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ENERGY ENGINEERING ANALYSIS PROGRAM FORT POLK, LOUISIANA

PRE-FINAL EXECUTIVE SUMMARY

INCREMENT 'F'

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PREPARED FOR

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS

CONTRACT NO. DACA63-84-D-0056

PREPARED BY

DTIC QUALITY INSPECTED 2

GRAHAM AND ASSOCIATES
PROFESSIONAL CONSULTING ENGINEERS INC.
OKLAHOMA CITY, OKLAHOMA

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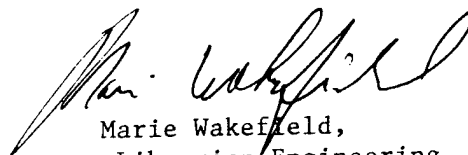


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ENERGY ENGINEERING ANALYSIS PROGRAM

FORT POLK, LOUISIANA

PRE-FINAL
EXECUTIVE SUMMARY

INCREMENT "F"

PREPARED FOR
Department Of The Army
Corps Of Engineers
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Contract No. DACA63-84-D-0056

PREPARED BY
Graham And Associates
Professional Consulting Engineers, Inc.
Oklahoma City, Oklahoma

November 1987

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1. INTRODUCTION

1.1 General

Executive Order 12003, dated 19 July 1977, initiated the U.S. Army's energy conservation effort. Specifically, the Executive Order led to the development of the Army Facilities Energy Plan which directs Army Staff and Major Army Commands to develop detailed implementation plans for energy conservation. As a result of these directives, the Fort Worth District of the U.S. Army Corps of Engineers contracted for an Energy Engineering Analysis Program (EEAP) at Fort Polk, Louisiana. The EEAP included Increments "A", "B", "E", and "G".

1.2 Authority

In an effort to complete all increments of the EEAP, Ft. Worth District contracted Graham & Associates Professional Consulting Engineers to conduct Increment "F" under Contract No. DACA63-84-0056, Delivery Order No. 5. The Contract included an "Increment "F" General Scope of Work for FORSCOM Installations", dated 10 May 1983, and a "Detailed Scope of Work" furnished with Delivery Order No. 5, dated 27 September 1984. The Scope of Work is included in Section 7 of the main report.

1.3 Analysis Methodolgy

To accomplish the intent of Increment "F", namely, providing low cost/no cost energy savings recommendations in the form of specific, practical instructions for use by the Facility Engineer, the following general steps were taken:

1. Consider measures identified in Detailed Scope of Work.
2. Identify other potential Low Cost/No Cost Energy Conservation Measures (ECM) through discussions with Fort Polk personnel and field surveys by Graham & Associates engineers.
3. Review Increments "A", "B", and "G" for ECM's within the Facility Engineer's funding authority; \$200,000 for alteration projects and \$1,000,000 for maintenance and repair type work.
4. Evaluate ECM's using relevant data for other Increments of the EEAP, and develop new data where appropriate.

1.4 Progress

Overall progress of the Increment "F" work by EEAP phases is:

<u>EEAP PHASE</u>	<u>PERCENT COMPLETE</u>
I. Data Gathering	100%
II. Data Analysis/Project Evaluation	100%
III. Programming Documents	100%

1.5 Overview

The Increment "F" report presents an analysis of proposed Energy Conservation Measures (ECM) based on a review of previous documents and extensive field survey. Each proposed ECM analysis is presented in Section 4 of the Increment "F" Final Report in the following manner:

ECM Number and Title: A brief title of the proposed measure.
The number is provided for a quick reference.

I. Reason For Energy Conserving Modification.

Description of why the modification was proposed.

II. Accomplishing Energy Conserving Modification.

Synopsis of how to accomplish the proposed ECM.

III. Estimated Man-Hours, Labor, and Material Costs.

1. Labor man-hours estimated by trade.

2. Material and labor costs estimated for calendar year 1986.

IV. Estimated Energy Savings.

Theory and technique used are documented with demonstration calculations. Other results are presented in a tabular form.

