Basewide Energy Systems Plan for Hunter Army Airfield, Georgia

Final Report

Executive Summary

Facilities Engineer

Conservation Measures

Increment F

Prepared for:

Savannah District,

Corps of Engineers

Prepared by:

JRB Associates

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July 1985

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BASEWIDE ENERGY SYSTEMS PLAN
FOR
HUNTER AAF, GEORGIA

FINAL REPORT
EXECUTIVE SUMMARY
INCREMENTS A, B, C, F, AND G

Prepared for:

Savannah District, Corps of Engineers
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Army Contract No. DACA21-80-C-0014
JRB Contract No. 2-815-04-225

July 1985

EXECUTIVE SUMMARY

1. INTRODUCTION

This report presents the results of Increments A, B, C, F, and G of the Energy Engineering Analysis Program conducted at Hunter Army Air Field, Georgia, by JRB Associates under Contract No. DACA21-80-C-0014. This report includes analyses of the energy patterns at the facility, and the identification and evaluation of energy conservation opportunities. The results obtained indicate that energy use at Hunter AAF can potentially be held at a 7.5 percent increase in FY 1985 over FY 1975 energy use. This is achieved even though the total square feet of heated space is projected to increase by 12 percent. The report is organized into 5 volumes, plus appendices.

2. EXISTING ENERGY USE

Fuel oil, natural gas, and electricity are the main energy sources at Hunter AAF. In FY 1975 the total energy use at the Post was 399,600 MBtu. A summary of the FY 1983 basewide energy use by fuel type is given in Table 1, which shows that electricity currently accounts for approximately 72 percent of total energy use. Total energy use at the Post for the years 1977 to 1983 is shown in Table 2.

Early work in this study emphasized energy use in buildings. Initial data for the study were gathered through a series of site visits during which buildings were inventoried, patterns of building energy use were identified, and typical buildings were selected for detailed study in each category. Energy use data was analyzed to determine how much energy the various types of buildings use and their functional energy use. Since this effort took place in 1980, FY 1979 energy use data was the basis of the analysis. Figures 1, 2, 3, and 4 provide a summary of the building inventory and energy use in FY 1979. The energy profiles in these figures were developed by evaluating the energy use of typical buildings and expanding those values to represent the entire Post.

TABLE 1. ENERGY USE AT HUNTER AAF - FY 1983

ENERGY SOURCE	PURCHASED ENERGY		SOURCE USE (MBtu)	ANNUAL ENERGY COST
ELECTRICITY	36,568,000	kWhr	424,188	$1,974,672
#2 FUEL OIL	1,039,540	gallons	144,184	$1,070,726
NATURAL GAS	193,700	therms	19,372	$993,681
PROPANE	5,453	gallons	518	$3,926
TOTALS			588,262	$4,043,005

Source: Facilities Engineers, Ft. Stewart, Georgia, written communications, 3 July 1984

TABLE 2. ANNUAL ENERGY USE AT HUNTER AAF - FY 1977-1983 (MBtu)

ENERGY SOURCE	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983
ELECTRICITY	421,900	424,200	422,900	397,945	427,565	419,774	424,188
#2 FUEL OIL	194,400	156,300	113,800	100,811	125,884	118,729	144,184
NATURAL GAS	14,200	18,600	20,800	21,050	16,669	16,368	19,372
PROPANE	2,400	2,000	1,700	1,022	973	409	518
TOTALS	632,900	601,100	559,200	520,828	571,091	555,280	588,262

Source: Facilities Engineers, Ft. Stewart, Georgia, written communication 3 July 1984

