

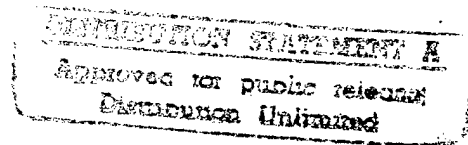
FINAL SUBMITTAL

EXECUTIVE SUMMARY

ENERGY SAVINGS OPPORTUNITY SURVEY FORT GILLEM, GEORGIA

Prepared for

**SAVANNAH DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA**



Under

CONTRACT NO. DACA21-91-C-0097

↖ FORT McPHERSON ESOS also done under same contract.



E M C ENGINEERS, INC.
Denver, Colorado
Atlanta, Georgia
Frankfurt, Germany

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September 1992

EMC No. 3105-000

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EMC Eng'rs, Marietta, GA
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1991
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E M C ENGINEERS, INC.
1950 Spectrum Circle
Suite B-312
Marietta, Georgia 30067
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COMMANDER SUMMARY

PURPOSE OF STUDY

The purpose of the study was to analyze energy requirements and energy conservation opportunities (ECOs) for selected buildings at Fort Gillem, Georgia.

RESULTS

Of the individual ECOs evaluated, 12 ECOs had a savings-to-investment (SIR) ratio greater than 1.0. Those ECOs having an SIR greater than 1.0 are, by definition, economically feasible. The total estimated construction cost for the 12 ECOs is \$4,455,080.

The individual ECOs were grouped into projects for possible funding under three main funding areas: 1) Military Construction Army (MCA) program; 2) Low-cost, No-cost projects; and 3) Non-Appropriated Funds (NAF) projects, funded by agencies and organizations maintaining clubs, commissary, exchange, and related buildings.

At Fort Gillem, two projects were evaluated for MCA funding:

- MCA Project 1 - Included the following ECOs:
 - ECO 1, Add duct insulation
 - ECO 1, Add roof insulation
 - ECO 5, Install high efficiency electric motors
 - ECO 7, Control hot water circulation pumps
 - ECO 11, Replace street lights
 - ECO 12, Revise or repair HVAC controls
 - ECO 14, Provide infrared heaters
 - ECO 15, Separate (automatic) light switches
 - ECO 18, Replace exit sign bulbs with fluorescent bulb kits
- MCA Project 2 - ECO 19, Previous lighting study review, for light fixture replacement

ECO 8, install low flow shower and faucet fixtures, was evaluated as a low-cost, no-cost ECO to be performed by in-house maintenance staff.

Two ECOs were evaluated for NAF facilities funding:

- ECO 14, loading dock seals
- ECO 18, replace exit sign bulbs with fluorescent bulb kits

Table 1 on the following page summarizes the savings, costs, and project economics of the proposed projects. It is recommended the Army fund and implement construction of the energy conservation projects to lower facility utility consumption in order to meet the energy reduction goals of Executive Order 12759 of April 17, 1991.

TABLE 1
ECONOMIC PROJECT SUMMARY

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)
MCA Project 1	86	974,092	6,671	9,994	56,008	8,843	(433)	64,418	735,360	1.1	11.4
MCA Project 2	1,270	2,971,800	0	10,134	75,781	130,378	0	206,159	2,380,795	1.3	11.5
Low-Cost/ No-Cost ECO	0	0	99	99	460	0	550	1,010	925	13.5	0.9
NAF ECO-14 Seals	0	100,073	3,829	4,170	20,433	0	0	20,433	102,705	4.5	5.0
NAF ECO-18	9	78,840	0	269	2,010	924	(906)	2,028	12,711	2.5	6.3
TOTAL	1,356	4,124,805	10,599	24,666	179,358	140,145	(789)	294,048	3,526,544	1.6	10.6

EXECUTIVE SUMMARY

PURPOSE OF STUDY

This study was conducted under Contract No. DACA21-91-C-0097, issued by the Corps of Engineers, Savannah District, in September 1991. The study analyzes energy requirements and energy conservation opportunities (ECOs) for selected buildings at Fort Gillem, Georgia.

ECOs EVALUATED

The 17 ECO projects identified in the SOW to be evaluated for selected buildings are listed in Table ES-1 on page ES-2.

During the entrance interview conference, ECO 18 was included. ECO 18, which converts incandescent exit sign light bulbs to fluorescent bulbs, was evaluated for all buildings specified for ECO 15, lighting controls.

