OAKDALE SUPPORT ELEMENT
PITTSBURGH, PENNSYLVANIA

ENERGY ENGINEERING ANALYSIS PROGRAM
EXECUTIVE SUMMARY

PREPARED FOR

U.S. DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT
CORPS OF ENGINEERS
CONTRACT NO. DACA31-81-C-0061

VOL 1 OF 4

APRIL 1982

NUS CORPORATION
A Halliburton Company

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

VOLUME I
EXECUTIVE SUMMARY

OVERALL
TABLE OF CONTENTS

VOLUME 1

VOLUME 2

VOLUME 3

ENERGY ENGINEERING ANALYSIS PROGRAM
PROJECT DEVELOPMENT PLANS (11-19)

VOLUME 4

FIELD DATA SUBMISSION

DETAILED
TABLE OF CONTENTS
Volume 1

DETAILED
TABLE OF CONTENTS (Cont'd)

Volume 1

VOLUME I
EXECUTIVE SUMMARY

1.0 INTRODUCTION

1.1 BACKGROUND

This report presents the Energy Engineering Analysis Program (EEAP) for Oakdale Support Element, Oakdale, Pennsylvania, to identify energy conservation opportunities. The work was initiated in the fall of 1980 when the Army Corps of Engineers, Baltimore District advertised through the Commerce Business Daily for the services of an architectural/engineering firm to conduct an energy conservation study for this Army facility. In the spring of 1981, NUS Corporation was selected to perform this work. Initial field investigation work and data gathering were completed in December 1981. This report includes analyses of the energy patterns at the base, and the identification and evaluation of energy conservation opportunities. As can be observed by the Energy Consumption Graphs included in Part 6 of Volume I, the base uses the greatest energy during the winter heating season, but with a high usage during the entire year. Based on the latest utility figures, the energy cost to the base is approximately $1.128/S.F.-yr.

The most attractive energy conservation opportunities are those with a less than 10 year simple payback period. The results of this study clearly indicate that energy consumption at Oakdale can potentially be reduced by FY1985 if all proposed projects were implemented.

It is not recommended at this time to install a solar heating system due to the high first cost and low demand level of domestic hot water at this base.

1.2 SCOPE OF WORK

The scope of work, as specified in Army Contract No. DACA31-81-C-0061 and copy of general scope of work dated November 5, 1979, reissued May 4, 1981, called for development of plan of projects that will result in the reduction of base energy use without degrading the present standard of living or the present level of services and activities. This study was conducted in three phases: 1) field investigation and data gathering phase; 2) potential energy conservation project development phase; 3) final report and executive summary report phase. Initial data for the study were gathered through numerous visits to the site, during which buildings were inventoried, patterns

of building energy use were identified, and typical buildings and/or family residences were selected for detailed analysis for each building group. building occupancy, functions, and sizes as well as existing building envelope and the main energy consuming systems were also investigated and data recorded, see Field Data Submission - Volume 4.

During the second phase a list of potential energy saving projects was developed based on data gathered from the base during the first phase (including utility bills for the years 1979, 80, and 81). During the final phase most of the projects listed in the second phase were developed, with in-depth analysis, backup calculations, ECIP Analysis, Project Development Brochure (PDB) and Form DD1391 were included. There is no record or previous energy studies for this base. Several energy conservation measures were implemented by the Facility Engineer (FE), however, these measure are mainly operating and maintenance (O&M) types of projects and are mainly electrical in nature, i.e., replacement of light bulbs with more efficient bulbs and installation of electric water heaters in each building for summer operation.

There is no record of FY1975 utility bills to be included in this report as base line statement and since the mission of this base was changed during the spring of FY1975 from a heavy energy consuming facility to a moderate energy consuming (administrative type facility), it was determined that calculated energy consumption for 1975 can not be representative of the time annual energy consumption for this base. The developed energy consumption profiles of the last three years (79, 80, and 81) can be used as base line statement for future comparison.

It should be noted that the energy analyses included in this report are based on averages such as those determined from the existing utitity records, local weather data, occupancy patterns, existing operating and maintenance records, etc. The savings and energy consumption rates predicted and/or calculated are reasonably accurate but in any one year they could differ from the actual results.

2.0 SUMMARY

2.0 SUMMARY

This subsection of the report presents the methodology used in determining the feasibility of energy conservation opportunities that are candidates for implementation at Oakdale. The energy conservation projects as developed in this report can be categorized as follows:

1. Projects for building envelope
2. Projects for building heating and cooling
3. Projects for Central heating plant and steam distribution system
4. Projects for building lighting
5. Miscellaneous and O&M projects

Each of the potential energy conservation projects were analyzed for applicability and the energy savings, the project costs, and the E/C and B/C ratios were subsequently calculated. The projects were then placed into one of the following categories:

- o ECIP projects
- o Operation and Maintenance Projects (will be addressed in subsection 5 of the Executive Summary)
- o Projects disqualified from consideration.

Each of the above project categories is summarized in the following sub-sections. The E/C and B/C ratios, the payback periods, the energy savings, and the project cost or current working estimates (CWE) for individual project were summarized in Table 1 thru 5 of this subsection. Details of these projects (background information, energy savings methodologies, project costs, backup calculations, etc.) are presented in the ECIP projects provided under Volume 2 and 3 of this report. The ECIP projects are those with E/C ratios greater than 13, B/C ratios greater than one, payback periods of less than the project life span, and CWE's (Current Working Estimates) greater than $100,000.

A total of 19 projects have been identified and developed which, when implemented will save a substantial amount of energy. The following is a list of the projects:

1. Projects for building envelope:

Project No.	Title
1	Insulation - Building Group "A"
2	Insulation - Building Group "B"
3	Insulation - Building Group "C"
4	Insulation - Building Group "D"
5	Insulation - Building Group "E"
6	Insulation - Building Group "F"
7	Insulation - Building Group "G"
8	Window Replacement-Neville Island
9	Storm Windows

2. Projects for Building Heating and Cooling:

Project No.	Title
10	VAV Conversion
13	Vent Dampers and Electronic Ignitors for Family Housing
14	Thermostatic Control Valves

3. Projects for Central Heating Plant and Steam Distribution System

Project No.	Title
11	Replacement of Underground Steam Distribution System
12	Replacement of Aboveground Steam Distribution System
15	Boiler Stack Heat Recovery and Boiler Trim - Control System

4. Projects for Building Lighting:

Project No.	Title
17	Reduction of Lighting Energy Consumption - Main Base
18	Reduction of Lighting Energy Consumption in Family Housing
19	Reduction of Lighting Energy Consumption in Sites 62C, 62L, and Neville Island Buildings T-1001 and T-1002.

5. Miscellaneous

16	Solar Heating for Domestic Water Heating

A summary of the project anlaysis is provided in Table 1. The projects have been prioritized in order of overall compliance with ECIP criteria as shown in Table 2, in order of B/C ratios as shown in Table 3, in order of E/C ratios as shown Table 4 and in order of payback period as shown in Table 5, the above mentioned tables are attached to the end of this subsection.

The results of the ECIP projects can be summarized as follows:

- The proposed projects if implemented would save a combined annual energy saving estimated at 81,925 MBTU, without the effect of synergism.
- The proposed ECIP projects if implemented would result in a combined annual dollar savings estimated at 609,640 dollars, without the effect of synergism.
- The proposed ECIP projects total estimated cost is 3,606,500 dollars.
- The current annual energy usage per square foot is approximately 298,557.

- The projected energy usage reduction by 1985 due to implementation of proposed ECIP projects is estimated at 138,588 Btu/sq.ft. which is equal to 46% of the current level (synergism is considered).

- The current annual energy cost per sq.ft. is approximately $1.128 (dollars) synergism considered.