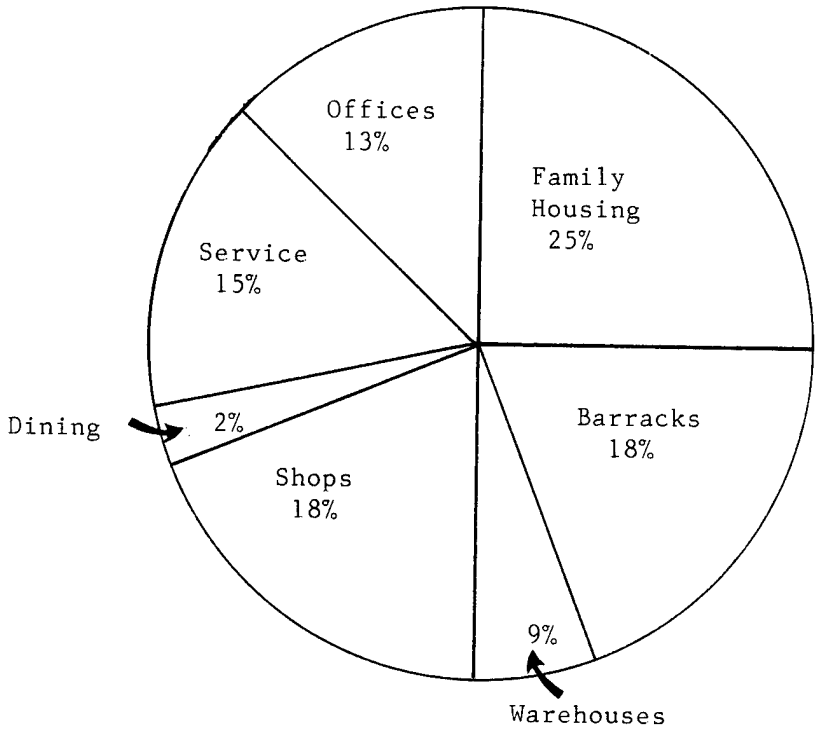

FIGURE 1. HEATED AREA BY BUILDING CATEGORY

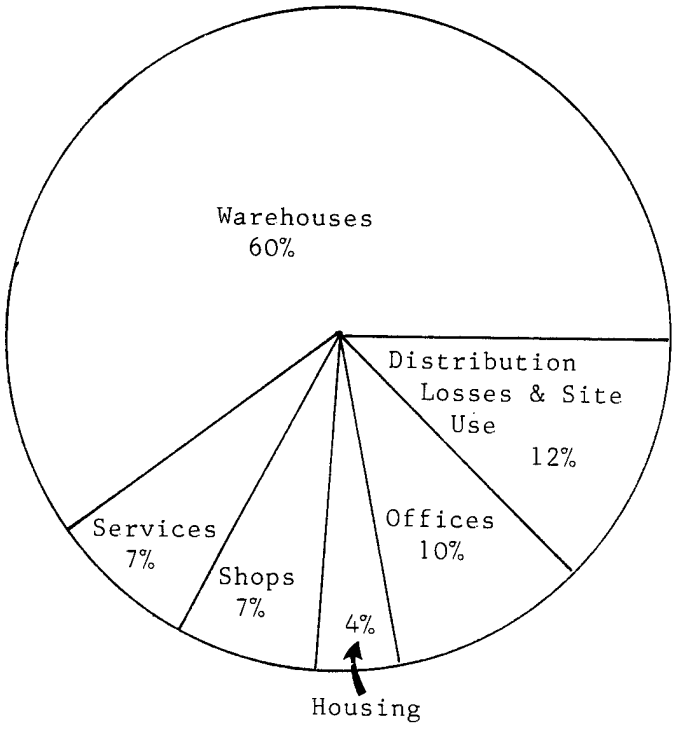

FIGURE 2. TOTAL ENERGY END USE

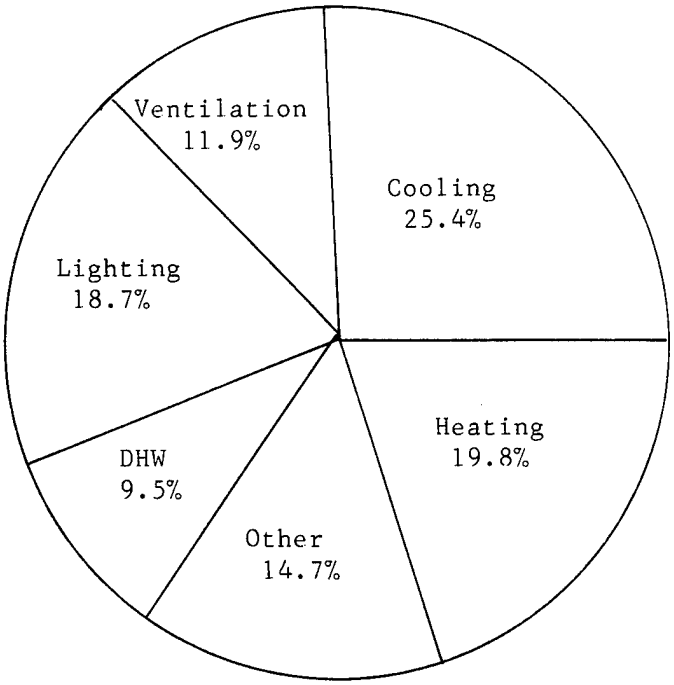

Figure 3. Estimated Energy Use By Energy Using System

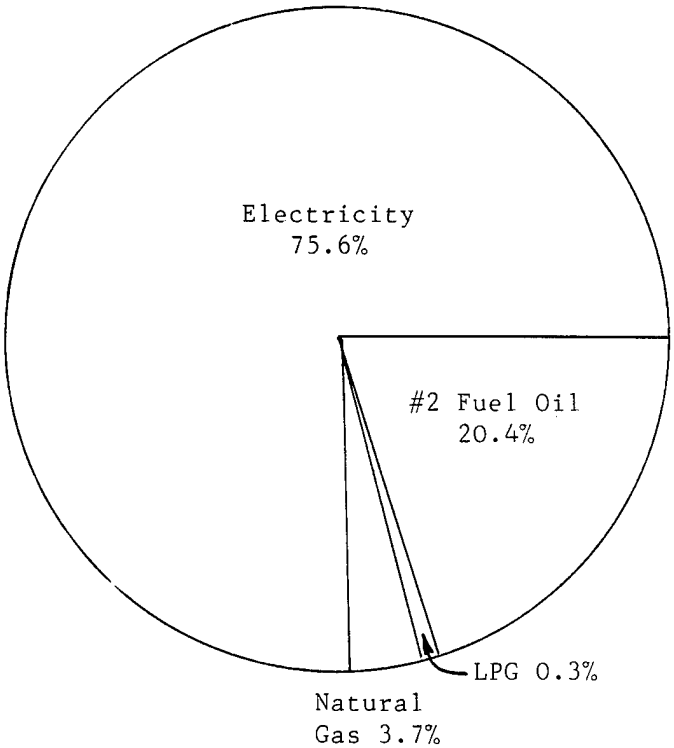

Figure 4. FY 79 Actual Energy Deliveries

3. ENERGY CONSERVATION MEASURES DEVELOPED

The energy conservation opportunities at Hunter AAF are summarized in Table 3. This table shows all projects recommended and the resulting economic indices. These energy conservation opportunities were developed by analyzing their applicability to typical buildings. Those that met ECIP criteria were developed into projects with appropriate documentation (DD Form 1391's and PDB's). Table 4 provides a listing of the recommended ECIP projects. Other recommended energy conservation projects identified by JRB are listed in Table 5.

Recommended policy changes for Hunter AAF to improve energy management include:

- Install a full time energy office at Hunter AAF to manage the conservation program; and
- Increase the level of contract maintenance activity on energy systems such as steam distribution lines, steam traps and HVAC controls.

4. ENERGY AND COST SAVINGS

The total energy savings potential of the recommended energy conservation projects is 167,539 MBtu per year. The represents an estimated energy cost savings of $1,184,751 using FY 1985 projected energy costs. The impact on Hunter AAF's total energy use represented by these projects is shown in Table 6.

5. RESULTS OF INCREMENT A - BUILDINGS

The scope of Increment A included an engineering analysis of all existing buildings at Hunter AAF. For each type of building, specific characteristics having a significant effect on energy were identified. Table 7 shows these characteristics. The energy use of these buildings is identified in that table. Based upon these analyses, energy conservation projects were evaluated using ECIP criteria to determine acceptability. The recommended ECIP projects developed under Increment A are identified in Table 4.

