ENERGY ENGINEERING ANALYSIS PROGRAM

DEPARTMENT OF THE ARMY
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ENERGY ENGINEERING ANALYSIS

FORT DEVENS
SENECA ARMY DEPOT
LETTERKENNY ARMY DEPOT

CONTRACT NO. DACA65-80-C-0003

EXECUTIVE SUMMARY

SENECA ARMY DEPOT
NEW YORK

ORIGINAL ISSUE FEBRUARY 1982
REVISED SEPTEMBER 1983
FINAL SUBMITTAL PRINTING NOVEMBER 1983

Reynolds, Smith and Hills
Architects-Engineers-Planners,
Incorporated

FINAL SUBMITTAL

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Original Issue (2/82)
Revisions (9/83)

In February 1980, the Norfolk District Corps of Engineers initiated Contract No. DACA65-80-C-0003 with Reynolds, Smith and Hills of Jacksonville, Florida. This contract called for the performance of Energy Engineering Analysis Programs of three U.S. Army installations: Fort Devens, Massachusetts; Letterkenny Army Depot, Pennsylvania; and Seneca Army Depot, New York. The objective of these Programs was the identification, evaluation, and development of programming documents for energy conservation projects which meet the criteria of the Army's Energy Conservation Investment Program (ECIP).

At Seneca Army Depot (SEAD) the initial work under this contract called for the following studies:

1. Increment A - Energy Conservation Investigations for Buildings and Processes
2. Increment B - Energy Conservation Investigations for Utilities and Energy Distribution Systems

This contract was performed in three phases. The first phase consisted of site surveys to inspect the major energy consuming buildings and systems, and collect data required for the identification and evaluation of potential ECIP projects. The detailed evaluation of the potential projects took place in the second phase and the development of the necessary documents in the third phase.

Since the original contract issue, several additional investigations were funded. In August 1980, the contract was expanded to include investigation of central boiler plant projects (Increment E). In May 1981, the contract was expanded to include development of projects identified in Increments A and B that did not qualify under ECIP criteria (Increment G). The original issue of the Executive Summary (Feburary 1982) summarized the above investigations and was included on pages 1 through 22 of this document.

In September 1982, the contract was extended to include investigation of Facilities Engineer conservation measures (Increment F) while in February 1983, the contract was extended to include investigation of renewable energy projects (Increment C). The revised Executive Summary (September 1983) summarizes the results of Increments F and C starting on page 23 of this Document. In addition, the discussion on fuel consumption and cost (pages 2 through 11) were updated with current information when available.

BASELINE DATA

1. Description of the Installation

Seneca Army Depot (SEAD) is a distribution/storage facility for general supply items, ammunitions, critical materials and engineering equipment. It occupies a site that lies on relatively flat land midway between Seneca and Cayuga Lakes, the approximate center of Seneca County and near the geographical center of New York State. The nearest city is Geneva, located approximately 15 miles north of the installation. SEAD abuts the village of Romulus.

SEAD is essentially broken down into two major areas separated by approximately six miles. The administrative area or south base consists primarily of administrative buildings, maintenance shops, warehouses, and family housing units. The troop area or north base consists primarily of a high security, special weapons area called the Q Area and troop billeting with related support facilities such as commissary, PX, theater, library, mess hall, gymnasium, etc. In addition to these two major areas of activity, there is a family housing area on Seneca Lake, an airfield, and a munitions storage area. SEAD's total civilian and military population is approximately 1,900.

2. Energy Consumption

Primary energy sources for building use at SEAD are electricity and fuel oil. No. 2 and No. 6 fuel oils are used at SEAD with No. 6 being used in the three central heating plants and No. 2 being used in all the other boilers or furnaces.

Over the period of 1975 through 1979, the consumption of electricity at SEAD has increased steadily. FY 80-81 showed slight decreases with an increase again in FY 82. The consumption of fuel oil changed very

little over the same period with the FY 79 consumption less than 1% higher than the FY 75 consumption (See Figure No. 1). However, FY 81 and FY 82 showed significant decreases.

The cost of these energy sources has risen steadily from FY 75, even with reductions in use. The annual expenditure for electricity in FY 82 was 275% that of FY 75. The annual expenditure for fuel oil in FY 82 was 291% that of FY 75. (See Figure No. 2).

