-
726	CHANGE HOUSE	524.1	464.1	20.5	-	630.3	-	-	-
733	HEATER HOUSE	-	-	-	-	28.9	-	-	-
736	HEATER HOUSE	-	-	-	-	27.9	-	-	-
739	HEATER HOUSE	-	-	-	-	27.9	-	-	-
741	POWDER BUGGY REST HOUSE	-	46.9	79.4	-	431.8	-	-	-

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ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

		INCREMENT "G" PROJECTS					INCREMENT "F" PROJECTS					
COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR
	27.9	-	-	-	-	-	-	-	-	62	28	.5
	196.4	-	-	-	-	-	-	-	-	725	300	.5
	27.9	-	-	-	-	-	-	-	-	62	28	.5
	1124.2	668.1	-	-	-	-	4.2	-	17.5	3231	2422.7	.4
2	1882.9	668.1	-	-	-	-	6.5	-	8.7	5710	4926.3	.4
2	1874.1	-	-	-	-	-	1.3	-	8.7	5710	4244	.4
	34.5	-	-	-	-	-	-	-	-	1323	359	.5
	28.3	-	-	-	-	-	-	-	-	147	205	.4
	630.3	-	-	-	24.8	-	40.7	-	-	897	1705	.4
	28.9	-	-	-	-	-	-	-	-	64	29	.5
	27.9	-	-	-	-	-	-	-	-	62	28	.5
-	27.9	-	-	-	-	-	-	-	-	62	28	.5
-	431.8	-	-	-	-	-	-	-	-	1366	558.1	.5

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PROJECT EEAP - KANSAS ARMY AMMUNITION PLANT

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ECTS		INCREMENT "F" PROJECTS									
EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	-	-	-	-	62	28	.5	48	164	292683	23
-	-	-	-	-	725	300	.5	575	1858	309473	21
-	-	-	-	-	62	28	.5	48	164	292683	23
-	-	4.2	-	17.5	3231	2422.7	.4	2262	8533	268253	29
-	-	6.5	-	8.7	5710	4926.3	.4	3739	8533	441345	34
-	-	1.3	-	8.7	5710	4244	.4	4012	8633	464728	30
-	-	-	-	-	1323	359	.5	1144	2001	571714	14
-	-	-	-	-	147	205	.4	65	1648	39442	56
4.8	-	40.7	-	-	897	1705	.4	215	10009	21481	76
-	-	-	-	-	64	29	.5	50	168	297619	23
-	-	-	-	-	62	28	.5	48	164	292683	23
-	-	-	-	-	62	28	.5	48	164	292683	23
-	-	-	-	-	1366	558.1	.5	1087	3288	330596	20

BLDG. NO.	DESCRIPTION	ECIP PROJECTS					INCREMENT "C		
		INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS
744	COMPRESSOR HOUSE	29.	112.4	22.8	-	-	-	-	-
745	LINE OFFICE	63.3	192.1	2.8	-	-	-	-	-
809	PRIMER LOADER	-	84.5	154.5	-	-	-	-	-
904	RECEIVING, PAINT & CLEANING BLDG.	1387	2574.2	998.2	-	978.2	-	-	-
909	CHANGE HOUSE	579.3	464.1	20.1		630.3	-	-	-
951	X-RAY BUILDING	187.1	-	-	-	-	-	-	-
1102	PROCESS STORAGE LINE OFFICE	492.6	2244.2	1054.9	-	702.8	-	-	-
1107	CHANGE HOUSE	579.3	464.1	20.1	-	630.3	-	-	-
1109	MELT POUR (FIRST FLOOR)	106.1	1492.1	331	-	-	-	-	-
1113	COOLING BUILDING	826.5	636.6	42.1	-	552.6	-	-	-
1114	COOLING BUILDING	576.3	563.3	46.7	-	391.5	-	-	-
1122	CHANGE HOUSE	579.3	464.1	20.1	-	630.3	-	-	-
1131	GUARD HOUSE	-	-	2.7	-	-	-	-	-

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

.EMENT "G" PROJECTS				INCREMENT "F" PROJECTS								
LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET
	-	-	-	-	-	-	4640	164	1	4476	2007	2230
	-	-	-	-	-	-	583	258	.4	480	1541	311
	-	-	-	-	-	-	2789	239	.4	2693	7366	365
	-	-	-	-	-	-	2608	5938	.2	1420	18407	771
	-	-	-	-	-	-	897	1694	.4	219	10009	218
	-	-	-	-	-	-	638	187	.5	545	4501	121
	-	-	-	-	-	-	1896	4495	.2	997	27148	367
	-	-	-	-	-	-	897	1694	.4	219	10009	218
	-	-	-	-	-	-	6420	1929	.5	5456	16955	3217
	-	-	-	-	-	-	1115	2058	.4	292	12436	234
	-	-	-	-	-	-	1058	1578	.4	427	11809	361
	-	-	-	-	-	-	897	1694	.4	219	10009	218
	-	-	-	-	-	-	18	2.7	.4	2	48	3333