TABLE 3. EEAP CONSERVATION PROJECTS FOR HUNTER AAF

INC	PROJECT	PROJECT COST	ENERGY (MBtu)	SIR B/C*	E/C	SIMPLE PAYBACK YEARS
F	Reduce DHW temperatures	$636	1,581	189.0	2,486	.1
G	Energy conserving lamps	$9,560	5,885	40.0*	616	.3
G	Reduce air flow rates	$6,996	1,561	21.0*	223	.9
F	Insulation of piping	$928	183	18.4	197	1.2
F	Heat recovery from A/C - BOQS	$3,978	773	17.6	194	1.3
F	Steam trap and line maintenance	$3,207	536	16.7	167	1.1
A	Night setback/dhw insulation -FH	$102,789	9,038	13.0*	88	.9
G	Substitute flourescent lamps	$54,843	12,493	11.0*	228	1.1
F	Reduce stratification heat loss	$704	84	10.8	119	1.1
F	Shower flow restrictors	$18,912	1,318	9.3	70	1.9
F	High eff. ballasts (each)	$12	2	7.0	167	1.2
A	Insulation in Family Housing	$423,476	11,509	6.0*	27	3.1
F	Energy conserving fluorescent lamp (each)	$1.20	0.15	5.5	125	1.8
F	Install fluorescent lamps - exit lights	$946	90	5.3	95	1.5
F	Exterior lighting control	$1,885	173	3.8	92	3.0
F	Reduce infiltration - barracks & shop	$3,680	171	3.4	46	8.3
F	High efficiency motors (each)	$233	20	2.9	154	13.4
G	Destratify high bays	$73,307	865	2.9*	12	7.0
A	Energy efficient lighting	$295,773	6,809	2.9*	23	5.8
G	Oil furnace flue dampers	$123,400	1,538	2.6*	12	7.0
A	Various options	$140,095	2,695	2.2*	19	5.8
G	Storm windows	$306,344	2,927	2.0*	10	9.6
F	Reduce infiltration - family housing	$39,527	872	1.9	22	12.8
F	Systems controls	$7,618	411	1.8	54	5.1
G	Office wall insulation	$96,511	933	1.8*	10	10.2
B	Install EMCS - Main Complex	$2,373,292	67,693	1.7	29	7.1
G	Recirc. toilet exhaust	$64,402	628	1.7*	10	9.9
B	Install radio control - FH	$238,000	+	1.7	0	
F	Heat recovery from A/C - BOQs #224 & #405	$7,510	110	1.7	15	12.4
F	Heat recovery from A/C - NCO Mess #128	$4,405	62	1.6	14	13.7
G	Solar dhw - Family Housing	$1,990,920	23,745	1.4*	12	12.7
A	Desuperheaters - Family Housing	$580,441	9,484	1.4*	16	8.4
F	Heat recovery from refrig. (commissary)	$10,887	411	1.1	38	10.1
F	Fluorescent dimmers	$284	8	1.0	29	4.9
B	Replace site lighting	$110,000	2,442	1.0	22	7.2
C	Solar hot water - 2 bldgs	$66,846	511	1.0*	8	19.5
	TOTAL	$7,162,102	167,539			

+ Energy demand savings only.