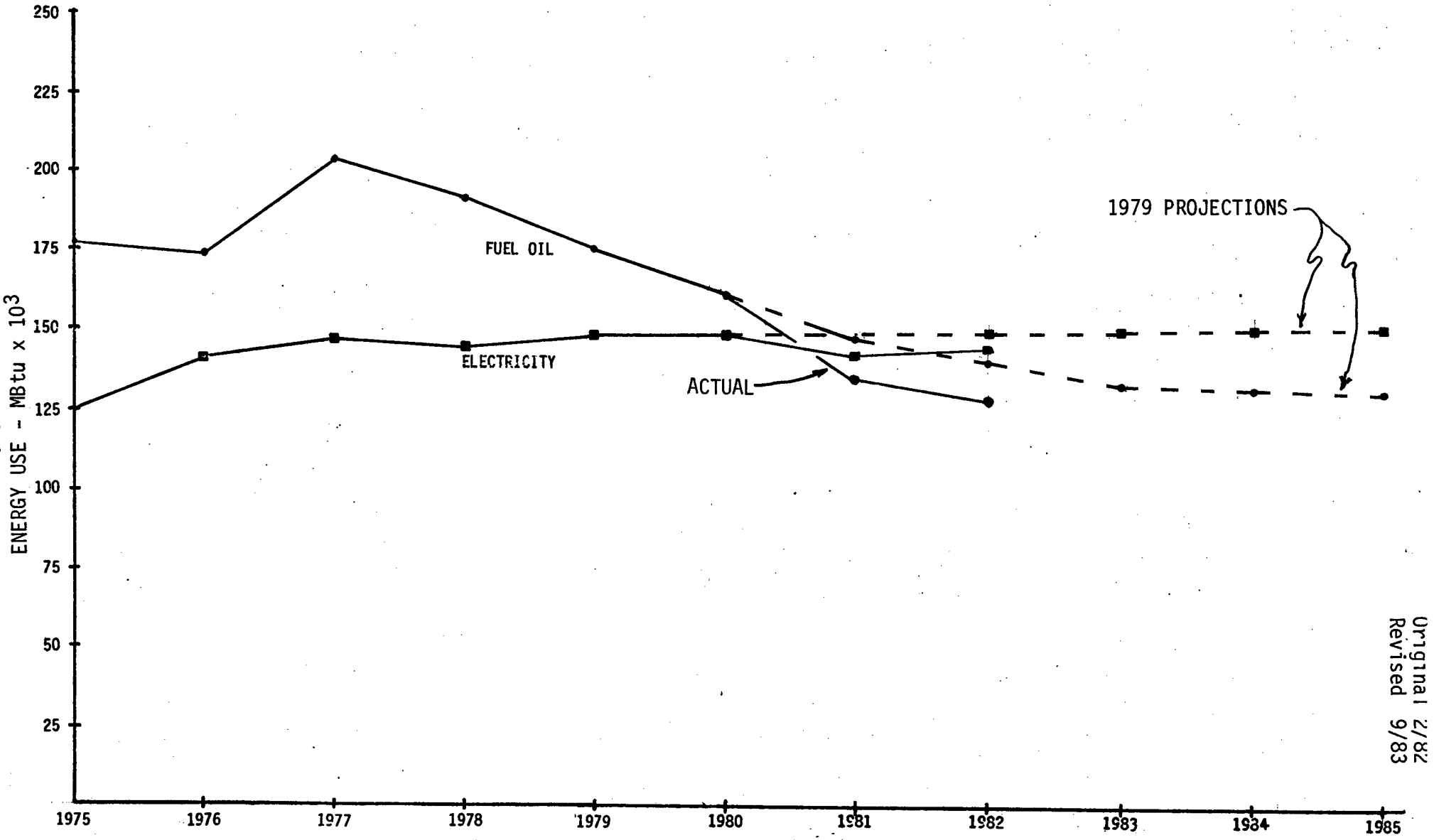
2.1 Electricity

Electricity for SEAD is supplied by New York State Electric and Gas Corporation. SEAD currently pays approximately $.03143 per kilowatt-hour ($2.94 per MBtu) for energy plus fuel adjustment and $4.11 per kilowatt for demand. This results in an average electric cost of $.0473 per kilowatt-hour ($4.08 per MBtu).

The consumption and demand for electricity at SEAD is highest during the heating season. The base electrical consumption which occurs during the non-heating/non-cooling months is approximately one million kilowatt hours a month (See Figure No. 3). This base load is primarily lighting, cooking, laundry, refrigeration, warehouse dehumidification, and shop related activities. The additional electrical consumption during the heating season is primarily from the motor driven auxiliaries, i.e., pumps, fans, for the heating systems.

2.2 Fuel Oil

Fuel oil for SEAD is supplied by various different contractors. The present cost of fuel oil at SEAD is approximately $1.21 per gallon for No. 2 fuel oil ($8.64 per MBtu) and $0.91 per gallon for No. 6