Based on discussions with DEH, it was also decided to include the results of previous lighting studies (see Section 1.6), which were originally evaluated as shared energy savings projects. The results are included as ECO 19; economics are based on design, bid, and construction, direct by the Government, rather than by an energy service contractor under a shared energy savings contract.

Subsequent to the field survey, each ECO for each building was reviewed to determine if it was technically feasible. ECOs which are not technically feasible were eliminated from further evaluation. A complete list of these ECOs, and the reasons they were eliminated, are included in Table ES-2 on page ES-3.

In addition, as the facilities were surveyed, some ECOs included in the SOW were found to apply to buildings not identified in the ECO matrix (Annexes B and C). With the approval of DEH, these buildings were added to the original list.

Table ES-3 on page ES-4 contains a building-ECO matrix, indicating which ECOs are:

- Applicable and evaluated projects
- Not applicable and dropped from further evaluation
- Added as an applicable project.

**TABLE ES-1
ENERGY CONSERVATION OPPORTUNITIES LIST**

ECO NUMBER	ECO DESCRIPTION
1	Insulate Walls, Roofs, Pipes, and Ducts
2	Insulate Windows
3	Weatherstripping and Caulking
4	Domestic Hot Water Temperature
5	Install High Efficiency Electric Motors
6	Economizers
7	Control Hot Water Circulation Pump
8	Install Low-flow Shower and Faucet Fixtures
9	Heat Reclaim from Hot Refrigerant Gas
10	Prevent Air Stratification
11	Replace Street Lights
12	Revise or Repair HVAC Controls
13	Thermal Storage
14	Radiant Heaters and Loading Dock Seals
15	Separate Light Switches
16	Investigate Post Demand Usage
17	Boiler Operation Schedule
18	Replace Exit Sign Bulbs with Fluorescent Bulb Kit
19	Previous Lighting Review Study

**TABLE ES-2
NONFEASIBLE ECOs**

BLDG. NO.	ECO NO.	REASON ECO NONFEASIBLE
207	14	Loading dock seals: No physical contact; doors kept closed; minimal usage
400	14	Loading dock seals: No physical contact; doors kept closed; minimal usage
401	5	No motors 1 horsepower or larger
401	14	Loading dock seals: No physical contact; doors kept closed; minimal usage
403	5	No motors 1 horsepower or larger
701-710, 198, 922, 923, 942	All ECOs	Buildings scheduled for demolition

TABLE ES-3
BUILDING-ECO MATRIX

BLDG #	DESCRIPTION	ECO NUMBER																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
101	Administration	A	A	A	A	A	A	A	A	A		A	A*		A	A	A		A*	A*
102	Maintenance				A	A				A						A	A			A*
103	Fire Station				A	A									A	A	A		A*	A*
133	Officers Club				A	A			A							A	A			A*
207	Storage	A*	A*	A*	A	A				A					A	A	A		A*	A*
213	CID Building				A	A										A	A			A*
214	Commissary				A	A				A					A		A			A*
308	Storage				A	A										A	A			A*
400	DOL				A	A											A	A		A*
401	Eighty-first Arc.				A	N				A					N	A	A		A*	A*
403	Dining Facility				A	N											A	A		A*
505	Storage				A	A											A	A		A*
506	Storage																A	A		A*
507	Storage																A	A		A*
508	Storage																A	A		A*
509	Storage																A	A		A*

A - Applicable and evaluated project
N - Not applicable and dropped from further analysis
A* - Added as an applicable project

TABLE ES-3
BUILDING-ECO MATRIX

BLDG #	DESCRIPTION	ECO NUMBER																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
510	Storage																A	A		A*
511	Storage																A	A		A*
512	Storage {1}	A	A	A	A	A				A				A	A		A		A*	A*
513	Storage																A	A		A*
514	Storage																A	A		A*
735	Theater (T)	A	A	A	A	A											A			A*
935	Fitness Center				A	A			A*							A	A	A	A*	A*

{1} Representative of Buildings 505 through 514

- A - Applicable and evaluated project
- N - Not applicable and dropped from further analysis
- A* - Added as an applicable project

RESULTS

Of the individual ECOs evaluated, 12 projects had an SIR greater than 1.0 (see Table ES-5 on page ES-9). Those ECOs having an SIR greater than 1.0 are by definition economically feasible. The total estimated construction cost for the 12 projects is \$4,455,080.