- The current total energy consummption (including natural gas, no fuel oil and electricity) can be listed as follows:

-	Electricity:	67,058 MBTU, 47.5%
-	Natural Gas:	66,584 MBTU, 47.2%
-	No. 2 Fuel Oil:	7,549 MBTU, 5.3%
	TOTAL	141,191 MBTU

TABLE 1

PROJECT ANALYSIS SUMMARY - ALL PROJECTS

Proj. No.	$(x1000) CWE	$(x1000) Total Cost	$(x1000) Disc. Energy	B/C	MBtu/Yr. Energy Savings	E/C	$(x1000)/Yr. Dollars Savings	Years Payback	FY	Meets ECIP Criteria
1	131.3	138.4	476.7	3.4	2770	21.1	23.9	5.5	85	Yes
2	131.7	138.8	454.6	3.3	3394	25.8	22.7	5.8	85	Yes
3	131.1	138.2	553.5	4.0	2825	21.5	27.7	4.7	85	Yes
4	142.8	150.5	590.0	3.9	3804	26.6	29.4	4.9	85	Yes
5	114.3	120.5	1144.0	9.5	9945	86.9	63.2	1.8	85	Yes
6	100.4	105.8	973.2	9.2	7988	79.5	48.5	2.1	85	Yes
7	247.0	260.2	264.0	1.0	2121	8.6	13.1	18.8	85	No
8	119.9	126.4	344.2	2.7	1768	14.7	17.1	7.0	85	Yes
9	136.0	143.3	528.5	3.7	3370	24.8	26.3	5.2	85	Yes
10	146.2	154.4	452.0	2.9	2279	15.6	23.2	6.3	85	Yes
11	724.0	762.8	1194.6	1.8	9595	13.3	82.0	8.8	85	Yes
12	874.7	921.5	1516.2	1.9	12178	13.9	101.8	8.6	85	Yes
13	122.7	122.7	222.4	1.8	2697	22.0	16.9	7.2	85	Yes
14	185.7	196.1	881.0	4.5	10820	58.3	67.1	2.8	85	Yes
15	132.4	139.7	396.8	2.8	3753	28.4	23.3	5.7	85	Yes
16*	46.3	--	--	--	214	--	1.3	35	--	No
17	101.3	106.7	278.4	2.7	2484	24.5	16.7	6.1	85	Yes
18	133.5	140.7	303.6	2.3	2255	16.9	18.3	7.3	85	Yes
19	18.3	19.3	187.0	9.9	1669	90.8	10.8	1.7	85	No

*Not recommended for implementation.

Note:

Project No. 19 does not meet ECIP funding criteria because the total cost is under $100,000.

TABLE 2

PROJECT ANALYSIS SUMMARY

Proj. No.	$(x1000) CWE	$(x1000) Total Cost	$(x1000) Disc. Energy	B/C	MBtu/Yr. Energy Savings	E/C	$(x1000)/Yr. Dollars Savings	Years Payback	FY	Meets ECIP Criteria
The following projects meet all ECIP criteria for cost, B/C, and E/C										
1	131.3	138.4	476.7	3.4	2770	21.1	23.9	5.5	85	Yes
2	131.7	138.8	454.6	3.3	3394	25.8	22.7	5.8	85	Yes
3	131.1	138.2	553.5	4.0	2825	21.5	27.7	4.7	85	Yes
4	142.8	150.5	590.0	3.9	3804	26.6	29.4	4.9	85	Yes
5	114.3	120.5	1144.0	9.5	9945	86.9	63.2	1.8	85	Yes
6	100.4	105.8	973.2	9.2	7988	79.5	48.5	2.1	85	Yes
8	119.9	126.4	344.2	2.7	1768	14.7	17.1	7.0	85	Yes
9	136.0	143.3	528.5	3.7	3370	24.8	26.3	5.2	85	Yes
10	146.2	154.4	452.0	2.9	2279	15.6	23.2	6.3	85	Yes
11	724.0	762.8	1194.6	1.8	9595	13.3	82.0	8.8	85	Yes
12	874.7	921.5	1516.2	1.9	12178	13.9	101.8	8.6	85	Yes
13	122.7	122.7	222.4	1.8	2697	22.0	16.9	7.2	85	Yes
14	185.7	196.1	881.0	4.5	10820	58.3	67.1	2.8	85	Yes
15	132.4	139.7	396.8	2.8	3753	28.4	23.3	5.7	85	Yes
17	101.3	106.7	278.4	2.7	2484	24.5	16.7	6.1	85	Yes
18	133.5	140.7	303.6	2.3	2255	16.9	18.3	7.3	85	Yes
The following projects do not meet one or more of the ECIP criteria for cost, B/C and E/C Ratios										
7	247.0	260.2	264.0	1.0	2121	8.6	13.1	18.8	85	No
16	46.3	--	--	--	214.2	--	1.3	35	--	No
*19	18.3	19.3	187.0	9.9	1669	90.8	10.8	1.7	85	No

*See note in Table 1.

TABLE 3

B/C RATIO PRIORITY LIST

Project No.	E/C	B/C	Energy Savings (MBtu/yr.)	Dollar Savings ($(x1000)/yr)	Payback (Years)	FY	Meets ECIP Criteria
19	90.8	9.9	1669	10.8	1.7	85	No
5	86.9	9.5	9945	63.2	1.8	85	Yes
6	79.5	9.2	7988	48.5	2.1	85	Yes
14	58.3	4.5	10820	67.1	2.8	85	Yes
3	21.5	4.0	2825	27.7	4.7	85	Yes
4	26.6	3.9	3804	29.4	4.9	85	Yes
9	24.8	3.7	3370	26.3	5.2	85	Yes
1	21.1	3.4	2770	23.9	5.5	85	Yes
2	25.8	3.3	3394	22.7	5.8	85	Yes
10	15.6	2.9	2279	23.2	6.3	85	Yes
15	28.4	2.8	3753	23.3	5.7	85	Yes
17	24.5	2.7	2484	16.7	6.1	85	Yes
8	14.7	2.7	1768	17.1	7.0	85	Yes
18	16.9	2.3	2255	18.3	7.3	85	Yes
12	13.9	1.9	12178	101.8	8.6	85	Yes
11	13.3	1.8	9595	82.0	8.8	85	Yes
13	22.0	1.8	2697	16.9	7.2	85	Yes
7	8.6	1.0	2121	13.1	18.8	85	No

TABLE 4

E/C RATIO PRIORITY LIST

Project No.	E/C	B/C	Energy Savings (MBtu/yr.)	Dollar Savings ($(x1000)/yr)	Payback (Years)	FY	Meets ECIP Criteria
19	90.8	9.9	1669	10.8	1.7	85	No
5	86.9	9.5	9945	63.2	1.8	85	Yes
6	79.5	9.2	7988	48.5	2.1	85	Yes
14	58.3	4.5	10820	67.19	2.8	85	Yes
15	28.4	2.84	3753	23.3	5.7	85	Yes
4	26.6	3.9	3804	29.4	4.9	85	Yes
2	25.8	3.3	3394	22.7	5.8	85	Yes
9	24.8	3.7	3370	26.3	5.2	85	Yes
17	24.5	2.73	2484	16.7	6.1	85	Yes
13	22.0	1.81	2697	16.9	7.2	85	Yes
3	21.5	4.0	2825	27.7	4.7	85	Yes
1	21.1	3.4	2770	23.9	5.5	85	Yes
12	13.9	1.92	12178	101.8	8.6	85	Yes
18	16.9	2.3	2255	18.3	7.3	85	Yes
10	15.6	2.9	2279	23.2	6.3	85	Yes
8	14.7	2.7	1768	17.17	7.0	85	Yes
11	13.3	1.85	9595	82.0	8.8	85	Yes
7	8.6	1.0	2121	13.1	18.8	85	No

TABLE 5

PAYBACK PRIORITY LIST

Project No.	E/C	B/C	Energy Savings (MBtu/yr.)	Dollar Savings ($(x1000)/yr)	Payback (Years)	FY	Meets ECIP Criteria
19	90.8	9.9	1669	10.8	1.7	85	No
5	86.9	9.5	9945	63.2	1.8	85	Yes
6	79.5	9.2	7988	48.5	2.1	85	Yes
14	58.3	4.5	10820	67.1	2.8	85	Yes
3	21.5	4.0	2825	27.7	4.7	85	Yes
4	26.6	3.9	3804	29.4	4.9	85	Yes
9	24.8	3.7	3370	26.3	5.2	85	Yes
1	21.1	3.4	2770	23.9	5.5	85	Yes
15	28.4	2.8	3753	23.3	5.7	85	Yes
2	25.8	3.3	3394	22.7	5.8	85	Yes
17	24.5	2.7	2484	16.7	6.1	85	Yes
10	15.6	2.9	2279	23.2	6.3	85	Yes
8	14.7	2.7	1768	17.1	7.0	85	Yes
13	22.0	1.8	2697	16.9	7.2	85	Yes
18	16.9	2.3	2255	18.3	7.3	85	Yes
12	13.9	1.9	12178	101.8	8.6	85	Yes
11	13.3	1.8	9595	82.0	8.8	85	Yes
7	8.6	1.0	2121	13.1	18.8	85	No

3.0 FACILITY DESCRIPTION

3. FACILITY DESCRIPTION

3.1 General Description

The U.S. Army support element in Oakdale is located on a 201 acre rolling hills site just to the west of Pittsburgh, Pennyslvania. The facility is divided into four sites plus family housing facilities in several locations.