ES-4

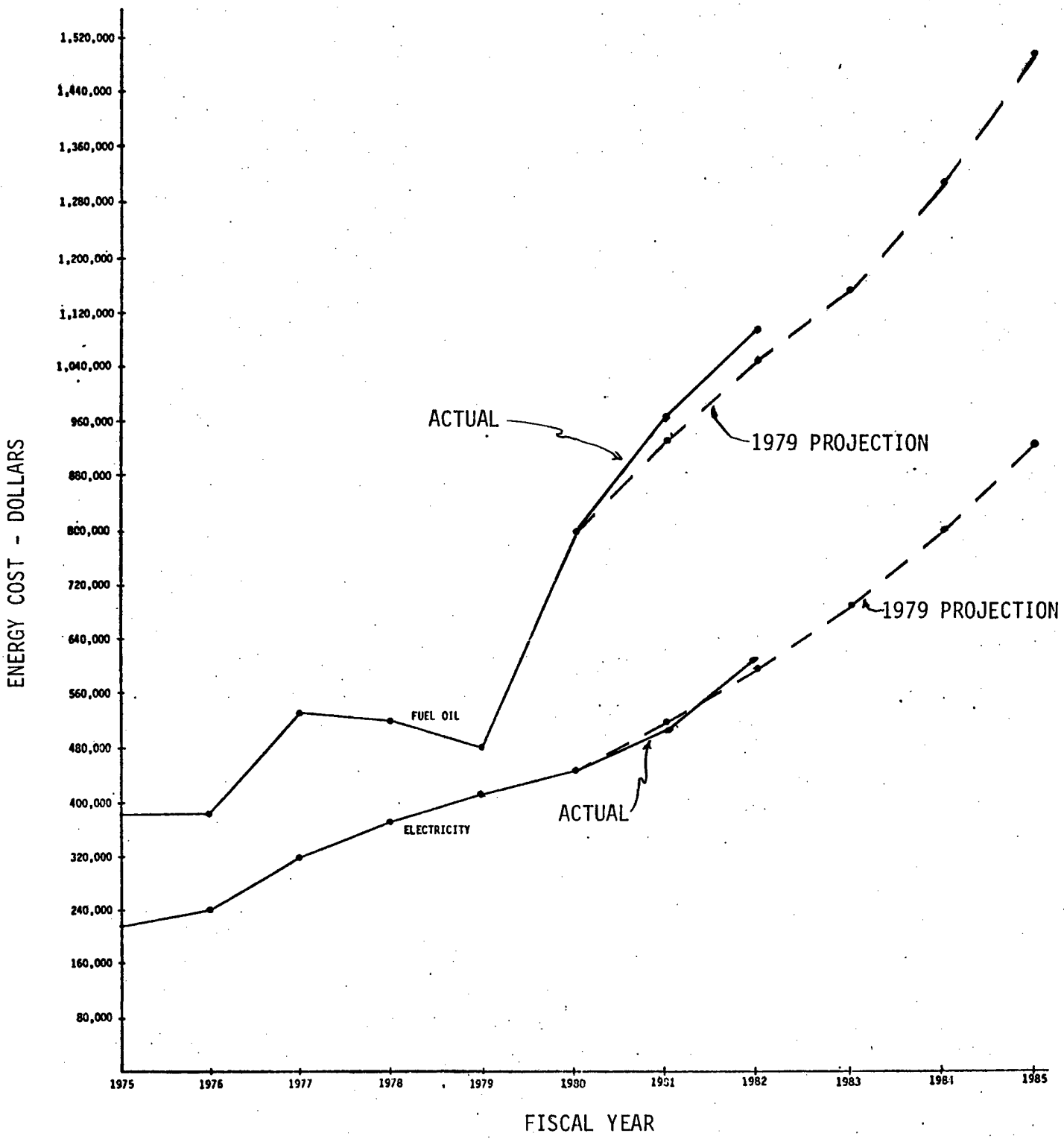
Original 2/82
Revised 9/83

SENECA ARMY DEPOT

ANNUAL ENERGY CONSUMPTION

FIGURE NO. 1

Original 2/82
Revised 9/83



SENECA ARMY DEPOT

ANNUAL ENERGY COSTS

FIGURE NO. 2

Original 2/82
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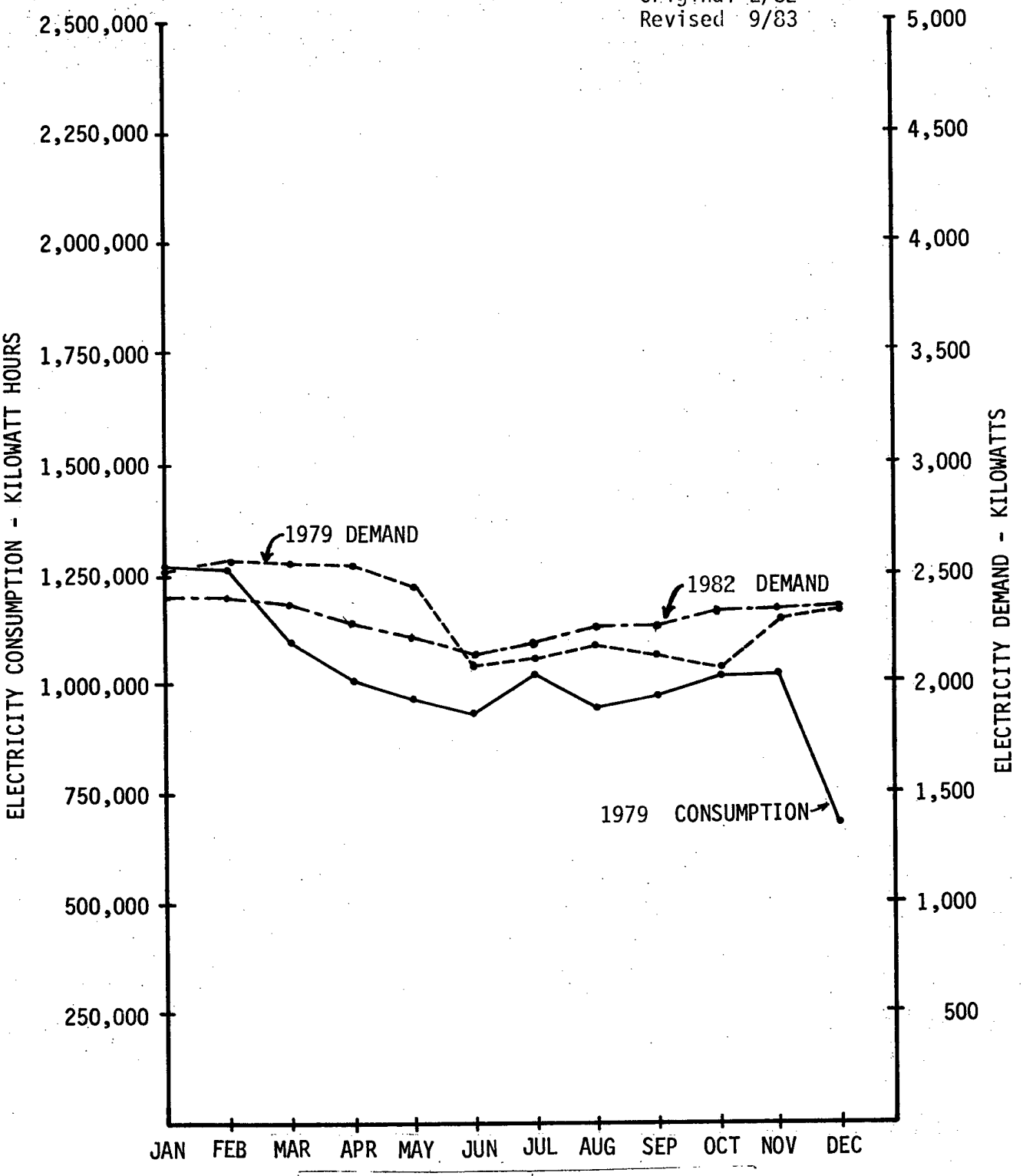

SENECA ARMY DEPOT

MONTHLY ELECTRIC

CONSUMPTION AND DEMAND

FIGURE NO. 3

fuel oil ($6.07/MBtu).

There are three central heating plants at SEAD which account for all the No. 6 fuel oil use. The largest plant, Building No. 718, serves almost the entire north base excluding the Q Area and accounts for about 51% of the total No. 6 fuel oil usage. The next largest building, No. 319, serves the maintenance and warehouse area of the south base and accounts for about 34% of the No. 6 usage. The third plant, Building No. 121, serves many of the buildings in the administrative area of the south base and accounts for the remaining 15% (See Figure No. 4). Overall consumption of No. 6 fuel oil has decreased significantly in all 3 buildings (Figure 5).

No. 2 fuel oil is used in all the buildings not supplied by the central heating plants. This consists primarily of the two family housing areas and the Q Area. These three areas account for over 57% of the total No. 2 fuel oil use at SEAD (See Figure No. 6).

These three areas combined with the three central heating plants account for almost 82% of the combined total fuel oil use at SEAD (See Figure 7).

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Total Consumption - 606,668 Gallons*