V. Economic Analysis.

Analysis performed in accordance with Energy Conservation Investment Program (ECIP) Guidance dated 10 August 1982 and revised 15 February 1985.

Section 5 of the Increment "F" Final Report presents tabular data summarizing the results Energy Conservation Measures from Increments "A", "B", "F" and "G" in order of decreasing SIR value. Also presented in the summary tables are increment "F" projects that qualify for "PECIP", "QRIP" or "Low-Cost" funding. These summaries coupled with the energy impact of

the Master Plan changes, as presented in Section 4.2 of the Final Report, show the possibilities available to meet energy reduction goals.

2.0 Existing Energy Consumption

From data presented by CRS Group, Inc. overall energy consumption in FY-83 at Ft. Polk is:

<u>FUEL</u>	<u>UNIT</u>	<u>SOURCE ENERGY</u>	<u>COST</u>
Electricity	KWH	1,709,585 MBTU	\$6.7 Million
<u>Natural Gas</u>	<u>MCF</u>	<u>642,245 MBTU</u>	<u>\$3.1 Million</u>
<u>Totals</u>		<u>2,351,830 MBTU</u>	<u>\$9.8 Million</u>

The use of other liquid petroleum products in FY-83 is shown as follows:

JP-4 (aviation turbine fuel):	0.06 trillion Btu's
Motor gasoline:	0.13 trillion Btu's
Diesel fuel:	0.18 trillion Btu's
Aviation gas:	0.0002 trillion Btu's

Energy consumption at Ft. Polk has increased significantly in the last ten years. Primaryly due to more buildings being air conditioned than before. Wise management of available funds to purchase energy conservative products and equipment will help hold down the dramatic growth of energy consumption.

3.0 Energy Conservation Measures Developed:

Twenty eight Energy Conserving Measures (ECM's) were investigated for implementation at Fort Polk, Louisiana for Increment "F".

3.1 ECM Summary

A summary of each Energy Saving Measure (ECM) Funding Category (QRIP, PECIP, LC/NC) is presented in Tables ES-1, ES-2, and ES-3. Each table includes a brief description of the ECM, Energy Savings Project Cost, SIR, and Simple Payback.

ECM's presented in Table ES-4 proved to be not fundable as QRIP, PECIP or Low Cost/No Cost, and did not meet ECIP criteria. "No-Calculations" shown in the table indicates the ECM did not merit consideration, had no savings, or has been previously implemented. These projects are listed only for continuity with the total project scope.

TABLE ES-1 INCREMENT 'F' ECM SUMMARY
QRIP PROJECTS

ECM NO.	ECM DESCRIPTION	ENERGY SAVED (MBtu/YR)		ENERGY SAVINGS (1985 \$/YR)		PROJECT COST (1985 \$)	SIR	SIMPLE PAY			LABOR REQUIRED (MAN-HOURS)						
		N. GAS	ELECT.	N. GAS	ELECT.			BACK	PLB	SMW	STF	ELT	OST	LAB			
14	SET-BACK THERMOSTATS-171XX	7018.0		\$27440.00		\$6240.00	59.20	0.23									
4	SET-BACK THERMOSTATS-610XX	14210.0		\$55560.00		\$12840.00	28.25	0.23									
12	ROOF INSULATION-171XX	62.0	292.0	\$244.00	\$5006.00	\$7189.00	10.00	1.37									
7	CHILLER SET-BACK BLDG 1052		3.0		\$54.00	\$181.00	6.27	1.52									
XXX TABLE TOTALS ==>		21290.0	295.0	\$83244.00	\$5060.00	\$26450.00	XXXXX	XXXXXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PLB = PLUMBER; SMW = SHEETMETAL WORKER; STF = STEAM FITTER; ELT = ELECTRICIAN; OST = OTHER SKILLED TRADES; LAB = COMMON LABORER

TABLE ES-2 INCREMENT 'F' PECIP PROJECT SUMMARY

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MBtu/YR)		ENERGY SAVINGS (1986 \$/YR)		PROJECT COST (1986 \$)	LABOR REQUIRED (MAN-HOURS)						SIMPLE PAY BACK	REMARKS
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SMW	STF	ELT	OST	LAB		
25	WOOD FUEL BOILER	24300.0		\$62937.00		\$126000.00	500	1000	500	1000	4.43	3.42	PECIP	
XXX PAGE TOTALS =>		24300.0	0.0	\$62937.00	\$0.00	\$126000.00	500	0	1000	500	1000	0	XXXXX XXXXXXXXXXXXXXXXXXXX	

COAL SAVINGS SHOWN UNDER N. GAS.