1 2-40w bulb fixture at 168 hour/week use - replace at failure (not included in totals)
2 168 hours/week operation - replace at failure (not included in totals)
3 values for 25 hp motor at 50 hours/week use - replace at failure (not included in totals)

TABLE 4. ENERGY CONSERVATION INVESTMENT PROGRAMS (ECIP)
PROJECTS FOR HUNTER AAF

INC	PROJECT	PROJECT COST	ENERGY (MBtu)	SIR B/C*	E/C	SIMPLE PAYBACK YEARS
A	Night setback/dhw insulation -FH	$102,789	9,038	13.0*	88	.9
A	Insulation in Family Housing	$423,476	11,509	6.0*	27	3.1
A	Energy efficient lighting	$295,773	6,809	2.9*	23	5.8
A	Various options	$140,095	2,695	2.2*	19	5.8
B	Install EMCS - Main Complex	$2,373,292	67,693	1.7	29	7.1
A	Desuperheaters - Family Housing	$580,441	9,484	1.4*	16	8.4
	TOTAL	$3,915,866	107,228			

*These are B/C Valves

TABLE 5. OTHER ENERGY CONSERVATION PROJECTS FOR HUNTER AAF

INC	PROJECT	PROJECT COST	ENERGY (MBtu)	SIR B/C*	E/C	SIMPLE PAYBACK YEARS
F	Reduce DHW temperatures	$636	1,581	189.0	2,486	.1
G	Energy conserving lamps	$9,560	5,885	40.0*	616	.3
G	Reduce air flow rates	$6,996	1,561	21.0*	223	.9
F	Insulation of piping	$928	183	18.4	197	1.2
F	Heat recovery from A/C - BOQS	$3,978	773	17.6	194	1.3
F	Steam trap and line maintenance	$3,207	536	16.7	167	1.1
G	Substitute flourescent lamps	$54,843	12,493	11.0*	228	1.1
F	Reduce stratification heat loss	$704	84	10.8	119	1.1
F	Shower flow restrictors	$18,912	1,318	9.3	70	1.9
F	High eff. ballasts (each)	$12	2	7.0	167	1.2
F	Energy conserving fluorescent lamp (each)	$1.20	0.15	5.5	125	1.8
F	Install fluorescent lamps - exit lights	$946	90	5.3	95	1.5
F	Exterior lighting control	$1,885	173	3.8	92	3.0
F	Reduce infiltration - barracks & shop	$3,680	171	3.4	46	8.3
F	High efficiency motors (each)	$233	20	2.9	154	13.4
G	Destratify high bays	$73,307	865	2.9*	12	7.0
G	Oil furnace flue dampers	$123,400	1,538	2.6*	12	7.0
G	Storm windows	$306,344	2,927	2.0*	10	9.6
F	Reduce infiltration - family housing	$39,527	872	1.9	22	12.8
F	Systems controls	$7,618	411	1.8	54	5.1
G	Office wall insulation	$96,511	933	1.8*	10	10.2
G	Recirc. toilet exhaust	$64,402	628	1.7*	10	9.9
B	Install radio control - FH	$238,000	+	1.7	0	
F	Heat recovery from A/C - BOQs #224 & #405	$7,510	110	1.7	15	12.4
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F	Heat recovery from refrig. (commissary)	$10,887	411	1.1	38	10.1
F	Fluorescent dimmers	$284	8	1.0	29	4.9
B	Replace site lighting	$110,000	2,442	1.0	22	7.2
C	Solar hot water - 2 bldgs	$66,846	511	1.0*	8	19.5
	TOTAL	$3,246,236	60,311			

+ Energy demand savings only.

1 2-40w bulb fixture at 168 hour/week use - replace at failure (not included in totals)
2 168 hours/week operation - replace at failure (not included in totals)
3 values for 25 hp motor at 50 hours/week use - replace at failure (not included in totals)

TABLE 6. PROJECTED ENERGY USE AT HUNTER AAF AFTER ENERGY CONSERVATION PROJECTS AND NEW CONSTRUCTION

FY	75	79	83	85 STATUS QUO *	BLDG STOCK CHANGE	% GROWTH** OVER 75	85 WITH EEAP +	EEAP PROJ. CHANGE	% GROWTH OVER 75
ENERGY USE (1000 MBtu)	399.6	559.2	588.3	596.9	8.6	49%	429.4	-167.5	7%
BLDG STOCK (Million S.F.)	2.72	2.894	2.907	3.037	.13	12%	3.037	0	12%
ENERGY USE (KBtu/S.F.)	146.9	193.2	202.4	196.5	--	34%	141.4	--	-4%

* Accounts for new and demolished buildings FY83-85
+ Assumes implementation of recommended EEAP projects (table 5-2)
**With all EEAP projects implemented, the reduction in energy for Btu per square foot will approximately 4 percent.