1. Main Post Site: Encompasses 45 buildings with a total finished space of approximately 246,719 square feet. Buildings are used for administration, commissary, storage, maintenance, food service and air traffic monitoring (Federal Aviation Admin. Building). These buildings are occupied by civilian and military personnel and were built in 1961.

2. Support Facility Annex: Site 62C: Encompasses 7 buildings with a total finished spaces of approximately 16,805 square feet. Buildings are used by Army personnel.

3. Support Facility Annex: Site 62L: Encompasses 10 buildings with total finished spaces of approximately 22,541 square feet occupied by military personnel.

4. Neville Island Element: Encompasses 2 buildings with total finished spaces of approximately 45,653 square feet occupied by Army personnel.

5. Family Housing: Encompasses 9 groups of houses in several locations around Pittsburgh.

3.2 Future Expansion

There are no plans for significant change in Scope of Activities or an increase in personnel and expansion of facilities that can be considered important for the purpose of this study.

3.3 Utilities

The following provides a brief description of existing utility systems and the specific ECIP projects developed to improve the overall base-wide energy consumption.

3.3.1 Natural Gas

Natural gas is the main source of energy used for space heating and domestic water heating throughout the main post facilities. Neville Island - building T - 1002 and family housing.

3.3.1.1 Steam heating and distribution System

Steam is generated at the central heating plant (bldg. S-9) by two gas-burning steam boilers. The plant was constructed in 1961 together with a complete network of steam distribution piping system. The steam system consist of:

1. 2-363 BHP. steam boilers (one is standby), generating steam at 80 psig.
2. Stand-by fuel oil system for use of No. 2 oil if gas is not available.
3. Water treatment system.
4. Feed water system.
5. Steam distribution underground and above ground piping system.

The piping system was installed in 1961, Rick-Wil pipe was used (steam pipe and cond. ret. pipe are both in the same pre-fabricated conduit). The piping system is considered to be in a very poor condition with several spots of steam leakage and deteriorated insulation.

The piping system serves most buildings at or near the main post with high pressure steam for domestic hot water heating, space winter heating and food preparation facilities.

An average of $40,000 is spent each year to maintain the system. A very high make-up water to the system (approx. 3,500 gals.) can be attributed to the poor condition of the steam distribution system.

The following projects address energy saving measures that would effect the total consumption of steam and natural gas:

- o Project No.: 1,2,3,4,5,6,7,8,9,11,12,13,14 & 15

  Total Saving = 72564 MBTU/YR

3.3.2 Fuel Oil (No. 2)

Fuel oil is the second source of energy used for space heating and domestic water heating in the annexes (site 62 C & L), Neville Island building T-1001 and at the main post in building S-14, consolidated supply, S-15, S-16, S-18 and building S-32. No. 2 fuel oil is also available at the central heating plant as a stand by source of energy.

The following projects address energy saving measures that would effect the total consumption of fuel oil:

- o Project No. 1,2,3,4,8,9 & 10

  Total Saving = 4991 MBTU/YR

3.3.3 Electric Energy

Electricity is the second major source of energy used for space lighting, operation of equipment and appliances. The following is a brief description of the major system elements:

Main Base: The main base (U.S. Army Support Det.) receives its power from an overhead 33KV 3 phase line which terminates in an outdoor substation adjacent to building S-14. The voltage is transformed to 4160 volts 3 phase and enters an outdoor enclosed switch gear adjacent to the substation where it is broken down for sub-distribution to the FAA complex, the old generator building for an emergency tie system (presently inoperative), and to the buildings of the support detachment.

Power Factor: Correction capacitors were installed at the outdoor substation but were rendered inoperative by a lightning stroke and have not been placed into service at this time.

The Power Feeder to the main base is run underground to the west side of a road adjacent to the 99th Arcom Headquarters Building (bldg. S-5) and continues overhead by pole line to the support detachment buildings.

Underground Feeder: This is a 5KV 250MCM cable. 4160 volt overhead cable is 3-1/C #1/0 ACSR and secondary cable (120/208 volts) is stranded aluminum 600V cable with Polychloroprene jacket.

Pole Transformers are single phase oil filled distribution types, mounted in a cluster of 3 and connected 4160V delta to 120/208 volts grounded wye. Total transformer KVA is 925. Transformer sizes vary from 7 1/2 KVA to 37 1/2 KVA single phase.

Street Lighting was pole mounted 175 watt mercury vapor which has been replaced with 150 watt high pressure sodium energy saving lamps. The lights are individually controlled by fixture mounted photocells. The street lighting feeder is 460V single phase and is Polychloroprene insulated #4 ACSR cable mounted on the power distribution poles.

Neville Island: Buildings T-1001 and 1002 at Neville Island are individually metered on Duquesne Light Co. schedule GM. Service to each building is 120/208 volts 3 phase 4 wire grounded wye.

Residences: The 124 residences are metered both individually for some clusters and group metered in other clusters. Power is supplied by Duquesne Light Co. & West Penn Power Co. where clusters fall within respective territories. Voltage supplied is single phase and is either 120/240 volts 3 wire or phase-phase-neutral tap off of a 3 phase 4 wire 120/208 volt secondary distribution system. All service drops are overhead.

Sites 62 C & 62 L: (Readiness group support element) is served by Duquesne Light Co. on schedule GM. Service voltage is 4160/2400 3 phase 4 wire. Distribution is overhead as is service drops to each building from pole mounted single phase oil filled transformers clustered in groups of 3 for 120/208 volt 3 phase 4 wire service.

The following projects address energy saving measures that would effect the total consumption of electrical power:

- Project No. 17
- Project No. 18
- Project No. 19

Total Savings = 8160 MBTU/YR

4.0 PRESENT ENERGY CONSUMPTION AND COST

4.0 PRESENT ENERGY CONSUMPTION & COST

4.1 Consumption

4.1.1 Electricity Consumption

Introduction

Research into the availability of metered electrical consumption at the facility indicated that for the most part, records do not exist for the period FY 75 through FY 78.

In accordance with DOD directives, the base has maintained recorded records of electrical consumption and has forwarded them to a storage facility at Indiantown Gap, Pennsylvania with the bills.

A request to Indiantown Gap for the records have indicated that the records have been either destroyed in accordance with Policy Directives or cannot be located.

A request of Mr. R. J. Wiehagen, Governmental Representative of the Duquesne Light Co. has indicated that no power company records exist for the period involved and they are just in the process of setting up a computer system for billing records.

Records do exist for the period FY 79 thru September of FY 81 and for the most part are complete except as hereinafter described.

1. Metering - The facility pays individual bills for each Power Co. meter used on the main site and the facilities external to the main base. They are as follows:

    a. Main Base - Single Meter - Schedule GL - see appendix for schedule.
    b. Site 62 C - Single Meter - Schedule GM - see appendix for schedule.
    c. Site 62 L - Single Meter - Schedule GM - see appendix for schedule.
    d. Bldg. T 1001 & T1002 - Neville Island - Single Meter Schedule GM for each bldg. - see Appendix for schedule.

e. Family Housing - Multiple Meters, 1 per unit or 1 per Building Group at 10 different sites around the city - Schedule R see appendix for schedule.