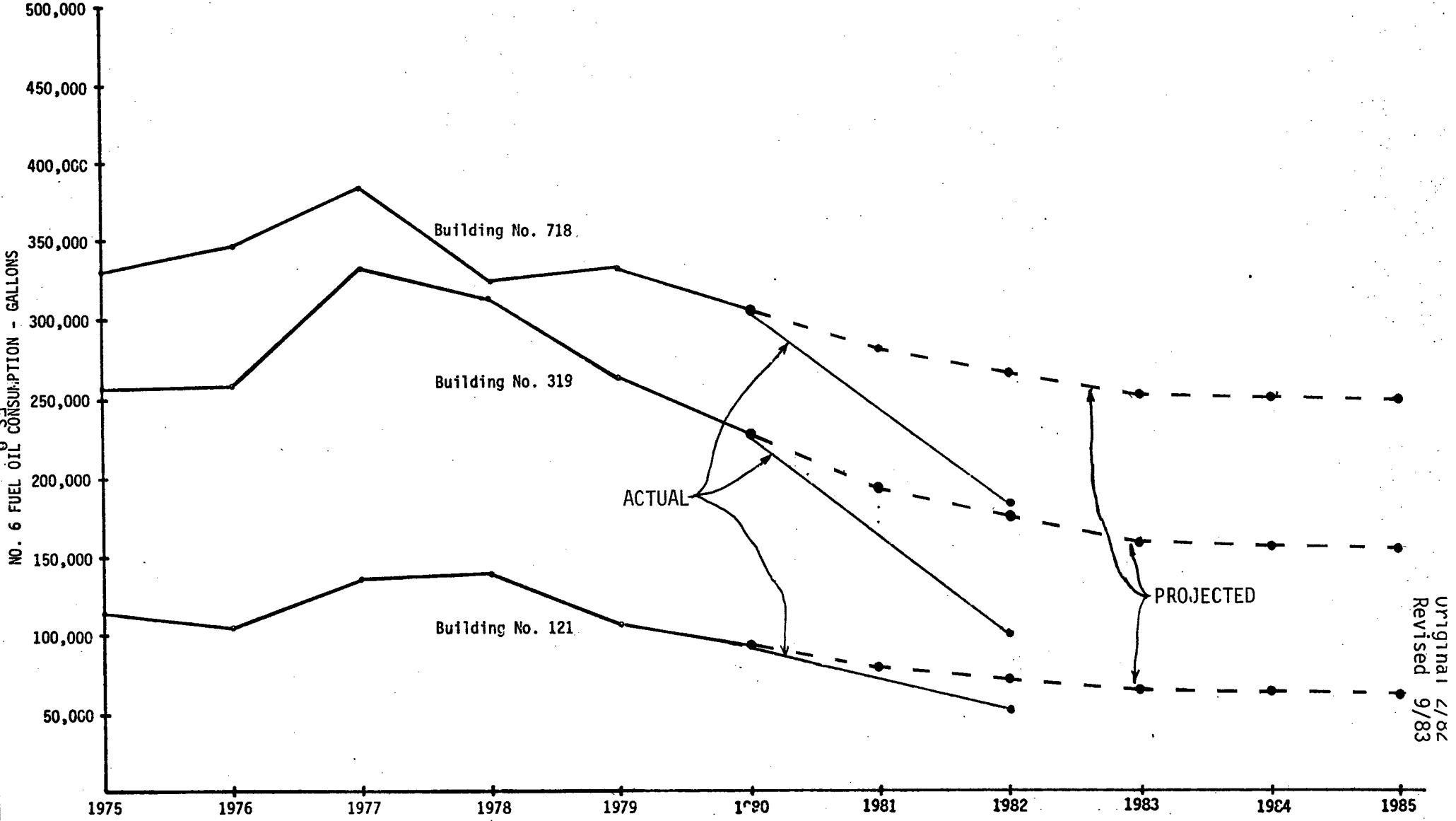
SENECA ARMY DEPOT

NO. 6 FUEL OIL USE

DISTRIBUTION - FY 80

FIGURE NO. 4

*FY 82 Consumption approximately 373,500 gallons



SENECA ARMY DEPOT

OIL CONSUMPTION - CENTRAL HEATING PLANTS

FIGURE NO. 5

Original 2/82
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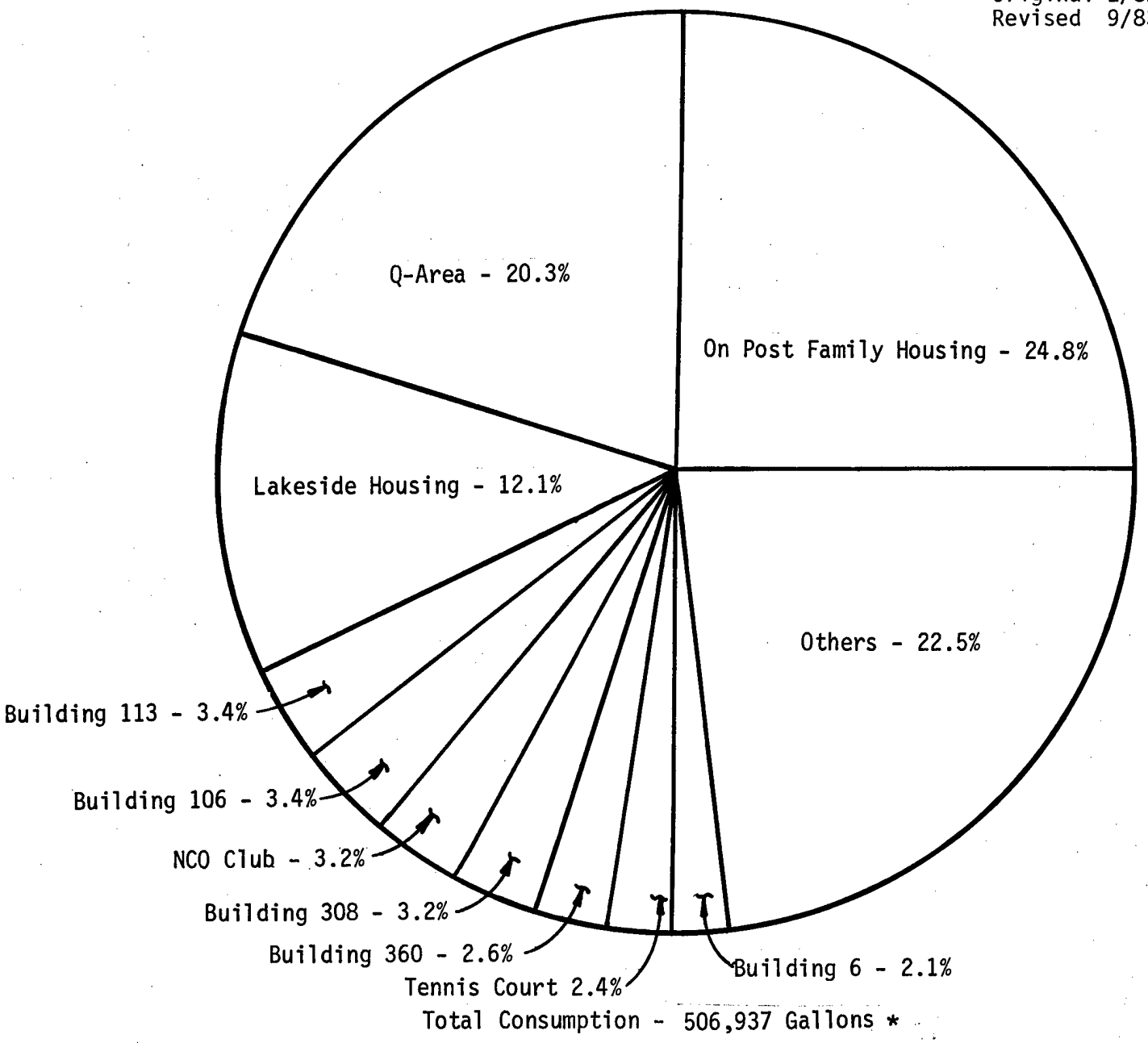