TABLE 7. HUNTER ARMY AIRFIELD CATEGORY DIVISION - TYPICAL BUILDINGS

CATEGORY	SUBGROUP	TYPICAL BUILDING	HEATED SQ.FT.	COOLED SQ.FT.	WALL TYPE	ROOF TYPE
OFFICES - A	A-1	232	126,297	67,899	Wood	Wood
	A-2	1157	98,856	88,998	Concrete/ Block	Wood
	A-3	1279	110,625	108,633	Concrete/ Block	Wood/ Metal
	A-4	1235	26,178	21,280	Concrete/ Block	Wood
	SUBTOTAL		361,956	286,810		
DINING B	B-1	1275	55,366	55,366	Concrete/ Block	Reinfor. Concrete
	SUBTOTAL		55,366	55,366		
HOUSING - C	C-1	1408	24,278	19,394	Wood	Wood
	C-2*	326	55,706	0	Concrete	Wood
	C-3	2209	664,730	664,730	Concrete/ Block	Wood
	C-4*	6010	35,918	34,350	Brick	Wood
	C-5	1275	394,061	393,789	Concrete/ Block	Reinfor. Concrete
	SUBTOTAL		1,174,693	1,112,263		
WAREHOUSES D	D-1	703	126,343	29,221	Wood	Wood
	D-2	1036	106,717	94,468	Concrete/ Block	Reinfor. Concrete
	SUBTOTAL		233,060	123,689		
SHOPS - E	E-1	1131	89,786	45,872	Metal	Metal
	E-2	811	160,721	129,215	Concrete/ Block	Reinfor. Concrete
	E-3	850	204,851	103,641	Metal	Reinfor. Concrete
	E-4	1203	39,487	17,557	Wood	Wood
	SUBTOTAL		494,045	296,285		
SERVICE - F	F-1	1031	98,533	82,520	Wood	Wood
	F-2	925	24,697	0	Brick	Reinfor. Concrete
	F-3	1290	60,705	49,963	Block	Metal
	F-4	1413	8,454	6,807	Wood/ Brick	Reinfor. Concrete
	F-5	1413	155,330	130,486	Brick	Metal
	F-6	1280	29,178	17,139	Brick	Reinfor. Concrete
	F-7	1286	27,288	27,288	Wood/ Brick	Reinfor. Concrete
	SUBTOTAL		404,185	314,203		
TOTALS			2,724,105	2,188,616		

*Barracks

6. RESULTS OF INCREMENT B - DISTRIBUTION SYSTEMS, EMCS

The scope of Increment B involved an engineering analysis of the Post's utilities, energy distribution systems, the existing plants, and the potential for an EMCS. Load profiles for each energy source were performed. The annual energy use profile for fossil fuel and electricity is presented in Figures 5 and 6, respectively. An evaluation was performed for connecting other buildings at Hunter AAF to the current EMCS. The use of an VHF-FM control energy management system was also analyzed. As the result of these evaluations, one ECIP project was recommended. This is listed in Table 4.