PLB = PLUMBER; SMW = SHEETMETAL WORKER; STF = STEAM FITTER; ELT = ELECTRICIAN; OST = OTHER SKILLED TRADES; LAB = COMMON LABORER

TABLE ES-3 INCREMENT 'F' EOM SUMMARY
LOW-COST PROJECTS

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MBtu/yr)		ENERGY SAVINGS (1985 \$/yr)		PROJECT COST (1985 \$)	SIR	SIMPLE PAV	LABOR REQUIRED (MAN-HOURS)						
		N. GAS	ELECT.	N. GAS	ELECT.				PLB	SMW	STF	ELT	OST	LAB	
1	REZONE BLDG 417	41.9	77.7	\$164.00	\$1333.00	\$1446.00	10.80	0.97			8		8		
8	CONTROL EXTERIOR LTS/MOTOR POOLS		40.5		\$704.00	\$1092.00	9.15	1.47					18		
2	ROOF BATT INSULATION-610XX	314.0	432.0	\$1230.00	\$7408.00	\$45231.00	2.75	5.25							579
9	RADIANT HEATERS	320.0		\$1251.00		\$11018.00	2.33	8.84							
23	SOLAR HEAT POOL 272	1172.0		\$4581.00		\$50972.00	1.85	11.17							
22	HEAT EXCH INSUL-TWO INCH	11.0		\$44.00		\$540.00	1.68	12.27							
22	HEAT EXCH INSUL-ONE&HALF INCH	10.0		\$40.00		\$493.00	1.66	12.42							
22	HEAT EXCH INSUL-ONE INCH	9.0		\$33.00		\$420.00	1.63	12.67							
23	SOLAR HEAT POOL 1459	582.0		\$2276.00		\$30380.00	1.54	13.39							
6	POINT OF USE HT HTR-610XX	4.0		\$16.00		\$259.00	1.24	16.63			6.0		2.0		
16	POINT OF USE HT WTR-171XX	4.0		\$16.00		\$259.00	1.24	16.63			6.0		2.0		
XXX TABLE TOTALS =>		\$2467.87	\$550.17	\$9651.00	\$9445.00	\$142110.00	XXXXX	XXXXXX	12.0	0.0	8.0	30.0	579	0.0	

PLB = PLUMBER; SMW = SHEETMETAL WORKER; STF = STEAM FITTER; ELT = ELECTRICIAN; OST = OTHER SKILLED TRADES; LAB = COMMON LABORER

TABLE ES-4 INCREMENT 'F' EOM SUMMARY BY EOM NO.