SENECA ARMY DEPOT

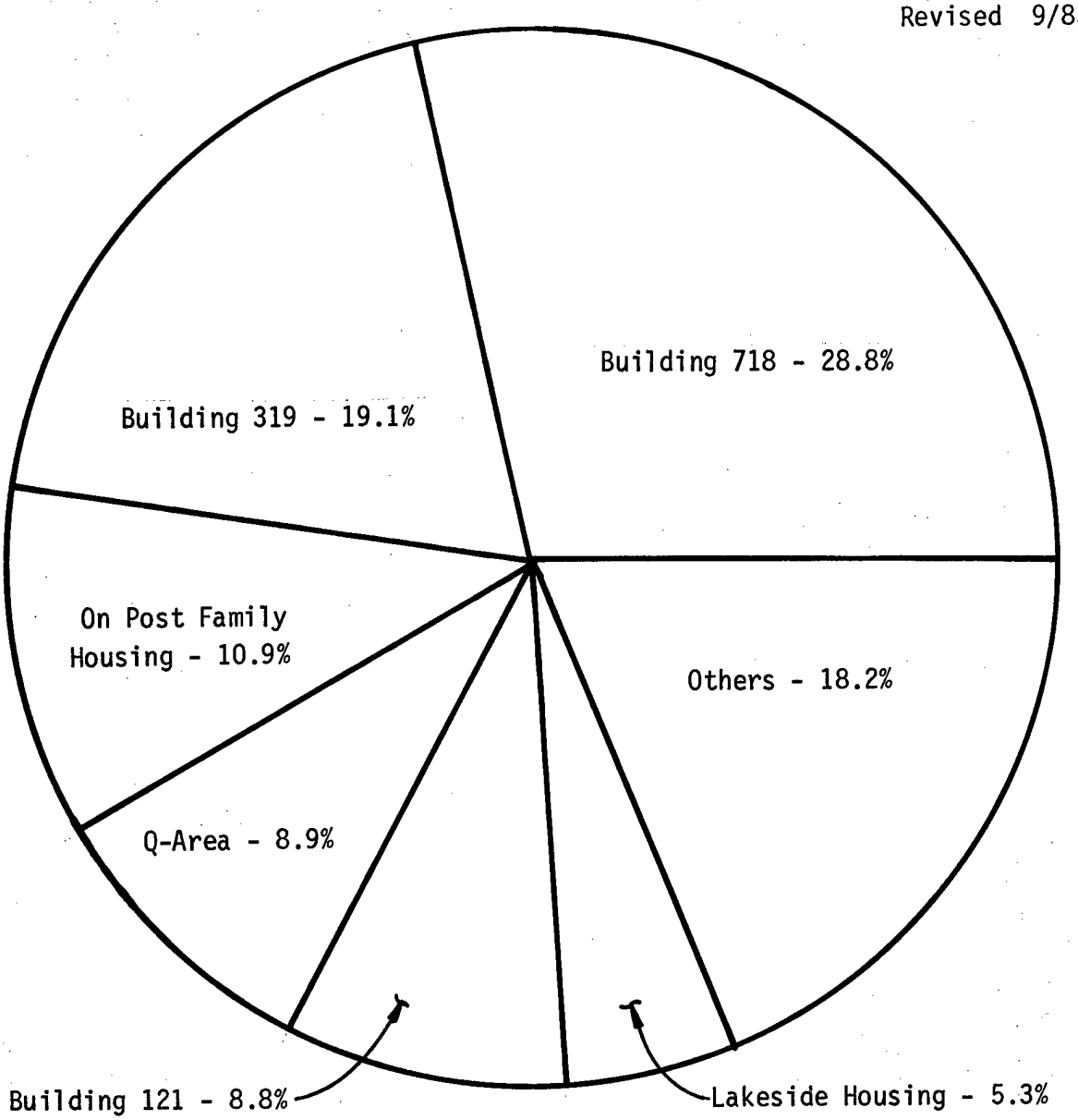
NO. 2 FUEL OIL USE

DISTRIBUTION - FY 80

FIGURE NO. 6

*FY 82 Consumption approximately 485,000 gallons

Original 2/82
Revised 9/83



TOTAL CONSUMPTION - 160,731* Million Btu

SENECA ARMY DEPOT
TOTAL FUEL OIL USE
DISTRIBUTION - FY 80

FIGURE NO. 7

* FY 82 consumption approximately 123,800 Million Btu

STUDY RESULTS

1. Field Surveys

Field surveys were conducted of the major buildings or groups of buildings included in the scope of work. The purpose of these surveys was to obtain data relative to the buildings' construction, occupancy, functional use, energy consumption, completed or programmed energy conservation or other modifications, and energy consuming equipment and systems. This data was then used to identify candidate ECIP projects and potential operating and maintenance improvements.

2. ECIP Projects

2.1 EMCS

After surveying the buildings at SEAD and analyzing the data collected, it became readily apparent that the most effective method of reducing fuel consumption at SEAD would be to provide a means of maintaining the buildings at their authorized temperatures during working hours and setting the temperature back during unoccupied hours.

For the most part, the existing heating system controls do not provide adequate control of the space temperature in the area they are supposed to be controlling. Many buildings had thermostats set

at 65 or 68° F but the actual space temperature was considerably higher. Other buildings had thermostats set higher because the occupants indicated that some areas of the building were always several degrees colder than the area near the thermostat. Thus, even though energy conscious authorized temperatures have been established for the buildings at SEAD, in most cases they cannot be properly maintained with the existing temperature controls.

In addition to preventing many of the buildings from being maintained at their authorized temperatures during occupied hours, the present heating system controls make it difficult to effectively setback the building temperatures during unoccupied hours. As such, only a few buildings are presently setback during unoccupied hours and most of these are done manually and only 5 to 10 degrees. When you consider that, with the exception of family housing and the barracks,* almost every other building at SEAD has limited hours of use, the potential for energy savings by significantly reducing the temperature of these buildings during unoccupied hours is substantial. The list of potential candidates includes every building served by Central Heating Plants 121 and 319, and the Q Area buildings. All of the buildings in these three areas are basically only used Monday to Friday from 0730 to 1600. Many of the buildings served by Central Heating Plant No. 718 are candidates as well, although their hours of use are more varied.