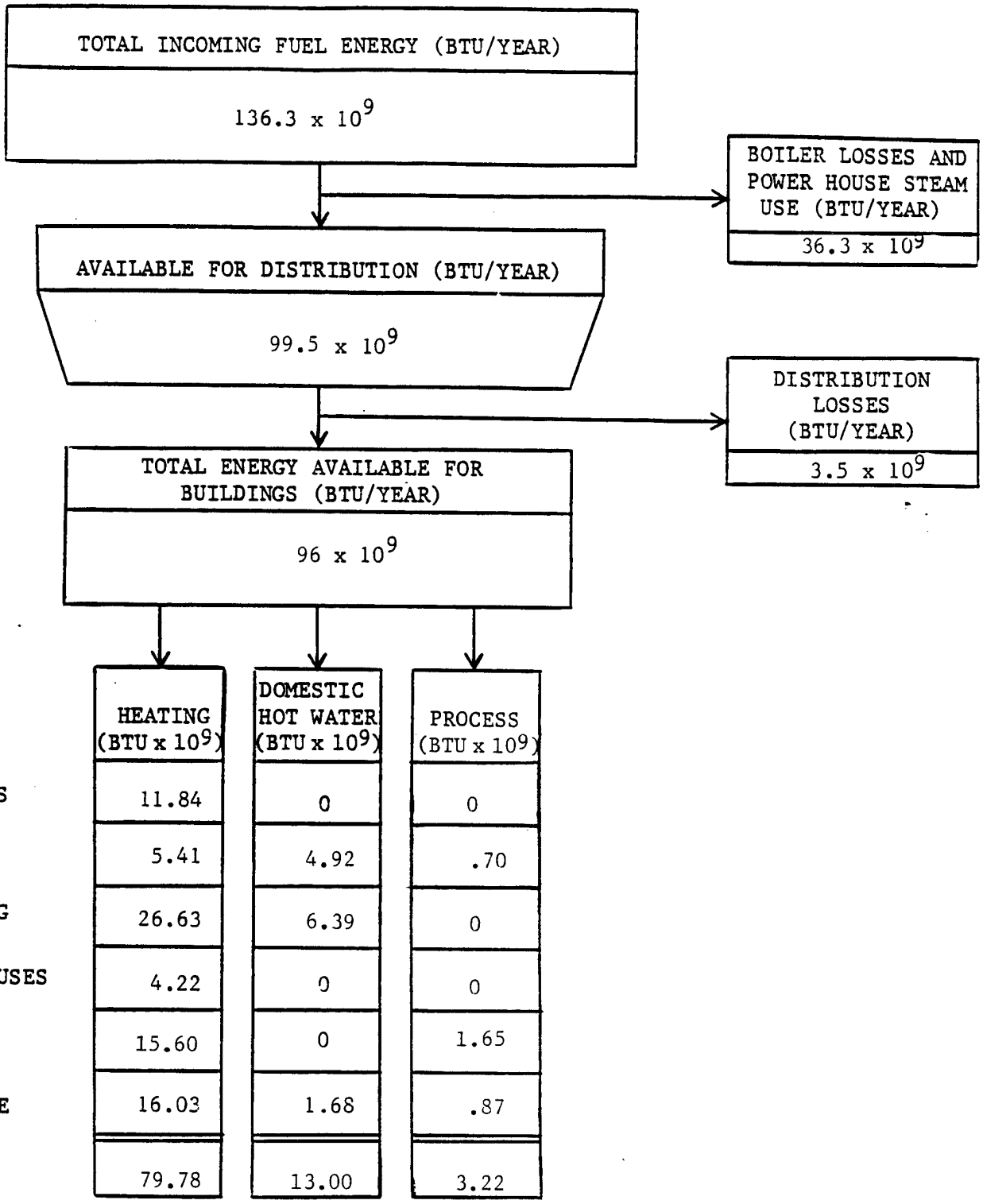
7. RESULTS OF INCREMENT C - RENEWABLE ENERGY

The Increment C study at Hunter AAF was an analysis of both passive and active solar applications on Post. A life cycle cost analysis was performed to determine the most economical system for solar application. The study showed that solar systems which would meet Total Energy Selection Live Cycle Cost Criteria (ETL 1110-3-302) could be installed for the commissary and dental clinic. The commissary solar system had a 13 year payback and saved 388 MBtu annually. The dental clinic had a 11 year payback and saved 123 MBtu annually.

8. RESULTS OF INCREMENT F - FACILITY ENGINEER CONSERVATION MEASURES

The scope of work to be performed under Increment F is the identification of energy conservation opportunities that are within the Facilities Engineer funding authority, or which satisfy QRIP, OSD PIF, or PECIP requirements. In the performance of the Increment F evaluation, 19 buildings on Post were evaluated and five infiltration tests were performed.

Another element of the Increment F report is to identify the energy conservation measures accomplished by the Post since 1975. Table 8 lists these projects. Also addressed are the planned facility changes and their impact on energy use. These are shown in Table 9. The recommended Increment F projects are presented in Table 10.