Table ES-4 on page ES-7 lists the economic summary of each individual ECO, in ECO number order. Table ES-5 on page ES-9 lists the economic summary of each individual ECO, in order by SIR.

All ECOs determined to have an SIR less than 1.0 should be dropped from further analysis. These include:

- - ECO 1, Pipe Insulation
 - ECO 1, Wall Insulation
 - ECO 2, Insulated Windows
 - ECO 3, Weatherstripping and Caulking
 - ECO 6, Economizers
 - ECO 9, Heat Reclaim from Hot Refrigerant Gas
 - ECO 10, Prevent Air Stratification
 - ECO 13, Thermal Storage

**TABLE ES-4
ECONOMIC SUMMARY OF ECOs, LISTED BY ECO NUMBER**

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)	
1-Wall Insulation		NO BUILDINGS WITH SIR GREATER THAN 1.0										
1-Roof Insulation	0	186,795	7,187	7,824	38,327	0	0	38,327	731,391	1.2	19.0	
1-Duct Insulation	0	4,596	38	54	295	0	0	295	2,040	3.0	6.9	
1-Pipe Insulation		NO BUILDINGS WITH SIR GREATER THAN 1.0										
2-Insulate Windows		NO BUILDINGS WITH SIR GREATER THAN 1.0										
3-Caulking		NO BUILDINGS WITH SIR GREATER THAN 1.0										
4-HW Temp		NOT APPLICABLE - MEASUREMENT ONLY										
5-High Eff. Motor	11	71,225	0	243	1,816	1,102	0	2,718	37,154	1.2	12.7	
6-Economizer		NO BUILDINGS WITH SIR GREATER THAN 1.0										
7-HW Pump Control	0	124,564	233	658	4,264	0	0	4,264	11,003	4.6	2.6	
8-Shower/Faucet	0	0	99	99	460	0	550	1,010	925	13.5	0.9	
9-Heat Reclaim		NO BUILDINGS WITH SIR GREATER THAN 1.0										
10-Air Stratification		NO BUILDINGS WITH SIR GREATER THAN 1.0										
11-Street Lights	0	4,928	0	17	126	0	174	300	2,682	1.7	8.9	
12-HVAC Controls	57	285,187	302	1,274	8,683	5,852	127	14,661	57,547	2.9	3.9	
13-Thermal Storage		NO BUILDINGS WITH SIR GREATER THAN 1.0										
14-Dock Seals	0	110,603	4,234	4,611	22,729	0	0	22,729	113,516	2.8	5.0	
14-IR Heaters	0	1,692,360	14,452	20,228	110,647	0	0	110,647	1,064,948	1.4	9.6	
15-Light Control	11	47,766	(18)	145	1,136	1,141	0	2,277	30,072	1.1	13.2	

TABLE ES-4
ECONOMIC SUMMARY OF ECOs, LISTED BY ECO NUMBER
(CONCLUDED)

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)
16-Demand		NOT APPLICABLE									
17-Boiler		NOT APPLICABLE									
18-Exit Signs	16	142,700	0	487	3,653	1,672	(1,640)	3,686	23,007	2.5	6.2
19-Lighting Retrofit	1,270	2,971,800	0	10,134	75,781	130,378	0	206,159	2,380,795	1.3	11.5

**TABLE ES-5
ECONOMIC SUMMARY OF ECOs, LISTED BY SIR**

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)
8-Shower/Faucet	0	0	99	99	460	0	550	1,010	925	13.5	0.9
7-HW Pump Control	0	124,564	233	658	4,264	0	0	4,264	11,003	4.6	2.6
1-Duct Insulation	0	4,596	38	54	295	0	0	295	2,040	3.0	6.9
12-HVAC Controls	57	285,187	302	1,274	8,683	5,852	127	14,661	57,547	2.9	3.9
14-Dock Seals	0	110,603	4,234	4,611	22,729	0	0	22,729	113,516	2.8	5.0
18-Exit Signs	16	142,700	0	487	3,653	1,672	(1,640)	3,686	23,007	2.5	6.2
11-Street Lights	0	4,928	0	17	126	0	174	300	2,682	1.7	8.9
14-IR Heaters	0	1,692,360	14,452	20,228	110,647	0	0	110,647	1,064,948	1.4	9.6
19-Lighting Retrofit	1,270	2,971,800	0	10,134	75,781	130,378	0	206,159	2,380,795	1.3	11.5
5-High Eff. Motor	11	71,225	0	243	1,816	1,102	0	2,718	37,154	1.2	12.7
1-Roof Insulation	0	186,795	7,187	7,824	38,327	0	0	38,327	731,391	1.2	19.0
15-Light Control	11	47,766	(18)	145	1,136	1,141	0	2,277	30,072	1.1	13.2
TOTAL	1,365	5,637,596	26,527	45,757	267,791	140,145	(963)	406,773	4,452,398		
4-HW Temp		NOT APPLICABLE									
1-Pipe Insulation		NO BUILDINGS WITH SIR GREATER THAN 1.0									
3-Caulking		NO BUILDINGS WITH SIR GREATER THAN 1.0									
1-Wall Insulation		NO BUILDINGS WITH SIR GREATER THAN 1.0									
2-Insulate Windows		NO BUILDINGS WITH SIR GREATER THAN 1.0									
9-Heat Reclaim		NO BUILDINGS WITH SIR GREATER THAN 1.0									