In view of the above, major emphasis and effort was placed on the development and analysis of a project which would first modify the building temperature control systems as required to allow accurate control ability; second, provide remote monitoring and control of the building temperatures to ensure that the authorized temperatures were not being exceeded during occupied periods; and, third; to provide automatic temperature setback during unoccupied periods. The result was a project which is essentially an EMCS together with the necessary building heating system modifications. The project will require a capital investment of $ 293,000 , an annual expenditure

*Barracks already have local temperature setback controls.

of $106,278 for operating and maintenance labor and materials, and will provide annual energy savings of 8,226 MBtu of No. 2 oil and 30,528 MBtu of No. 6 oil. This represents a 12% reduction in current consumption of No. 2 fuel oil and a 33% reduction in current consumption of No. 6 fuel oil.

2.2 Building Shell Modifications

Numerous buildings at SEAD have already had shell modifications made to reduce heat loss/heat gain. Insulation has been added in walls and ceilings, window areas have been reduced, and storm windows have been installed on many buildings with more of the same type of work programmed or underway.

Other potential building shell projects not yet considered by SEAD personnel were identified and evaluated as part of this study. The results of this evaluation indicate that if the EMCS project is implemented, the additional energy which would be saved by insulation or other shell modifications is not enough to produce acceptable E/C ratios. Thus, no qualifying ECIP projects for building shell modifications were identified.

2.3 Electrical

The electrical load at SEAD is widely dispersed. As such, the opportunity for a single large ($100,000 or more) project which will significantly reduce electrical consumption is limited. Two such projects were identified and evaluated.

The first, replacement of existing street lighting with high pressure sodium lighting, had initially been developed and submitted by SEAD personnel. The project had been rejected for funding. A re-evaluation was performed as part of this study in order to determine if the proposed project could be improved sufficiently to qualify as an ECIP. The re-evaluation concluded that the street lighting replacement would not qualify.

The other potential ECIP project to reduce electrical consumption was the addition of a vapor barrier to the dehumidified warehouses. This vapor barrier would reduce moisture infiltration through the walls, thereby reducing the load on the electrically regenerated desiccant dehumidifiers. The cost of the vapor barriers was determined to be $429,034 and they will produce an annual energy savings of 13,322 MBtu. This represents a 9 percent reduction in the present annual electrical consumption for SEAD.

Miscellaneous lighting replacement projects were investigated on a first cut basis. The details of the investigation are presented after the Non-Qualifying Projects, as the results indicate that the projects are not economically viable. The projects were analyzed individually but the results shown in the project summary are approximate combined values.

2.4 Alternate Energy Sources

The evaluation of several alternate sources of energy was performed under Increment B of this study.

The first alternate fuel considered was natural gas because SEAD is located on sedimentary rock formations which have natural gas production potential. Several producing wells are in operation in the area. To determine the feasibility of obtaining natural gas from wells drilled on the SEAD property, a local Consulting Geologist was retained. His report indicated that producing sufficient natural gas from on-site wells to fuel a central heating plant was not practical. A natural gas well to supply fuel to an individual building also was considered but was not found to be sufficiently attractive enough to warrant a speculative investment. Natural gas from wells at SEAD is therefore not a viable alternate source of energy.

Solid waste also was evaluated as a potential alternate source of energy. A modular incinerator equipped with a heat recovery boiler and sized for the on-Post generated solid waste was found to be

unattractive. The major impediment to such a project is the lack of a sufficiently high year-round demand for steam. As such, the energy available from the solid waste can only be utilized during part of the year. Thus, the fuel oil savings accrue over only part of each year and it takes too many years to recover the initial capital investment.

The Study Team was requested to look into waste oils as a possible boiler fuel. The results of a preliminary investigation indicate that waste oils cannot be recommended as an alternate energy source for the following reasons:

1. The long-term effect on the boiler from the various additives and other components of these oils is unknown, and

2. There is an increasing trend toward recovering and recycling these waste oils. Reclamation centers are being opened all over the country. The market for these waste oils will therefore be highly competitive and it is doubtful that a long-term, economical supply of these waste oils could be secured.

The evaluation of coal-fired central plants, including supplemental firing of wood was investigated. The evaluation of coal-fired central plants, including supplemental firing of wood, was investigated under Increment E of this study. The results indicate that there is no clear-cut economic advantage to burning coal in a centralized boiler plant over continuing with petroleum-based methods at existing local boiler plants. This conclusion was reached by comparing life cycle costs of four alternatives against the "base" (existing petroleum) method.

Since SEAD is divided into two geographic areas (North and South Base), four central plant concepts for each area were developed. In addition,

the life cycle costs were predicted under the different assumptions of a 25 versus 40 year escalation rate.

2.5 Family Housing

Family Housing accounts for 36.9 percent of all No. 2 oil consumption. Normally, a large family housing area represents an ideal opportunity for ECIP projects because of the numbers and similarities of units. At SEAD most of the good candidate energy conservation projects have already been implemented or have been programmed by Facilities Engineering. As such, no additional work was investigated as part of this study.

2.6 Central Heating Plants

As is the case with family housing, Facilities Engineering at SEAD has already implemented or programmed the most attractive central heating plant ECIP projects. This includes the installation of air-atomized burners in place of the mechanical atomized burners on the boilers in Building No. 718, and the replacement of the condensate return piping and repair of the steam pipe insulation for Building Nos. 718 and 121.

Central Heating Plant No. 319 has a unique situation in that it has a new boiler which is considerably oversized for present loads and will be even more oversized as other programmed or proposed energy conservation projects are implemented on the buildings supplied by No. 319. As such, the boiler can only be operated during the coldest weather and then only at partial loads. In order to alleviate this condition, SEAD can either downsize the burner in the existing boiler to match the boiler capacity to actual demand, or a new, properly sized boiler can be purchased. The clear

economic choice is to downsize the burner in the existing boiler.

3. Summary of ECIP Projects

The number of potential ECIP projects for SEAD is limited by the work already implemented or programmed by Facilities Engineering and by the limited hours of use for all but the living quarters. This limited use provides excellent conditions for the implementation of temperature controls via an EMCS, but once these controls are implemented, other measures cannot be justified. Thus, the number of ECIP projects (Increments A and B) in the following summary table of projects recommended for Increments A, B & G is very small compared to the similar tables for other Army installations studied as part of this contract. However, the qualifying ECIP projects will produce the following reductions in the current energy consumption levels at SEAD:

No. 2 Fuel Oil	-	12 Percent
No. 6 Fuel Oil	-	33 Percent
Electricity	-	9 Percent

It should be noted that the above savings represents an 11 percent reduction from FY-75 energy consumption.