Records are complete for main base, bldgs. T 1001 and T 1002 but comparitively spotty for 62 C & 62 L. These 2 sites do not have enough of a base to extrapolate a meaningful curve and are plotted as is.

2. Submetering

The following buildings have had submeters installed and are billed by the facility as a prorated portion of the main base electrical bill. They constitute part of the main base electrical consumption.

a. FAA Tower (Bldg. S-32)
b. Motorola Tower (Bldg. S-46)
c. Post Exchange (Bldg. S-13)
d. 4 Seasons (Bldg. S-7)
e. Gas Station (Out of Operation)
f. Class VI Pkg. Store (Bldg. S-22)

2. Power Factor

The power factor penalty for three years (FY79, 80 & 81) is derived from the following formula.

$$\text{PF Multiplier} = \frac{\text{RKVAH}}{\text{KWH}} \times 0.6 + 0.8$$

This number is multiplied by the measured demand and results in the billing demand used in the Power Co.'s bill.

The average penalty is 3.7% of the demand charge, $1,400 calculated per year, or 0.6% of the annual billing. Since the low power factor recorded in the three year period was 85% only three times in the 20 readings constituting the three year period and all other readings were in the middle

to high 90% range it is apparent that power factor is excellent and needs no correction. See appendix for "power factor analysis.

4.1.1.1 Kilowatt HR Consumption (KWH)

	FY 79	FY 80	FY 81
Main Base	4,704,000	4,771,600	4,582,400*
Site 62 C	105,555*	132,840	103,350*
Site 62 L	225,720*	208,440	227,040*
Bldg. %T1001	98,640	105,840	94,080
Bldg. T1002	211,080	212,400	207,760*
Family Housing	722,500**	802,600**	882,933**

Notes: *Designates extrapolation from 8 months of readings per year for FY 79 and 9 months of readings for FY 81.

**Designate typical monthly average per unit of housing multiplied by 124 units.

4.1.1.2 Source Energy Consumption (MBTU's)

	FY 79	FY 80	FY 81
Main Base	54,566	55,350	53,156*
Site 62 C	1,224*	1,541	1,199*
Site 62 L	2,618*	2,418	2,634*
Bldg. T 1001	1,144	2,464	2,410*
Bldg. T 1002	2449	2464	2410*
Family Housing	8,381**	9,310**	10,242**

Notes: * and ** - See Par. 4.1.1.1

4.1.1.3 Building Group Source Energy Consumption

Same as Paragraphs 4.1.1.1 and 4.1.1.2

4.1.4.4 Typical Building Energy Consumption/Yr.

Bldg. S-32 - 982,000 KWH
Bldg. S-46 - 5,782 KWH
Bldg. S-13 - 117,120 KWH
Bldg. S-7 - 38,620 KWH
Bldg. S-22 - 11,430 KWH
T 1001 - 94,080 KWH
T 1002 - 207,760 KWH
Housing Unit (Typ.) - 6,473 KWH

These buildings are the only buildings with kilowatt hour meters. All other buildings on the site have no ammeters, voltmeters or kilowatt hour meters from which to obtain consumptions.

4.1.2 Natural Gas Consumption

Utility Bills for natural gas for the last three years has been collected by the Facility Engineer's staff. The following is a total gas consumption per year, see appendix for table of gas consumption.

MAIN BASE

Record Period	Gas Consumption (1000 Cubic Feet)
Oct. 1978 thru Sept. 1979	46,588
Oct. 1979 thru Sept. 1980	38,137
Oct. 1980 thru Sept. 1981	32,176

NEVILLE ISLAND

Oct. 1978 thru Sept. 1979	5,782
Oct. 1979 thru Sept. 1980	4,921
Oct. 1980 thru Sept. 1981	4,338

FAMILY HOUSING

Oct. 1978 thru Sept. 1979	20,987
Oct. 1979 thru Sept. 1980	20,437
Oct. 1980 thru Sept. 1981	20,375

- Base-wide consumption for FY 1979 = 73,357 X 10^3 cubic feet

4.1.3 Fuel Oil Consumption

Fuel oil (No. 2) consumption record for the last two years has been recorded by the Facility Engineer's staff. The following is the total fuel oil consumption per year.

Record Period	Fuel Oil (Gallons)
Main Base	
Oct. 1979 thru Sept. 1980	17621
Oct. 1980 thru Sept. 1981	18964
Neville Island	
Oct. 1979 thru Sept. 1980	13944
Oct. 1980 thru Sept. 1981	16265
Annex Sites 62C and 62L	
Oct. 1979 thru Sept. 1980	13944
Oct. 1980 thru Sept. 1981	19279

- Base-wide consumption for FY 79 = 54,319 gallons.

4.2 Energy Cost

4.2.1 Fuel Costs and Escalation Rates

1) Energy, material, and labor prices are escalated from current FY 1981 rates to those projected for September 30 of each fiscal year listed below.

	FY 82	FY 83	FY 84	FY 85	FY 86
o Supervision inspection and overhead (SIOH)	5.0%	5.0%	5.0%	5.0%	5.0%
o Design	6.0%	6.0%	6.0%	6.0%	6.0%
o Maintenance & Repairs, O&M, Salvage	5.6%	5.6%	5.6%	5.6%	5.6%
o Fuel Oil	14.0%	14.0%	14.0%	14.0%	14.0%
o Natural Gas	14.0%	14.0%	14.0%	14.0%	14.0%
o Electricity and Demand Charge Reduction	13.0%	13.0%	13.0%	13.0%	13.0%

2) The differential escalation rates given below are used for computing the present worth of recurring annual costs/benefits:

Maintenance & Repairs, O&M	0.0%
Fuel Oil	8.0%
Natural Gas	8.0%
Electricity and Demand Charge Reduction	7.0%

3) The present worth factors for multiplication of recurring annual savings are selected from the appropriate differential escalation rate. A table of differential escalations discount factors is given below:

Economic Life in Years	O&M 0%	Coal 5%	Electricity 7%	Oil & N.G. 8%
15	7.980	10.798	12.278	13.112
25	9.524	14.777	18.049	20.050

5.0 ENERGY CONSERVATION MEASURES

5.0 ENERGY CONSERVATION MEASURES

Based on the field gathering phase of this study, several potential ECIP projects were listed. Some of these projects were developed to include detailed analysis, back up calculations, the necessary forms 1391 and PDB sections. Some of the projects did not merit further investigation.

The following is a brief characterization fo those projects that were developed to comply with ECIP criteria and those that were disqualified from consideration.

5.1 ECIP Projects

5.1.1 General Projects

5.1.1.1. Addition of insulation to the building envelope - This energy conservation measure was found to be necessary for most buildings. To generate an acceptable number of project packages, buildings were grouped and addressed under one project as follows:

- Project No. 1, Group 'A': Addresses building No. S-1, 6, 13, 19, 63052, 63054 and 63055. Insulation to be added to roofs and walls. Estimated annual energy saving = 2,770 MBTU

- Project No. 2, Group 'B': Addresses building No. S-14, 15, 16, 18 and 36. Insulation to be added to roofs and walls. Estimated annual energy saving = 3,394 MBTU

- Project No. 3, Group 'C': Addresses building No. S-3, 4, 32, 35, 37, 62001, 62002 and 62005. Insulation to be added to walls and roofs. Estimated annual energy savings = 2,825 MBTU

- Project No. 4, Group 'D': Address building No. T-1001 and T-1002. Insulation to be added to the walls and roofs. Estimated annual energy saving = 3,804 MBTU

- o Project No. 5, Group 'E': Address family housing site No. PI-02,25, 42, 52, 71 C & 71 L. Insulation to be added to walls and roofs. Estimated annual energy saving = 7,087 MBTU

- o Project No. 6, Group 'F': Address family housing site no. PI-03, 36, 37 and 43. Insulation to be added to walls and roofs. Estimated annual energy saving = 7,988 MBTU

5.1.1.2 Replacement of Windows

This energy conservation measure was found to be necessary for both buildings in Neville Island.

o Project No 8:

Addresses building No T-1001 and T-1002. Existing windows shall be replaced with new windows. Estimated annual energy saving = 1768 MBTU.