TABLE ES-5
ECONOMIC SUMMARY OF ECOs, LISTED BY SIR
(CONCLUDED)

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)
6-Economizer											
17-Boiler											
16-Demand											
10-Air Stratification											
13-Thermal Storage											

ENERGY PROJECT DEVELOPMENT

The individual ECOs were grouped into projects for possible funding under three main funding areas:

- Energy Conservation Investment Program (ECIP) projects
- Non-ECIP, including Quick Return on Investment Program (QRIP), Military Construction Army (MCA) program, and low-cost/no-cost projects
- Non-Appropriated Funds (NAF) Projects, funded by agencies and organizations maintaining clubs, commissary, exchange, and related buildings.

Following the Interim Submittal, Fort McPherson DEH provided EMC with a list of buildings which have reimbursed utilities (NAF buildings) at Ft. Gillem. These facilities were eliminated from the possible ECIP funded projects. The Interim Submittal recommended ECIP projects were revised to take into account lower individual ECO construction cost estimates due to the elimination of these facilities.

At Fort Gillem, no projects were evaluated for ECIP funding because the construction cost of all combined economically feasible projects was less than \$300,000.

At Fort Gillem, two projects were evaluated for MCA funding:

- MCA Project 1 - Includes the following ECOs:
 - ECO 1, Add duct insulation
 - ECO 1, Add roof insulation
 - ECO 5, Install high efficiency electric motors
 - ECO 7, Control hot water circulation pumps
 - ECO 11, Replace street lights
 - ECO 12, Revise or repair HVAC controls
 - ECO 14, Provide infrared heaters
 - ECO 15, Separate (automatic) light switches
 - ECO 18, Replace exit signs bulbs with fluorescent bulb kits
- MCA Project 2 - ECO 19, Previous lighting study review, for light fixture replacement

ECO 8, install low flow shower and faucet fixtures, was evaluated as a low cost, no cost ECO to be done with in-house maintenance staff.

ECOs evaluated for NAF facilities which have an SIR greater than 1.0 and a simple payback less than 8 years, were lumped together for consideration by NAF related organizations.

Table ES-6 on page ES-12 provides an economic summary of ECO projects which should be considered for funding. Overall, there are \$3,124,931 of potential Non-ECIP ECO projects, and \$115,416 of potential NAF projects to fund.

TABLE ES-6
ECONOMIC PROJECT SUMMARY

ECO NO.	ANNUAL DEMAND SAVINGS (kW)	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL GAS SAVINGS (MBtu)	TOTAL ENERGY SAVINGS (MBtu)	ANNUAL ENERGY SAVINGS (\$)	ANNUAL DEMAND CREDIT (\$)	NON-ENERGY SAVINGS (\$)	TOTAL COST AVOID (\$)	CONST COST (\$)	SIR	SIMPLE PAYBACK (yrs)
MCA Project 1	86	974,092	6,671	9,994	56,008	8,843	(433)	64,418	735,360	1.1	11.4
MCA Project 2	1,270	2,971,800	0	10,134	75,781	130,378	0	206,159	2,380,795	1.3	11.5
Low-Cost/ No-Cost ECO	0	0	99	99	460	0	550	1,010	925	13.5	0.9
NAF ECO-14 Seals	0	100,073	3,829	4,170	20,433	0	0	20,433	102,705	4.5	5.0
NAF ECO-18	9	78,840	0	269	2,010	924	(906)	2,028	12,711	2.5	6.3
TOTAL	1,356	4,124,805	10,599	24,666	179,358	140,145	(789)	294,048	3,526,544		

RECOMMENDATIONS

- It is recommended the Army fund the construction of the two MCA projects to lower facility utility consumption in order to meet energy reduction goals of the Department of Defense.
- It is recommended Fort Gillem DEH complete the low-flow shower and faucet fixture project (ECO-8) in-house, using operation and maintenance money and local government staff.
- It is recommended the results of the energy evaluations on NAF buildings be provided to the related organizations for possible funding.