4. Increment E - Central Coal-Fired Heating Plants

Increment E of the study for Seneca Army Depot covers the feasibility and most practical method of constructing a coal-fired central boiler plant at SEAD. Several plant design options were considered. For these designs, different available fuels were also investigated.

The results of the study indicate the feasibility of implementing a new central coal-fired steam plant with boilers designed to accommodate the possible future use of supplemental fuels.

For further details see Increment E - Feasibility Study: Central Coal-Fired Heating Plants

5. Increment G - Projects Identified in Increments A & B That do not Meet ECIP Criteria

Identification of Increment G projects were accomplished during Phase I and II of Increments A and B. These projects are energy saving projects that do not qualify under ECIP criteria. There are 11 of the projects which are combined with those from Increments A and B and summarized in the table called Project Summary, Increments A, B, and G.

The recommended projects represent an investment of $446,961 with an estimated annual savings of 6233 MBtu.

SENECA ARMY DEPOT
PROJECT SUMMARY
INCREMENTS A, B, & G
FINAL SUBMITTAL

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)
QUALIFYING/RECOMMENDED PROJECTS:								
G-A		Plastic Door Curtains for Bldg. No. 723	1,256	10.9	276.5	.4	347	2,889
A/B-B		Installation of Energy Monitoring and Control System *	293,000	9.4	132.2	2.0	38,754	143,056
G-K		Equipment Modifications-Central Heating Plant-Bldg. 319	2,677	1.8	44.5	8.4	119	320
A/B-A		Vapor Barrier for Dehumidified Warehouses	429,034	2.3	31.1	9.5	13,322	35,070
G-L		Equipment Modifications-Central Heating Plant-Bldg. 718	19,873	2.8	26.0	8.3	516	2,339
G-B		Building Shell Insulation Bldg. No. 720	38,800	4.3	21.7	5.5	843	7,015
G-C		Insulate Roof of Fire Control Rooms Bldg. No.s 357 & 358	710	1.6	14.2	13.4	10	53
G-D		Lighting System Modifications Bldg. No. 116	5,032	1.8	10.6	8.8	53	575
G-E		Building Shell Insulation 100-Series Bldgs	116,430	2.4	10.3	9.7	1,198	11,987
G-F		Building Shell Insulation Bldg. No. 707	86,765	1.9	9.9	12.2	855	7,116

* Some Increment F projects are contained in these numbers.

QUALIFYING/RECOMMENDED PROJECTS, CONT'D.

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)
	G-G	Building Shell Insulation 320-Series Bldgs	184,095	1.8	9.3	12.9	1,712	14,243
	G-H	Building Shell Insulation 800-Series Bldgs	57,680	1.9	6.7	12.7	390	4,535
	G-I	Elimination of Steam Reheat in 800-Series Bldgs.	33,643	1.8	5.6	13.3	190	2,522
SUBTOTALS:			1,268,995	-	-	-	58,309	241,720

SENECA ARMY DEPOT - INCREMENTS A & B
NON-QUALIFYING PROJECTS:

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)
A/B-C		Installation of Natural Gas Wells	210,739	2.14	11.4	9.6	2,400	22,053
A/B-D		Building Shell Insulation *	212,300	1.21	9.8	19.7	2,075	10,790
A/B-E		Street Lighting Modification	78,662	0.75	8.24	17.2	648	4,565
A/B-F		Heat Recovery Incineration	1,073,851	0.023	2.77	--	2,972	(16,884)
A/B-G		Miscellaneous Lighting Replacements	100,000	0.5	8.0	--	850	2,000
SUBTOTALS:			1,675,552	-	-	-	8,945	22,524

SENECA ARMY DEPOT - INCREMENT G
NON-QUALIFYING PROJECTS:

G-J		Exhaust Heat Recovery - Bldg. No. 813 Paint Booth	78,017	.7	3.8	22.8	294	3,417
G-N		Building Shell Insulation Bldg. No. 812 (Guard House)	30,913	.82	2.8	30.6	86.8	1,007
G-M		Equipment Modifications-Central Heating Plant - Bldg No. 121	22,623	.35	2.57	471	56.3	48
SUBTOTALS:			131,553	-	-	-	437	4,472
TOTALS ALL PROJECTS:			3,076,100	-	-	-	67691	668,716

*Some Increment G Qualifying Projects are contained in these numbers.

6. INCREMENT F - FACILITIES ENGINEER CONSERVATION MEASURES

This phase of work provided for: (A) The development of recommendations for modifications and changes in system operation which are within the Facilities Engineer Funding Authority and Management Control, (B) The development of a prioritized summary of these energy conservation measures and projects, (C) The identification of energy related areas where Facilities Engineering personnel training is required and (D) The listing of energy related proposed changes in SEAD's Master Plan.

Twenty-five modifications/changes in system operation were investigated and the results of these investigations are shown in a table called Project Summary, Increment F. Projects are prioritized by their SIR and grouped into the two categories of qualifying and non-qualifying. Qualifying projects are those which have an SIR greater than 1.0. Non-qualifying projects have an SIR less than 1.0. The SIR is based on a life which does not exceed the proposed equipment life, the facility's life, or 15 years, whichever is least.

Eight courses for energy related training were identified and are listed in a table called Training Opportunities. The table lists the course type, cost and duration.

Two energy related changes in SEAD's Master Plan were identified. The first is the conversion of a general service warehouse to a dehumidified storage warehouse. This change is expected to increase base electrical consumption by 384 MBtus per year. The second proposed change is the conversion of the area between buildings 123 and 124 into office space. This change is exepected to increase base No. 6 oil consumption by 112 MBtus per year. The net effect of all these changes will be an increase in base consumption by 496 MBtu per year.