5.1.1.3 Addition of Storm Windows

This measure was found necessary for most buildings in the main post area.

o Project No 9:

Adresses building No. S-1, 3, 4, 5, 6, 7, 8, 15, 20, 21, 35, 36, and 37.
Estimated annual energy saving = 3370 MBTU.

5.1.2. Projects for Building Heating and Cooling

5.1.2.1 Addition of Thermostatic Control Values:

This energy conservation measure was found to be necessary for all buildings that are heated with conventional Finned-tube radiators, since these radiators are not equipped with control valves.

o Project No. 14:

Addresses building No. S-1, 4, 5, 6, 7, 8, 12, 15, 20, 21, 35, 36, 37.
New thermostatic control valves shall be added to each heating element.
Estimated annual energy saving = 10870 MBTU.

5.1.2.2. (VAV) System Conversion:

This energy conservation measure was found to be suitable for building No. S-14.

o Project No. 10:

Addresses building No. S-14.
Existing constant Volumer system shall be converted to VAV system.
Estimated annual energy saving = 2279 MBTU.

5.1.2.3. Adddition of Vent Dampers and Automatic Ignition System.

This energy conservation measure was found to be applicable for all of the family housing at this base.

o Project No. 13:

Addresses all of the family housing at this base.
New vent dampers and automatic ignitor shall be installed in every heating furnace.
Estimated annual energy saving = 2697 MBTU.

5.1.3. Projects for Central Heating Plant and Steam Distribution System.

5.1.3.1. Replacement of Underground and Above Ground Steam Distribution System:

This project was considered to be very important for this facility due to the poor condition of the existing system.

o Project No. 11:

Estimated annual energy saving = 9595 MBTU

o Project No 12:

Estimated annual energy saving = 12178 MBTU.

5.1.3.2. Addition of Boiler Stack Heat Recovery and Oxygen Trim Control:

This project is suitable for the existing boiler plant equipment and is considered to be a good energy saving measure.

o Project No. 15:

Boiler Stack Heat Recovery and Oxygen Trim Control:
Estimated annual energy saving = 3753 MBTU.

5.1.4. Projects for Building Lighting:

5.1.4.1. Reduction of Lighting Energy Consumption.

o Project No. 17

This project is concerned with the reduction of lighting energy consumption at the main facility. The buildings contain appreciable quantities of incandescent lighting fixtures and a large proportion of square footage is illuminated to levels in excess of DOD recommended levels with fluorescent fixtures of the non energy saving lamp and ballast type.

The project addresses the replacement of incandescent fixtures with fluorescent fixtures and only those quantities which will result in meeting the DOD recommended energy saving levels. All fixtures not replaced will be rendered inoperative by having their lamps removed. In the overlit fluorescent areas, lamps will be rendered inoperative by having their ballasts disconnected and in such quantities as will result in them meeting the DOD lighting level criteria. In addition, all remaining active lamps

will be replaced with 34 watt 3050 lumen energy saving lamps at a 6 watt saving per lamp.

Estimated annual energy saved = 2484 MBTU.
This project meets all ECIP criteria and should be funded.

• Project 18:

This project is concerned with the reduction of lighting energy consumption in 124 units of 2 and 3 bedroom officers and enlisted men's family housing. The units are illuminated by incandescent lighting fixtures which are by nature the highest consumer of electrical energy per unit of light output:

The project addresses the replacement of these incandescent light sources with more energy efficient fluorescent lighting. To maintain the quality of atmosphere necessary in a family residential unit and to avoid the institutional look, a new line of residential fluorescent fixtures using circular lamps was selected. The kitchen and bathroom fixtures selected are 2' and 4' long fluorescent fixtures which have been standardized in today's residential market. The fluorescent fixtures in all cases were selected by comparing them to the incandescent fixtures in order to maintain the same lighting output.

By substituting these more efficient lighting sources it was found that appreciable energy was saved and all ECIP criteria was met. Estimated annual energy saved = 2255 MBTU.
It is recommended that this project should be funded.

5.1.5 Miscellaneous and O & M Projects

The implementation of Operations & Maintenance (O&M) procedures can be a rather quick and inexpensive way to conserve energy. In the past and at the present, there has been an extensive maintenance effort to reduce energy use. This includes repair and replacement of damaged equipment components, replacement of one of the main boiler's tube bundles, repair of the steam distribution system leaking, installation of electric domestic water heaters for use during summer shut down of the heating plant and replacing of light bulbs with energy saving type (10% of Lamp Tot.). This overall

effort has contributed substantially to the base energy use growth control in the last seven years.

In addition to the maintenance effort to reduce energy consumption, the entire base personnel is aware and well trained to maintain the current army regulations regarding energy saving measures like turning off lights in unoccupied areas, lowering thermostats set points...etc.

In addition to the actions already taken at the base, a number of O&M practices and promects were identified during the field investigation phase of this report. Most of the O&M items identified are basically maintenance actions that would require low cost/no cost implementation. The following list of O&M procedures, if implemented, could reduce the base wide energy consumption substantially.

5.1.5.1 Building Envelope

1. Caulk and weatherstrip doors and windows:
2. Keep windows and doors closed during heating and cooling operations.
   Often times, heat is not distributed evenly, and occupants in those rooms that are too hot will open windows "to let in fresh air." In such cases, instruct staff how to close off water and steam valves, or supply dampers, to allow heat to reach the farthest rooms. Check to see that door closers are working properly. If not, oil and adjust them.

3. Where practical, cover all window and through-the-wall cooling units when not in use. Specially designed covers can be obtained at relatively low cost. Use window shading to control heat gain and heat loss.

   Drapes, blinds, and shades can be used effectively to help control room temperatures.

   During the cooling season, close the shades where the sun is creating a "greenhouse" effect and warming interior spaces excessively, even if it means turning on more lights. During the heating season, close shading devices to retard the loss of heat to the night air, and open them during sunny days to let in heat and light. Instruct staff of these recommendations and see that they practice them.

4. Seal openings in roofs and walls.

Heated air will rise and escape through openings in the roof or high on the walls.

The most common openings left uncovered are ventilation and exhaust fan openings in assembly areas. Gravity relief vents should also be closed off (except in rest-rooms). Do not seal off fresh air louvers in boiler rooms; these are necessary to supply combustion air to burners.

5. Repair doors and windows that have substantial cracks or that are broken.

If immediate repair is not possible, tape cracks and cover openings with plywood or corrugated board until repairs can be made. Repair door closers that do not operate properly.

5.1.5.2 Building Heating and Cooling

1. Replace Faulty Thermostats.

Install tamper-proof locking covers on thermostats. Reduce thermostat settings by a minimum of $10^{o}F$ at nights, for weekends and holidays during heating season.

2. Utilize Time Clocks Properly.

Install time clocks that will reduce heating and/or turn off air conditioner.

Time clocks that are set to turn heating, cooling, or lighting systems on and off automatically also waste energy automatically if they are set wrong.

Routinely check all time clocks and other control equipment for proper programming of on-off set points. Protect from unauthorized adjustment.

3. Insulate Hot Water, Steam and Condensate Piping.

Thirty feet of uninsulated 2" hot water piping burns at least an extra quarter gallon of oil during an average heating day. An equivalent 6" steam line burns even more.

Check to seed that these lines have at least 1" thick insulation which is tight and securely wrapped around them.

4, Shut outside air dampers at night and during other unoccupied periods.

It takes much more energy to heat cold, outside air than recirculated inside air. Outside air is not needed if the building is empty.

If dampers are automatic, make sure they close tightly. Find out what in particular triggers dampers to shut (e.g., time clocks, thermostats, etc.) and make sure that these devices are working properly. Some dampers are fixed open to draw in a certain percentage of fresh air all of the time. Nothing can be done in these cases. If controls permit, shut outside air dampers during warm-up and shut again an hour before occupants leave.

Replace old style dampers with new high quality opposed-blade models with better close-off ratings.

5. Shut down exhaust fans when not required.

Continually running exhaust fans not only waste electricity, but also draws out heat from heated spaces.