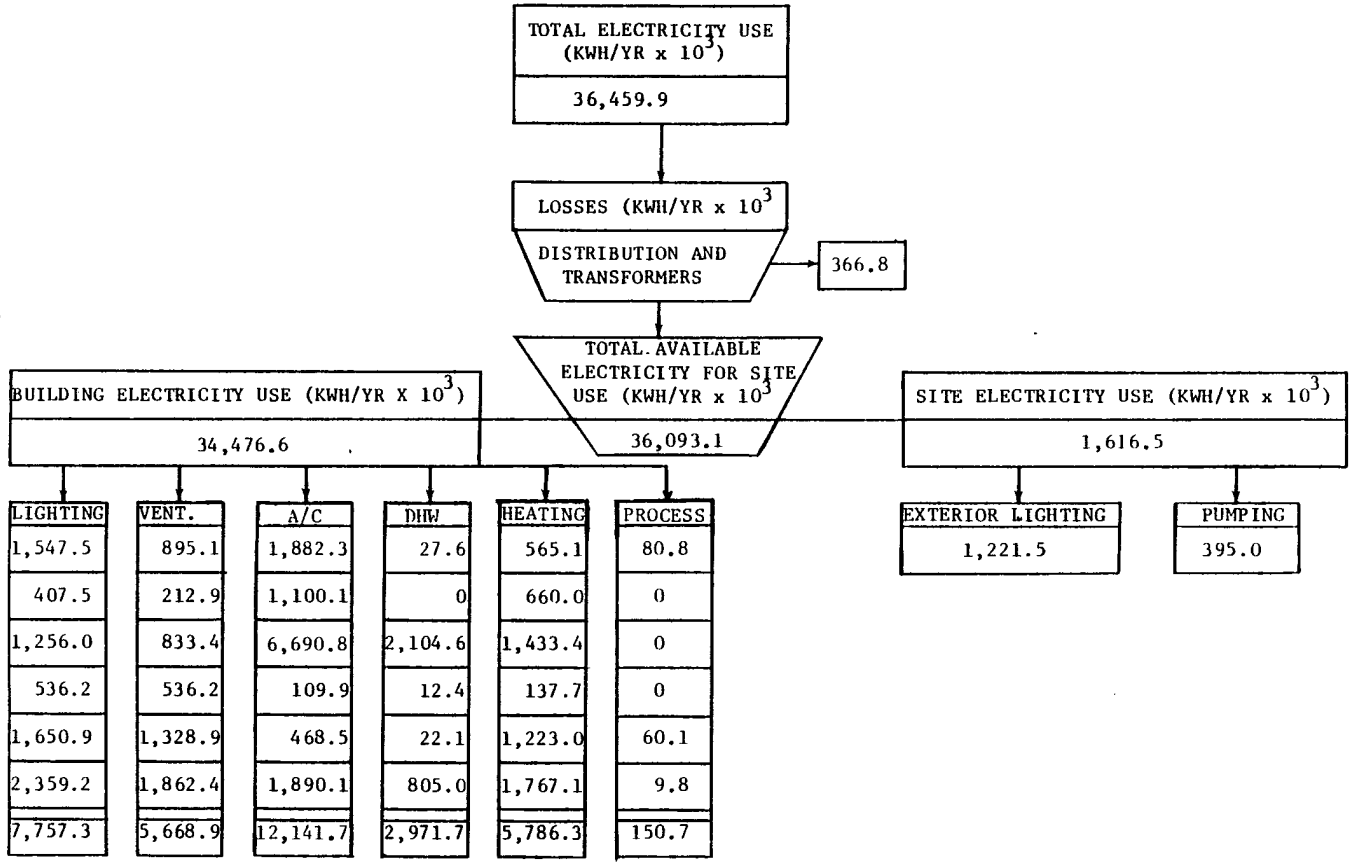


	HEATING (BTU x 10^9)	DOMESTIC HOT WATER (BTU x 10^9)	PROCESS (BTU x 10^9)
OFFICES	11.84	0	0
DINING	5.41	4.92	.70
HOUSING	26.63	6.39	0
WAREHOUSES	4.22	0	0
SHOPS*	15.60	0	1.65
SERVICE	16.03	1.68	.87
TOTAL	79.78	13.00	3.22

FIGURE 5. HEATING ENERGY PROFILE FY 1979 —HUNTER ARMY AIRFIELD

SOURCE: Appendix C

*Adjusted to account for partial shut off (FY 1979) during facility renovation, see Appendix C, pg. 23



	LIGHTING	VENT.	A/C	DHW	HEATING	PROCESS
OFFICES	1,547.5	895.1	1,882.3	27.6	565.1	80.8
DINING	407.5	212.9	1,100.1	0	660.0	0
HOUSING	1,256.0	833.4	6,690.8	2,104.6	1,433.4	0
WAREHOUSES	536.2	536.2	109.9	12.4	137.7	0
SHOPS	1,650.9	1,328.9	468.5	22.1	1,223.0	60.1
SERVICE	2,359.2	1,862.4	1,890.1	805.0	1,767.1	9.8
TOTAL	7,757.3	5,668.9	12,141.7	2,971.7	5,786.3	150.7

FIGURE 6 . ELECTRICAL ENERGY PROFILE, FY 1979 — HUNTER ARMY AIRFIELD

SOURCE: Appendix C, page 26

TABLE 8. PROJECTS WITH ESTABLISHED ENERGY SAVINGS

Project	Annual Energy Savings (MBtu)		
	Electricity	No. 2 Oil	Total
1. Family Housing			
• Storm windows	4,744.8	4,602.0	9,346.8
2. ECIP Funded			
• Insulate and weatherstrip administration buildings	15,594.0	30,406.0	46,000.0
3. Operation and Maintenance			
• Storm doors in family housing	1,099.4	1,384.5	2,483.9
• Honeywell 1000 computer	N/A	N/A	N/A
• Renovate steam lines	N/A	N/A	N/A
TOTAL	21,438.2	36,392.5	57,830.7

TABLE 9. FACILITY BUILDING STOCK CHANGES AT HUNTER AAF (FY83-FY85)

FY	*	Building Type	Change (SF)	Building Energy Use (Btu/SF)	(MBtu)
83	N	Barracks	47,810	37,902	1,812
84	N	TAC Equip shop	46,886	51,983	2,437
	N	TAC Equip shop	10,347	142,155	1,471
	N	CO Admin/Supply	14,490	79,831	1,157
	N	BN Hqs and Clrsm	12,330	146,508	1,806
85	N	Para Dry Tower	1,020	55,952	57
	D	Parachute Shop	-2,640	55,952	-148
		TOTAL	130,243		8,593