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MBtu/yr)		ENERGY SAVINGS (1986 \$/yr)		PROJECT COST (1986 \$)	LABOR REQUIRED (MAN-HOURS)					SIMPLE PAY		REMARKS	
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SMW	STF	ELT	OST	LAB	SIR		BACK
3	D-WT INSULATION-610XX														NO CALCULATIONS
5	EMCS-1715	4.0	87.0	\$16.00	\$1496.00	\$15319.00								0.61	17.75 NQ
5	EMCS-1701		85.0		\$1458.00	\$15319.00								0.58	18.93 NQ
5	EMCS-317		204.0		\$3501.00	\$15319.00								-1.91	-4.26 NQ
6	POINT OF USE HT HTR-610XX	4.2	-7.3	\$16.50	(\$12.40)	\$343.00								0.28	83.90 NQ
9	RADIANT HEATERS	256.0		\$1001.00		\$11018.00								1.87	11.05 NQ
10	ALTERNATE TRANSPORTATION														NO CALCULATIONS
11	RADIO DISPATCH MAINT VEHICLES														NO CALCULATIONS
12	ROOF INSULATION-171XX	82.0	43.0	\$319.00	\$736.00	\$8164.00				80				2.01	7.76 LOW-COST
13	D-WH INSULATION-171XX														NO CALCULATIONS
15	EMCS-7419	7.0	113.0	\$28.00	\$1932.00	\$15319.00								0.95	11.18 NQ
15	EMCS-7401	7.0	108.0	\$28.00	\$1850.00	\$15319.00								0.89	11.99 NQ
15	EMCS-7420	4.0	84.0	\$16.00	\$1444.00	\$15319.00								0.62	17.46 NQ
15	EMCS-7801		38.0		\$656.00	\$25000.00								0.04	796.10 NQ
16	POINT OF USE HT WTR-171XX	4.2	-7.3	\$16.50	(\$12.40)	\$343.00								0.28	83.90 NQ
17	VAV CONVERSION		82.0		\$1400.00	\$16589.00								0.40	29.20 NQ
18	REFLECT ROOF COAT, SCH A-ROOF 1	-4.0	2.4	(\$15.00)	\$41.00	\$297.00								0.35	11.73 NQ
18	REFLECT ROOF COAT, SCH A-ROOF 2	-0.7	0.4	(\$3.00)	\$8.00	\$297.00								0.07	63.45 NQ
18	REFLECT ROOF COAT, SCH C-ROOF 1	-3.9	2.0	(\$15.00)	\$34.00	\$297.00								0.26	15.65 NQ
18	REFLECT ROOF COAT, SCH C-ROOF 2	-4.0		(\$15.00)	\$6.00	\$297.00								0.15	-32.90 NQ
19	URETHANE INSULAT, SCH A-ROOF 1	13.0	5.0	\$52.00	\$85.00	\$3250.00								0.48	23.66 NQ
19	URETHANE INSULAT, SCH A-ROOF 2	1.0	1.0	\$4.00	\$7.00	\$3250.00								0.04	281.48 NQ
20	RPL INC TO HPS		152.0		\$2608.00	\$80355.00								1.08	11.42 NQ
20	RPL INC TO LPS		175.0		\$2996.00	\$147561.00								0.60	20.77 NQ
20	RPL IW TO HPS		2.0		\$34.00	\$536.00								0.13	1525.60 NQ
20	RPL IW TO LPS		3.0		\$46.00	\$984.00								0.53	26.53 NQ
22	HEAT EXCH INSUL-TWO INCH	11.0		\$44.00	\$540.00	\$540.00								1.68	12.27 NQ
22	HEAT EXCH INSUL-ONE&HALF INCH	10.0		\$40.00	\$493.00	\$493.00								1.66	12.42 NQ
22	HEAT EXCH INSUL-ONE INCH	9.0		\$33.00	\$420.00	\$420.00								1.63	12.67 NQ
24	USE EXCESS STEAM TO GENER ELEC														NO CALCULATIONS
26	GROUND WATER TO CONDENSERS		542.0		\$9294.00	\$2941490.00								0.03	317.00 NQ
27	SOLAR SCREEN		13.0		\$223.00	\$13000.00								0.25	53.94 NQ
XXX PAGE TOTALS =>		399.8	1727.2	1566.0	29830.2	3346438.0	0	0	0	80	0	XXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXX	

COAL SAVINGS SHOWN UNDER N. GAS.

4.0 Energy Cost and Savings

4.1 Basewide Consumption After ECIP Implementation

While it is somewhat difficult to predict the actual Fort Polk energy consumption in the future due to the ongoing and future growth, it is clear that it energy will increase. This increase is not due to poor energy use practices, but from increased square footage and the increased use of air conditioning. Even on a per square foot basis the amount of energy use at Fort Polk has increased since FY-75. This is due to the increased use of electricity for air conditioning in new structures. Natural gas consumption has actually decreased since newer construction is better insulated. Fort Polk's use of energy today is not simply related to increased use or square footage, but to a distinct change in the building stock and interior conditions in the new buildings.