Spaces to check in particular are shops, auditoriums, kitchens, and locker rooms.

6. Repair air duct leakage and insulation.

Heated air that escapes from the ducting system before it reaches the farthest rooms may cause the occupants of those rooms to raise their thermostats unnecessarily high.

Condensation on air handling surfaces is a sign of inadequate or loose insulation. Tape or caulk openings, and repair or replace insulation as necessary.

7. Clean dirty air filters and heating coil units.

Dirty and other obstructions act as undesirable insulation, preventing a heating

unit from delivering heat properly. When this happens, people may turn up thermostats unnecessarily high

Heat transfer surfaces of radiators, convectors, baseboard and finned-tube units must be kept clean for efficient operation. Inspect for obstructions in front of the unit and remove whenever possible. Air movement in and out of convector unit must be unrestricted.

o Bleed air from units.

o Establish a systematic cleaning schedule.

o Remove items obstructing discharge grilles.

8. Repair faulty automatic controls.

If temperature controls are broken or inaccurate, the tendency is for people to turn the heat up and run it continuously. Also, "fine-tuning" the operation of your building is only as efffective as controls and meters are accurate.

Room thermostats: Check by moving temperature setting from one extreme to the other. Do fans turn off? Can you hear water or steam entering the radiator? Do circulating pumps respond by turning on and off? If nothing happens, the thermostat may be faulty. In pneumatic control systems air will hiss out when the temperature setting is lowered.

Hot water valves: If hot water valves do not open and close with the automatic controls, replace them. If you cannot hear the supply water shutting off and turning on, you should feel the temperature of the supply pipe changing.

Steam traps: Feel the pipe on the downstream side of the steam trap. If it is excessively hot, the trap probably is passing steam. This may be caused by dirt in the trap, valve stem, excessive steam pressure, or worn trap parts (especially valve seats). If it is moderately hot (as hot as a hot water pipe), it is probably passing condensate which it should do. If it is cold, the trap is not working at all and should be replaced.

5.1.5.3 Domestic Hot Water System.

1. Lower domestic hot water temperatures.

Maintaining a water tank at 180°F takes more energy than at 110°F because heat is lost faster through the tank walls and pipes.

Assuming adequate pipe insulation, 110°F is the threshold for scalding (dangerously hot) water temperature. Temperatures may be set higher if much heat is lost between heating unit and faucet. Check to see if it is possible to eliminate all hot water to public restrooms.

Dishwashing requires a rinse temperature of 180°F. Most dishwashers have a hot water booster that boosts the water temperature to this level. If you have one, make sure it is operating correctly, and lower main supply temperatures correspondingly.

Electric water heaters normally have no time restrictions on heating cycle.

Limit the duty cycle with a time clock or other control devices to avoid adding the water heating load to the building during peak electrical demand periods.

2. Install flow restrictors.

Substantial savings can be gained by employing hot water saving devices. For example, self-closing faucets can be used on hot water taps. Flow restrictors can also be applied to each individual faucet or in the branch that supplies groups of taps.

3. Insulate domestic hot water piping.

A 1½" uninsulated line 30 feet long carrying 120°F water requires burning three to four extra gallons of oil a month.

Check to see that insulation is adequate. Repair or replace as necessary. Use at least a half inch of insulation; one inch on runs longer than 40 feet.

5.1.5.4 Lighting systems and Motors.

1. Replace non-decorative incandescent lamps with more energy conserving types such as fluorescents in general purpose areas and mercury vapors in large group areas.

2. Disconect ballasts which still use significant amounts of energy even though tubes have been removed.

3. Establish a regular inspection and cleaning schedule for lamps and luminaires. Dust build up reduces effectiveness.

4. Replace lens shielding that is yellow or that has become hazy with new acrylic lenses which do not yellow.

5. Utilize natural lighting whenever possible.

6. Replace burned out fluorescent ballasts with energy saving type.
7. Clean walls or repaint with light reflective non-glossy colors.

8. Using name plate data, prepare an up-to-date list of all motors and pumps used in the facility and list routine maintenance to be performed on each.

Check regularly for:

1. Correct motor voltage and amperage.
2. Loose connections and worn contacts.
3. Unbalanced voltages on 3-phase motors.

4. Improper grounding.
5. Packing wear.
6. Wear and binding on bearings and drive belts.
7. Proper sequencing of pumps and motors.

9. Replace worn motors with high efficient units.

5.1.6 Projects Disqualified from Consideration or Does Not Comply with ECIP Criteria.

5.1.6.1 Projects Disqualified from Consideration

o Project No 16:

Solar heating for domestic hot water, was found to be not economical for this facility due to low consumption and location of the base.

o ECMS Investigation:

To determine the feasibility of installing an ECMS system, the following check list was considered to evaluate the current facilities suitability for such system:

ITEM	EVALUATION
1. Scheduled Start/Stop	Can be achieved thru time clocks.
2. Optimum Start/Stop	Can be achieved thru time clocks.
3. Duty Cycling	Demand KW is very low and very few items can be used to achieve any substantial load reduction.
4. Demand Limiting	Demand KW is very low and very few items can be used to achieve any substantial load reduction.
5. Day/Night Setback	Can be achieved thru regular building automatic temperature controls.
6. Economizer	Not Applicable.
7. Enthalpy	Not Applicable.
8. Ventilation and Recirculation	Can be achieved thru regular automatic temperature controls.
9. Hot Deck/Cold Deck Temperature Reset.	Not Applicable.
10. Reheat Coil Reset	Not Recommended.
11. Steam Boiler Optimization	Not Recommended
12. Hot Water Boiler Optimization	Not Applicable.
13. Hot Water Outside Air Reset	It is presently achieved thru outside Air Thermostats.

14. Chiller Optimization	Only two buildings are equipped with chillers which are too old to be tampered with.
15. Chiller Water Temperature Reset	Only two buildings are equipped with chillers which are too old to be tampered with.
16. Condenser Water Temperature Reset	Only two buildings are equipped with chillers which are too old to be tampered with.
17. Chiller Demand Limit	Only two buildings are equipped with chillers which are too old to be tampered with.
18. Lighting Control	Is currently achieved by base personnel awareness and practice of DOD regulations.

At this point we do not recommend the installation of ECMS system due to lack of major equipment at the base that would contribute to the energy saved to justify the ECMS application.

5.1.6.2 Projects That Do Not Comply with ECIP Criteria:

o Project No. 7:

This project addresses building S-5, 7, 8, 20, and 21. Addition of insulation to walls and roofs was considered under this project.; Although the project is not an ECIP project, we still recommend it for architectural appearance purposes. If these buildings were left without adding insulation to the walls from outside, then these buildings would be in an awkward shape in comparison with the rest of the buildings. Also the wall insulation part of the project was found to be in compliance with most of ECIP criteria.

o Project No. 19:

This project is concerned with the reduction of lighting energy consumption at sites 62C, 62L and buildings T-1001 and T-1002 at Neville Island. The buildings contain appreciable quantities of incandescent lighting and high levels of illumination in some areas which are illuminated with fluorescent fixtures. In addition the fluorescent lamps are of the daylight type which produce less lighting for higher energy consumption than either the standard white lamp or the energy saving lamp.

The project addresses the replacement of the incandescent fixtures with fluorescent fixtures and only those quantities which will result in meeting DOD recommended lighting levels. Fluorescent ballasts will be disconnected in order to meet these same levels and all lamps will be changed to lower wattage higher light level types.

Although the project does not meet ECIP funding criteria because the cost is under $100,000, it should be funded from other sources because of it's extremely high B/C and E/C ratio's, it's 1.7 year payback period and its relatively large energy saving.

5.1.7 Electrical Energy Policy Recommendations

1. Reduction of Lighting energy Consumption.

   a. Disconnect Ballasts and associated lamps in areas illuminated above DOD energy conservation directives.

   b. Replace existing 40w fluorescent lamps with new 3050 lumen 34 watt lamps.

   c. Replace existing standard ballasts with energy saving type.

   d. Replace incandescent fixtures in all areas except Officers Club with new fluorescent fixtures of the energy saving type.

   e. Replace incandescent lamps in Officers Club with energy saving incandescent lamps

f. Establish a system of group lamp replacement and fixture cleaning for the entire facility.