* N = New construction, D = Demolished

SOURCE: MCA construction plans; Energy use based upon comparable existing biulding use (App. E)

TABLE 10. ENERGY CONSERVATION PROJECTS EVALUATED AT HUNTER AAF - INC. F

NO.	PROJECT	PROJECT COST	ENERGY (MBtu)	SIR	LABOR (MAN-HRS)	FUEL TYPE	ANN. COST SAVINGS	STATUS	SIMPLE BACK YR
1	Reduce DHW temperatures	$636	1,581	189.0	28	ELEC & NG & Oil	$9,727	Post funded	.1
2	Insulation of piping	$928	183	18.4	11	NG	$756	Post funded	1.2
3	Heat recovery from A/C - BOQS	$3,978	773	17.6	32	NG	$3,012	QRIP project	1.3
4	Steam trap and line maintenance	$3,207	536	16.7	20	NG&OIL	$2,956	O & M	1.1
5	Reduce stratification heat loss	$704	84	10.8	48	Oil	$624	Post funded	1.1
6	Shower flow restrictors	$18,912	1,318	9.3	269	ELEC & OIL	$10,190	PECIP project	1.9
7	High efficiency ballasts (each)	$12*	2*	7.0	0*	ELEC	$10*	Replace at Fail	1.2
8	Energy Conserving fluorescent lamps (each)	$1.20*	.15*	5.5**	0*	ELEC	$0.67*	Replace at Fail	1.8
9	Install fluorescent lamps in exit lights	$946	90	5.3**	5	ELEC	$635	Post Funded	1.5
10	Exterior lighting control	$1,885	173	3.8	17	ELEC	$632	Post funded	3.0
11	Reduce infiltration - barracks & shop	$3,680	171	3.4	125	NG	$442	O & M	8.3
12	High efficiency motors (each)	$233*	20*	2.9	0*	ELEC	$74*	Replace at Fail	13.4
13	Reduce infiltration - family housing	$39,527	872	1.9	950	NG	$3,092	O & M	12.8
14	Systems controls	$7,618	411	1.8	68	ELEC	$1,504	O & M	5.1
15	Heat Recovery from A/C Barracks #224 & #405	$7,510	110	1.7	62	ELEC & OIL	$604	Post funded	12.4
16	Heat Recovery from A/C NCO Mess #128	$4,405	62	1.6	23	ELEC & OIL	$322	Post funded	13.7
17	Heat recovery from refrigeration (commissary)	$10,887	411	1.1	165	ELEC	$1,078	Post funded	10.1
18	Fluorescent dimmers	$284	8	1.0**	3	ELEC	$58	Post funded	4.9
	TOTAL	$105,107	6,783		1826		$35,632		

* Values not included in table totals
** Non-energy SIR

1 2-40w bulb fixture at 168 hours/week use - replaced at failure
2 168 hours/week operation - replaced at failure
3 values for 25 hp motor at 50 hours/week use - replaced at failure

9. RESULTS OF INCREMENT G - MAINTENANCE, REPAIR, AND MINOR PROJECT FOR ENERGY CONSERVATION

The scope of work for Increment G was to identify cost-effective energy saving projects which do not qualify for ECIP funding. Increment G work was performed in conjunction with Increments A and B. The recommended projects are listed in Table 5.

10. ENERGY PLAN

A summary of the impact of JRB recommended energy conservation projects and future Post actions on annual energy use is presented in Table 6. As can be seen in this table, from 1975 to 1983, Hunter AAF increased its energy use 47 percent. Square footage increased 7 percent from 1975 to 1983. By the close of 1985, building space is expected to reach 3.04 million square feet--an 11.7 percent increase over 1975. Without the implementation of EEAP projects, energy use on the Post is projected to rise 49 percent above 1975 levels. Implementation of all EEAP projects would hold the FY 1985 energy use to 7.5 percent above 1975 levels. Energy savings attributable to recommended projects are estimated to be 167.5 billion Btu. This increase in energy use without an increase in conditioned space is due to the low activity level in 1975 as compared to 1984. In 1975 the Post population was less than 1,500 personnel. The current population is more than 13,000.

When comparing energy use at Hunter AAF on a building square foot basis, the projected reduction from FY 1975 to FY 85 is 4 percent.

11. RESULTS AND RECOMMENDATIONS

The increased mission at Hunter AAF has resulted in an increase in utility consumption and the outlook for major savings is not favorable. However, the Post has several promising areas where energy conservation may be applied. These areas are:

- First, the EMCS ECIP project will provide opportunities for major energy conservation actions on Post. This project should be actively pursued including training and upgrading of operating and maintenance personnel; and

- Second, the Post is located in a metropolitan area and offers the possibility of renewable energy financed by a third party. This should be a long-term objective for the Post to further reduce non-renewable energy requirements.