ENERGY CONSUMPTION

Electricity, natural gas, and water and sewer use will be conserved if the ECOs identified in this study are implemented.

Electrical energy consumption for FY90 and FY91 is tabulated in Table ES-7 on page ES-14. The average monthly electrical consumption varies from a minimum of 1,896,000 kWh in February, to a maximum of 3,048,000 kWh in August.

Natural gas consumption for FY90 and FY91 is tabulated in Table ES-8 on page ES-15. The average monthly natural gas consumption varies from a minimum of 12,437 therms in July, to a maximum of 300,308 therms in March.

**TABLE ES-7
ELECTRICAL ENERGY CONSUMPTION
FORT GILLEM**

Month	Post-wide Electrical Consumpt. kWh, FY90	Post-wide Electrical Consumpt. kWh, FY91	Post-wide Electrical Consumpt. kWh Avg.90/91
Oct.	2,035,200	2,304,000	2,169,600
Nov.	1,737,600	2,054,400	1,896,000
Dec.	2,131,200	2,102,400	2,116,800
Jan.	2,409,600	2,150,400	2,280,000
Feb.	1,920,000	2,227,200	2,073,600
March	2,121,600	1,958,400	2,040,000
April	1,920,000	2,112,000	2,016,000
May	2,236,800	2,140,800	2,188,800
June	2,707,200	2,649,600	2,678,400
July	2,755,200	2,793,600	2,774,400
Aug.	3,081,600	3,014,400	3,048,000
Sept.	2,515,200	2,544,000	2,529,600
TOTAL	27,571,200	28,051,200	27,811,200

**TABLE ES-8
NATURAL GAS CONSUMPTION
FORT GILLEM**

Month	Post-wide Natural Gas Consumption (Therms - FY90)	Post-wide Natural Gas Consumption (Therms - FY91)	Post-wide Natural Gas Consumption (Therms - Avg.)
Oct.	57,815	54,080	55,948
Nov.	155,197	124,669	139,933
Dec.	365,521	235,094	300,308
Jan.	209,241	299,628	254,435
Feb.	139,875	206,257	173,066
March	113,897	135,811	124,854
April	72,354	36,386	54,370
May	14,396	17,102	15,749
June	12,782	13,485	13,134
July	12,381	12,493	12,437
Aug.	13,431	13,182	13,307
Sept.	13,013	15,507	14,260
TOTAL	1,179,903	1,163,694	1,171,798

The percentage comparison of historical consumption and cost for electricity and natural gas are tabulated in Table ES-9 below. Table ES-10 below provides a comparison of the percent of energy and dollars saved after the ECOs recommended are implemented.

**TABLE ES-9
FY91 UTILITY USAGE AND COST COMPARISON**

UTILITY	CONSUMPTION FY91		COST FY91	
	(MBtu)	(%)	(\$)	(%)
Electricity	95,739	45	1,470,583	70
Natural Gas	116,369	55	644,169	30
Total	212,108	100	2,114,752	100

**TABLE ES-10
PERCENT ENERGY AND DOLLAR SAVINGS**

UTILITY	ENERGY SAVINGS			DOLLAR SAVINGS		
	Base Energy (MBtu)	Energy Savings (MBtu)	Percent Savings (%)	Base Energy (\$)	Energy Savings (\$)	Percent Savings (%)
Electricity	95,739	18,740	19.6	1,470,583	140,015	9.5
Natural Gas	116,369	21,972	18.9	644,169	102,609	15.9
Total	212,108	40,712	19.2	2,114,752	242,624	11.5

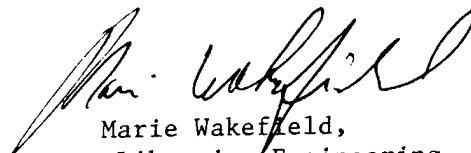


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