SENECA ARMY DEPOT
PROJECT SUMMARY

INCREMENT F

Incrmt./Proj. No.	Project Description	Investment ($ 82)	SIR	Payback Period (Yrs.)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($ 82)
QUALIFYING PROJECTS						
F-A	Automatic Night * Temperature Set-back, Bldgs. 316 and 318	47,376	9.3	1.4	5682	34,473
F-B	Automatic Night * Temperature Set-back, BLdgs. 320, 321 and 323	72,235	6.9	1.8	6624	40,188
F-C	Automatic Night * Temperature Set-back, Bldg. 317	31,875	6.8	1.9	2841	17,236
F-6.1	High Efficiency Shower Heads	12,641	6.3	1.7	1772	7,487
F-D	Automatic Night * Temperature Set-back, Bldgs. 117, 118, 120, 124 and 127	66,924	5.8	2.0	5454	33,089
F-E	Automatic Night * Temperature Set-back, Bldgs. 719, 722, 723 & 724	59,697	5.5	2.1	4626	28,066
F-P	Pony Boilers, 700-Series Bldgs.	42,376	4.8	1.1	2495	46,264
F-G	Exhaust Heat Re-covery from Kit-chen Hood, Bldg. 707	86,559	4.4	3.3	4071	26,638
F-F	Automatic Night * Temperature Set-back, Bldgs. 113, 114 and 116	29,855	3.9	2.1	1611	13,924

SENECA ARMY DEPOT, PROJECT SUMMARY
INCREMENT F, CONTINUED

Incrmt./Proj. No.	Project Description	Investment ($ 82)	SIR	Payback Period (Yrs.)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($ 82)
QUALIFYING PROJECTS, CONT'D.						
F-6.2	High Efficiency Motors	10,962	3.9	2.6	1030	4,200
F-8.1	Water Heater Insulation	4,739	3.0	3.4	339	1,384
F-H	Automatic Night * Temperature Set-back, Bldgs. 115 and 122	38,279	2.9	3.7	1728	10,484
F-8.2	Steam Pipe Insulation	566	2.8	5.1	18	112
F-6.3	High Efficiency Flourescent Lights	9,986	2.5	1.9	1298	5,293
F-J	Reduce Window Heat Loss, Bldgs. 115, 701, 702-First Floor	7,529	1.9	6.4	194	1,177
F-O	Freezer Heat Recovery, Bldg. 707	12,741	1.7	8.3	252	1,531
F-K	Reduce Window Heat Loss, Bldg. 702-Second Floor	20,859	1.7	8.3	410	2,490
F-I	Automatic Night * Temperature Set-back, Bldgs. 706, 710 and 732	23,104	1.5	4.5	846	5,133

SENECA ARMY DEPOT, PROJECT SUMMARY
INCREMENT F, CONTINUED

Incrmt. / Proj. No.	Project Description	Investment ($ 82)	SIR	Payback Period (Yrs.)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($ 82)
QUALIFYING PROJECTS, CONT'D.						
F-M	Reduce Window Heat Loss, Bldg. 708	64,307	1.4	10.0	1058	6,418
F-L	Reduce Window Heat Loss, Bldg. 704	66,582	1.4	10.3	1069	6,484
F-6.4	High efficiency flourescent lights and ballasts	30,992	1.3	3.6	2091	8,527
F-8.3	Plastic Door Curtains, Bldgs. 114, 316, 317, 318, and 321	77,171	1.1	12.2	1047	6,349
SUBTOTALS:		817,355	-	-	46,556	306,947
NON-QUALIFYING PROJECTS						
F-8.4	Building Shell Modifications - Family Housing	2,016,000	0.2	62.8	3715	32,112
F-8.5	Water System * Modifications	2,016,000	0.1	157	3149	12,842
F-N	Hot Water Heat Pumps in Family Housing, 200-Series	186,000	0.0	60	2060	3,600
SUBTOTALS:		4,218,000	-	-	8924	48,554
TOTALS:		5,035,355	-	-	55,480	355,501

TRAINING OPPORTUNITIES

	COURSE DESCRIPTION	DURATION	COST
1.	Energy Conservation Awareness Seminar	4 - 3½ hr. Sessions	Varies Per Post
2.	Energy Conservation For Existing Buildings	40 hrs.	$580
3.	Energy Conservation For New Buildings	40 hrs.	$660
4.	Economic Analysis Of Energy Systems	40 hrs.	$660
5.	Kewanee Boiler Operators School	24 hrs.	$200
6.	Fundamentals of Delta 2000 Operation	20 hrs.	$630
7.	Energy Monitoring and Control Systems Operator Training	40 hrs.	$450
8.	Energy Monitoring and Control System Inspection	40 hrs.	$425

7. INCREMENT C - RENEWABLE ENERGY

Renewable energy sources that were considered include solar, biomass, hydro, tidal, nuclear, geothermal and wind. Each of these sources is discussed below:

Solar - The solar study assesses the feasibility of producing domestic hot water - for three barracks buildings at SEAD, Bldg. 704, Bldg. 708 and the New Barracks. Each has a year-round demand for low temperature (110° F) water. The solar system would not only save energy, but would also allow a central boiler plant in Bldg. 718 to be shut down during the non-heating season.

The solar project saves 3270 MBtu per year and allows reassignment of 1744 man-hours for operating the boiler plant in Bldg. 718 at a cost savings of $25,150 per year. However, the project does not meet ECIP project criteria. In addition, the life cycle cost of utilizing solar energy exceeds the life cycle cost of continuing existing fossil-fuel-based methods, and therefore it is not recommended for SEAD.

Biomass - This investigation assesses biomass fuel's (i.e., wood's) potential to provide space heating, space cooling, domestic hot water or process heat. At SEAD only space heating and domestic hot water production are truly candidates for utilizing biomass fuels because there are essentially no space cooling or process heating loads. The candidate loads are currently met either through steam supplied from central boiler plants or by small individual No. 2 fuel oil furnaces/boilers.

Results indicate that replacing oil-fueled boilers in Bldg. 718 with a wood-fueled steam boiler is economically viable and should save 26610 MBtu per year of No. 6 oil.

Hydro - There are no significant rivers or flowing bodies of water on SEAD, therefore, no hydro energy source is available.

Tide and Wave Propagation - SEAD is in a non-coastal location and, therefore, has no potential tide or wave propagation energy source.

Nuclear - The nationwide moratorium on new nuclear power plants rules out the possibility of nuclear power production at SEAD.

Geothermal - Most U.S. geothermal potential lies in the West and Eastern seaboard. SEAD is located on the edge of an area in which low temperature reservoirs are likely (reference National Geographic, Special Report, February 1981). However, current technology restricts development of geothermal energy sources to those with high heat gradients. There are no such areas at SEAD.

Wind - According to National Oceanic and Atmospheric Administration data, mean monthly wind speeds in the SEAD area range from 8.1 to 11.3 mph. According to "Wind Machines" Frank R. Eldridge, The Mitre Corporation, these velocities are only marginally acceptable for power generation via wind turbines. Also, recent articles on wind power economics ("Power", February, 1983) indicate levelized cost of power at 28 to 48¢/KWH using current available technology. Therefore, additional studies concerning use of wind as an energy source at SEAD is not recommended at this time.