PROJECT: EEAP - KANSAS ARMY AMMUNITION PLANT

DATE: 31 Jan83

REF FROM

(2) The BenhamGroup architects / engineers planners / consultants

JOB NO. 0811 0 1 3 3 0

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INCREMENT "F" PROJECTS									
WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	-	-	4640	164	1	4476	2007	2230194	4
-	-	-	583	258	.4	480	1541	311486	18
-	-	-	2789	239	.4	2693	7366	365600	3
-	-	-	2608	5938	.2	1420	18407	77145	76
-	-	-	897	1694	.4	219	10009	21880	76
-	-	-	638	187	.5	545	4501	121084	15
-	-	-	1896	4495	.2	997	27148	36725	47
-	-	-	897	1694	.4	219	10009	21880	76
-	-	-	6420	1929	.5	5456	16955	321793	15
-	-	-	1115	2058	.4	292	12436	23480	74
-	-	-	1058	1578	.4	427	11809	36159	60
-	-	-	897	1694	.4	219	10009	21880	76
-	-	-	18	2.7	.4	2	48	333333	11

		ECIP PROJECTS					INCREMENT "G"		
BLDG. NO.	DESCRIPTION	INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS
1133	GUARD HOUSE	-	-	2.7	-	-	-	-	-
1135	GUARD HOUSE	-	-	2.7	-	-	-	-	-
1136	PACK & SHIP BLDG.	78.4	2045.6	165.1	-	796.7	-	-	-
1139 X-RAY	ASSEMBLY BLDG.	223.4	154.8	-	-	90.3	-	-	-
1140	CUBICLE BLDG.	1212.7	9.9	118.8	-	786.3	-	-	-
1147	COOLING BLDG.	247.4	446.2	42.9	-	144.8	-	-	-
2106	FILTRATION BLDG.	-	139.1	62	-	6.8	-	-	-
2203	SEWAGE DISPOSAL	-	-	1.0	-	-	-	-	-
BUILDING TOTALS: (Current 60 Bldgs.)		10617	26105	9611	3084	21101.8	1563	135	-
102X (a)	NEW ADMINISTRATION BLDG.	-	-	-	-	2612.2	-	-	-
BUILDING TOTALS: (with Bldg. 102X (a)		10617	26105	9611	3084	23714	1563	135	-

(a) 102X Will replace Bldgs 102, 105 and 106.

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

	INCREMENT "G" PROJECTS					INCREMENT "F" PROJECTS						
INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION
-	-	-	-	-	-	-	-	-	18	3	.6	1
-	-	-	-	-	-	-	-	-	18	3	.6	1
96.7	-	-	-	-	-	-	-	-	2109	3086	.4	87
90.3	-	-	-	-	-	.8	-	-	279	469	.4	9
86.3	-	-	-	-	-	-	-	-	1526	2128	.4	67
44.8	-	-	-	-	-	-	-	-	509	881	.4	15
6.8	-	-	-	45.6	-	-	-	-	2122	254	.5	199
-	-	-	-	-	-	-	-	-	37	1.0	1.0	3
101.8	1568	135	-	838.5	93.9	263	220	35	78011	73672	-	490
512.2	-	-	-	-	-	-	-	-	3587	2612	.5	228
714	1568	135	-	838.5	93.9	263	220	35	78681	76165	-	48460

PROJECT

EEAP - KANSAS ARMY AMMUNITION PLANT

The BenhamGroup architects / engineers planners / consultants

JOB NO. OFF | YR | SEQ SUBDIVISION EXT DISC TYPE

1 0 8 1 0 1 3 3 0

(2)

INCREMENT "F" PROJECTS									
WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	-	-	18	3	.6	16	48	333333	11
-	-	-	18	3	.6	16	48	333333	11
-	-	-	2109	3086	.4	875	30200	28974	59
.8	-	-	279	469	.4	91	1969	46216	67
-	-	-	1526	2128	.4	675	21861	30877	56
-	-	-	509	881	.4	157	5675	27655	69
-	-	-	2122	254	.5	1995	4333	460420	6
-	-	-	37	1.0	1.0	36	683	52709	3
263	220	35	78011	73672	-	49035	537885	99163	37
-	-	-	3587	2612	.5	2281	67000	34045	36
263	220	35	78681	76165	-	48460	548927	88281	38