If all other things were held static, the implementation of the recommended Increment "F" ECM's would result in a reduction of FY-83 gas and electric use. Refer to Table ES-1 below.

As mentioned earlier, it is difficult to forecast the future energy use at Fort Polk at this time. What is clear is that as new construction continues, energy use will increase. Fort Polk is in a unique position since virtually the entire post is being rebuilt with new, modern structures. The opportunity to include energy conserving concepts into the designs should not be ignored. Much more energy can be saved if such concepts are part of the original building design rather than added after construction is complete.

TABLE ES-5 OVERALL ENERGY CONSUMPTION (SITE)

<u>ITEM</u>	<u>N. GAS MBTU/YR</u>	<u>ELECTRICITY MBTU/YR</u>	<u>TOTAL MBTU/YR</u>
1983 Base Wide Consumption:	642,245	503,000	1,145,245
Increment "F" Savings:	58,990	3,009	61,998
Base Consumption With Increment "F" Savings:	583,255	499,092	1,082,347
Percent Reduction, 1983 Base:	9.2%	0.6%	5.4%

INCREMENT F
EXECUTIVE SUMMARY

ENERGY ENGINEERING ANALYSIS PROGRAM
FORT POLK, LOUISIANA

5.0 Results of Increment "A"

5.1 General

Increment "A" identifies similar groups of buildings that would benefit from various Energy Conservation Measures (ECM's). The large users of energy were identified and studied to determine the most beneficial conservation measure. This basic data was developed for use by other increments.

Twelve ECM's in Increment "A" were analyzed and identified as meeting ECIP criteria. Four of these ECM's were previously combined into one ECIP which has been funded and designed.

5.2 Savings

Implementation of the ECIP's will yield a total natural gas savings of 49,272 MBTU/YR, a total fuel oil savings of 7,811 MBTU/YR, and a total source electricity savings of 45,730 MBTU/YR.

The total FY-86 cost including retrofit contingencies and supervision for implementation of these ECIP's is \$1,703,062. Three ECM's were combined into the "Load Reducing Projects For Non-Family Housing", two ECM's were combined into the "Boiler Alterations" ECIP, and two ECM's were combined into a "Controls For Family Housing" ECIP. The ECIP projects are summarized in Table ES-6.

TABLE ES-6 ECIP ENERGY SAVINGS SUMMARY

ECIP	-----Energy Savings (MBTU/YR)-----				Const. Cost (FY84 \$)	Total Net Discounted Savings (\$)	SIR
	Nat Gas	Electric	Diesel	Total			
Load Reducing Projects For Non-Family Housing T-100	33,521	12,518	---	46,039	570,904	2,219,262	3.54
Boiler Alterations T-102	14,945	---	7,811	22,756	284,595	881,762	3.77
Controls For Family Housing PECIP T-101	806	11,174	---	11,980	326,924	609,530	1.70
TOTALS	49,272	23,692	7,811	80,775	1,182,423	3,710,554	XXXX

5.3 Non-ECIP's

ECM's investigated in Increment "A" which did not meet ECIP criteria are:

- * Domestic Hot Water Tank Insulation
- * Replace Heating Systems in North Fort Barracks
- * Storm Windows for Family Housing
- * Solar Domestic Hot Water for Residences
- * Electronic Furnace Ignition
- * Floor Insulation
- * Wall Insulation
- * Roof Insulation
- * Energy Conserving Project for New Family Housing
 - Automatic Setback Thermostats
 - Water Heater Insulating Jackets

6.0 Results of Increment "F"

Increment "F" identified specific Energy Conservation Measures that fall into the Low Cost/No Cost conservation measure category. Evaluation data was drawn from previous Increments and applied to the specific ECM's studied. In addition, interviews of Fort Polk staff were conducted and field surveys made to determine additional ECM's for analysis. The field survey concentrated on types of facilities rather than specific buildings.

Specific ECM's studied are presented in Section 3.0. If all fundable ECM's are implemented Fort Polk would save 250,208 dollars per year (1986) and 61,998 MBTU/YR. All qualified projects are recommended for installation.