2. Replacement of Standard Motors with New High Efficienty Types

a. Replace only when motor needs repair, replacement or rewinding. Replacement of operating motors is not economical.

3. Building Utility Services

a. Disconnect all window air conditioning units. Main Base, site 62C, and 62L.

b. Disconnect all electric water heaters during June, July, August, and September.

4. Maintenance of Records

a. Meters should be read monthly.

b. Metering records kept by the facility should include KWH and RKVAH consumption, actual demand, billing demand, power factor multiplier, net energy clause and dollar total. These figures should be kept for a 3 to 5 year period and will prove a valuable tool in analyzing the total energy consumption by the facility engineer.

5. Metering

a. More meters should be installed for verification of energy consumption in major buildings, (i.e., Boiler Plant, Officers Club, etc.).

b. Where family housing is group metered, individual units should have meters installed using new residential doughnut current transformers on the service drop and an exterior meter.

6.0 ENERGY SAVINGS AND PROJECTED ENERGY CONSUMPTION PROFILES

6.1 Electric Energy Consumption Profiles

Energy bills for the last two or three years was collected for most sites of the base. These bills were tabulated for each month (except few months, due to lack of records or due to one meter reading combining several months). See "Energy Data Forms shown in Appendix 'A' of this report.

Based on these tables, several graphs were developed and plotted into two categories:

1. Main base = FY 1979 thru 1981 profile showing KW Demand and KWH versus time.

2. Other sites = FY 1979 thru 1981 profile showing KW Demand and KWH versus time.

3. Composite basewide energy consumption profile.

4. Project consumption profile to FY 1985 and beyond.

6.2 Natural Gas Consumption Profiles

Energy bills for the last two or thru years was collected for most sites of the base. These bills were tabulated for each month on "Energy Data Forms" as shown on Table No. 6. thru 14 under Appendix 'A; of this report.

Based on these tables, several graphs were developed as follows:

1. Main base = FY 1979 thru 1981; the total energy in MBTU was plotted versus time. One could notice that during the summer of FY 1979 there was a base energy consumption which is that portion of the profile that is normally not related to the weather changes. Base energy in this facility can be related to domestic water heating, cooking and similar functions. This base energy has been eliminated when the policy was changed in the summer of the following year when the central heating plant was shut down for the entire summer season!! The base energy was then converted to

electric energy used to heat the domestic water, however at a much better overal efficiency.

2. Main base FY 1979, 1980, and 1981: Individual graphs for each year was plotted showing time versus energy used, total cost and heating degree days.

3 Neville Island: FY 1979 thru 1981; the total energy in MBTU was plotted versus time. The three year profile is consistent and is considered to be representative, however one could notice that there is no base energy in this site.

4. Neville Island: FY 1979 thru 1981; individual graphs for each year was plotted showing time versus; energy used, total cost and D-Day.

5. Family Housing: FY thru 1981; the total energy in MBTU was plotted versus time. This three year profile can be considered representative of ;the actual energy consumption in this part of the facility. The profile also shows base energy during the summer seasons.

6. Family Housing: FY 1979 thru 1981; individual graphs for each year was plotted showing time versus; energy used, total cost and D-Day.

7. For graphs see Appendix "A".

6.3 Fuel Oil Consumption Profiles

Fuel oil bills for the last two years was collected and tabulated for the main base, Neville Island and Sites 62-C and 62-L, see tables 15 thru 20.

Based on these tabulated figures, several graphs were developed for the main base, Neville Island and Sites 62-C and 62-L. Time versus energy, total cost and heating degree days were plotted in these graphs.

6.4 Steam Consumption Profile

Steam generation at the main base central heating plant has been tabulated for the last three years on tables No. 21 thru 23.

Based on these tables two graps have been plotted as shown in Appendix "A", showing time versus steam produced, make-up water and Heating Degree Days.

6.5 Projected Consumption of Natural Gas, Fuel Oil and Steam to FY 1985 and beyond was developed as shown on in Appendix "A".

The following was noted:

1. Decline in natural gas consumption in FY 1979 thru 1981. This trend is due to strict following of energy policies set by DOD and due to central boiler shutdown during summer.

2. Family housing profile for MBTU/Degree Day shows the same MBTU in 1980 even though the degree days were less than the other winter seasons!!

3. Boiler make-up water during FY 1980 thru 1981 is in a rising trend although steam generation shows a decline during that period.