BLDG. NO.	DESCRIPTION	ECIP PROJECTS					INCREMENT "G" PROJ			
		INSTALL AUTOMATIC VALVES & TRAPS ON STEAM RADIATORS, AND REPLACE TRAPS ON HP STEAM DISTRIBUTION SYSTEM	INSULATE PIPING AND MECHANICAL EQUIPMENT	WEATHERSTRIPPING AND CAULKING	HEAT RECLAIM FROM AIR COMPRESSOR COOLING WATER	INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	
209	BOILER HOUSE	-	-	-	-	534	-	-	-	-
314	BOILER HOUSE	-	-	-	-	362	-	-	899.2	-
724	BOILER HOUSE	-	-	-	-	1027	-	-	-	-
902	BOILER HOUSE	-	-	-	-	227	-	-	-	-
1105W	BOILER HOUSE	-	-	-	-	261	-	-	899.2	-
AREA 300	DISTRIBUTION SYSTEM	6517.8	-	-	-	-	-	-	-	-
AREA 700	DISTRIBUTION SYSTEM	6517.8	-	-	-	-	-	-	-	-
AREA 1100	DISTRIBUTION SYSTEM	6517.8	-	-	-	-	-	-	-	-
PIPING LEAK REPAIR & HANGER REPLACEMENT		-	5130.8	-	-	-	-	-	-	-
SYSTEMS SUBTOTAL (This Page)		19553	5131	-	-	2411	-	-	1798.4	
BASEWIDE TOTAL (With Bldg. 102X (a)		30170	31236	9611	3084	26125	1568	135	1798.4	83

ACTIONS AND SAVINGS MATRIX

(ENERGY VALUES IN MMBTU/YR.)

	INCREMENT "G" PROJECTS					INCREMENT "F" PROJECTS					
INSTALL EMCS	REDUCE AIR VOLUME	LOAD DOCK SEALS	BOILER ECONOMIZERS	EFFICIENT LIGHTING SOURCES	RAMP DOORS	WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR
534	-	-	-	-	-	-	-	-	-	534	-
362	-	-	899.2	-	-	-	-	-	-	1261.2	-
1027	-	-	-	-	-	-	-	-	-	1027	-
227	-	-	-	-	-	-	-	-	-	227	-
261	-	-	899.2	-	-	-	-	-	-	1160	-
-	-	-	-	-	-	-	-	-	-	6517.8	-
-	-	-	-	-	-	-	-	-	-	6517.8	-
-	-	-	-	-	-	-	-	-	-	6517.8	-
-	-	-	-	-	-	-	-	-	-	5130.8	-
2411	-	-	1798.4	-	-	-	-	-	-	28893.4	-
26125	1568	135	1798.4	838.5	93.9	263	220	35	78681	105178	-

PROJECT

EEAP - KANSAS ARMY AMMUNITION PLANT

The BenhamGroup
architects / engineers
planners / consultants

JOB NO. 10811013 | SUBDIVISION 310 | DISC | TYPE

CREMENT "F" PROJECTS									
WATER FLOW RESTRICTORS	REDUCE LIGHTING LEVELS	REPAIR STEAM PIPING LEAKS	CURRENT ENERGY CONSUMPTION (MM BTU/YEAR)	TOTAL ENERGY SAVED (MM BTU/YEAR)	COMMON SAVINGS FACTOR	PROJECTED ENERGY CONSUMPTION FY 85 (MM BTU/YEAR)	BUILDING AREA (SQ. FT.)	PROJECTED FY 85 ENERGY BUDGET (BTU/SQ.FT.)	PERCENT REDUCTION BY FY 85 (%)
-	-	-	-	534	-	-	1610	-	-
-	-	-	-	1261.2	-	-	1440	-	-
-	-	-	-	1027	-	-	1610	-	-
-	-	-	-	227	-	-	1610	-	-
-	-	-	-	1160	-	-	1260	-	-
-	-	-	-	6517.8	-	-	-	-	-
-	-	-	-	6517.8	-	-	-	-	-
-	-	-	-	6517.8	-	-	-	-	-
-	-	-	-	5130.8	-	-	-	-	-
-	-	-	-	28893.4	-	-	7530	-	-
263	220	35	78681	105178	-	48460	556457	87087	38

KANSAS ARMY AMMUNITION PLANT

DATE 31 Jan83 | REF FROM | INT FJ"

architects / engineers
planners / consultants (3)

JOB NO (OFF | YR | SEQ) | SUBDIVISION EXT | DISC | TYPE E | EXP | C | MFI | SHEET 1-25 | REV

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