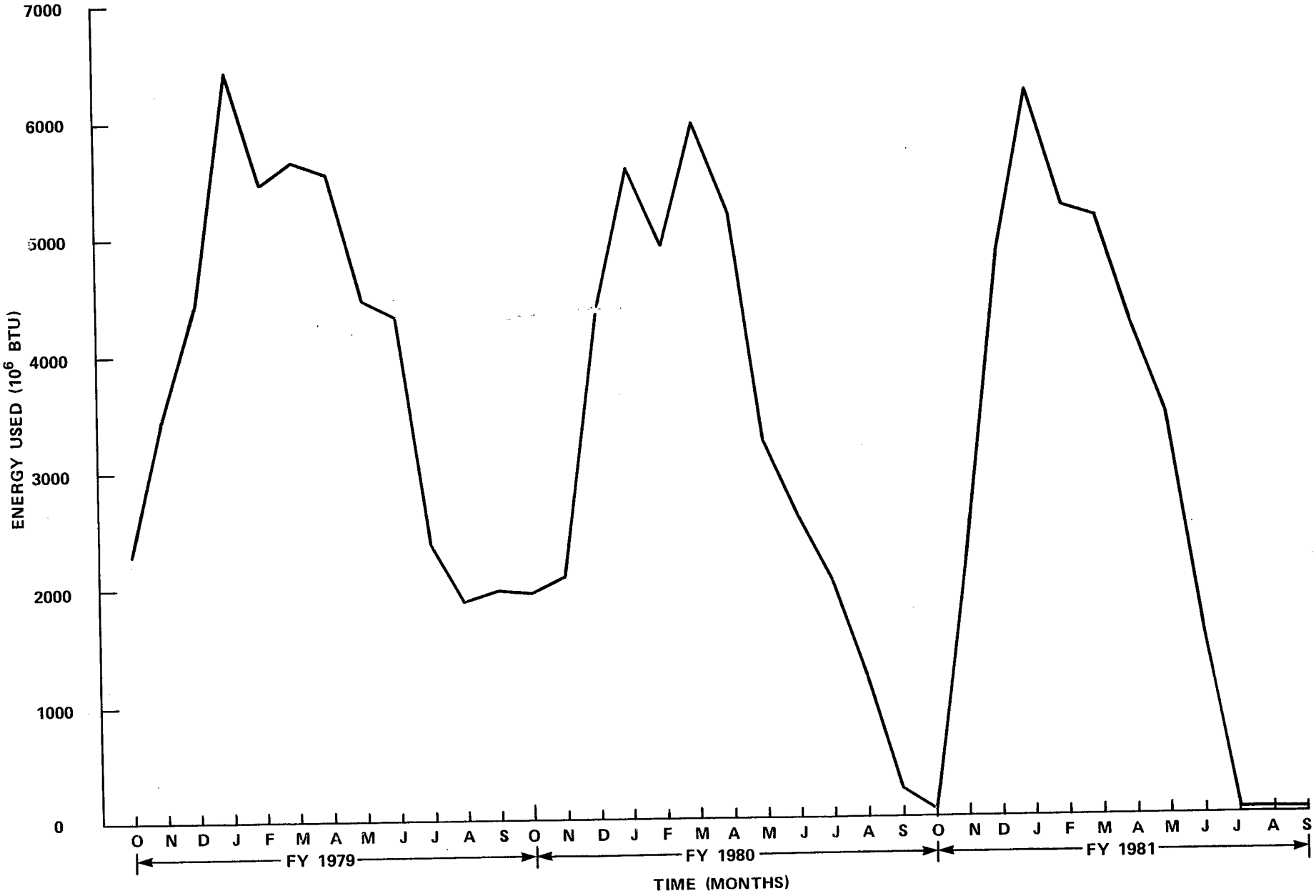
6.6

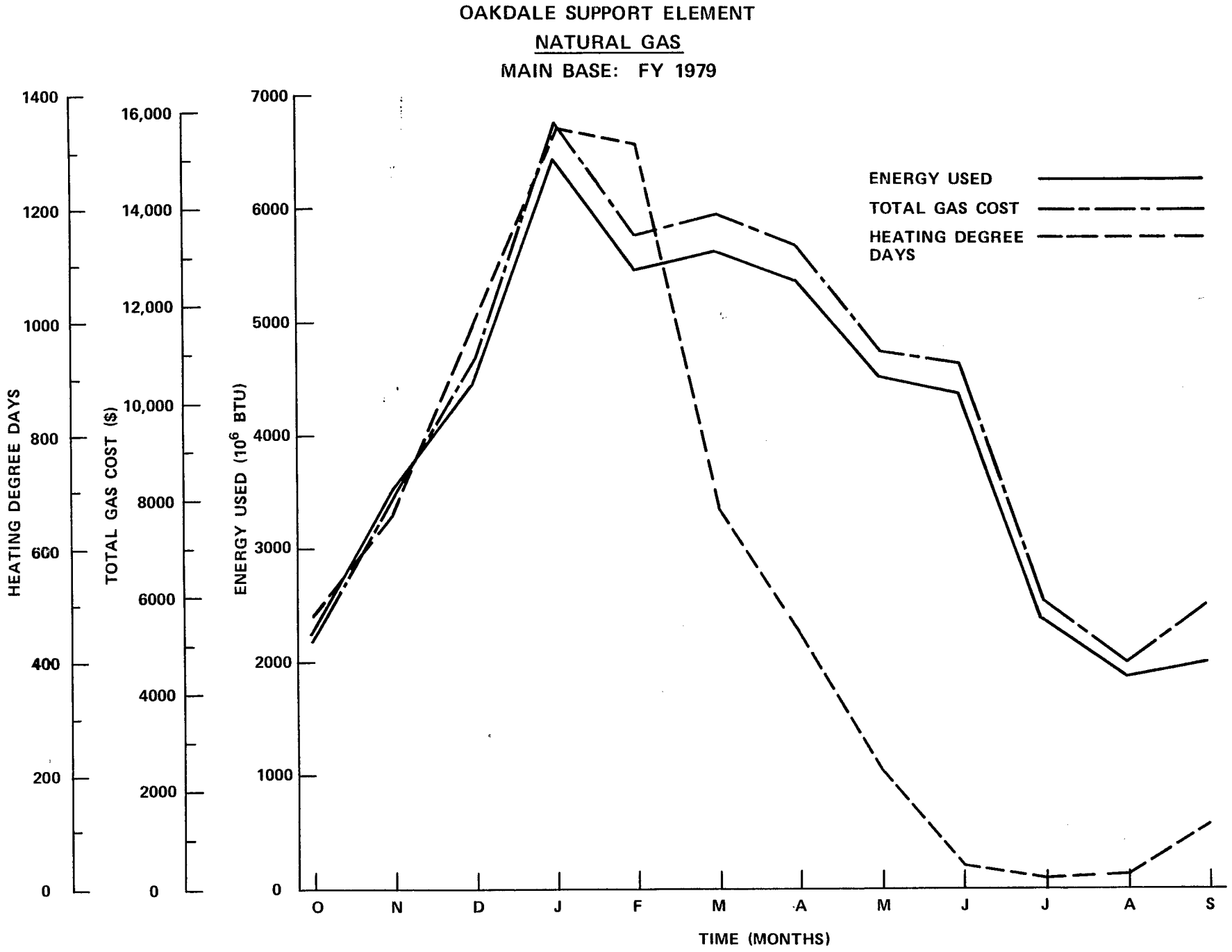
A composite energy profile for the entire base is in Appendix "A", with the projected consumption to FY 1985 and beyond. It should be noted that synergism was considered in estimating the energy saving due to implementation of all projects recommended in this report.

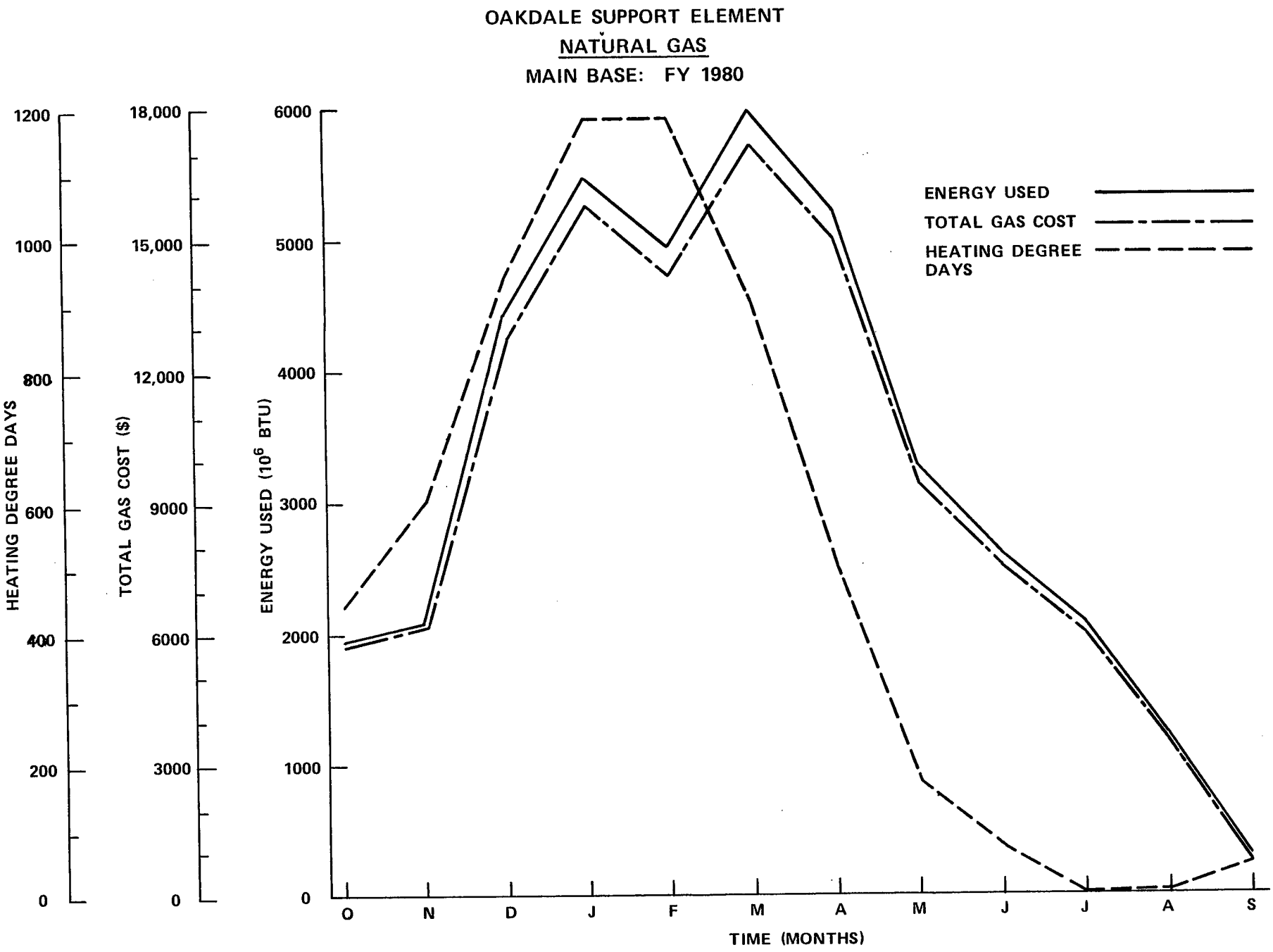
OAKDALE SUPPORT ELEMENT

NATURAL GAS

MAIN BASE: FY 1979 THROUGH 1981



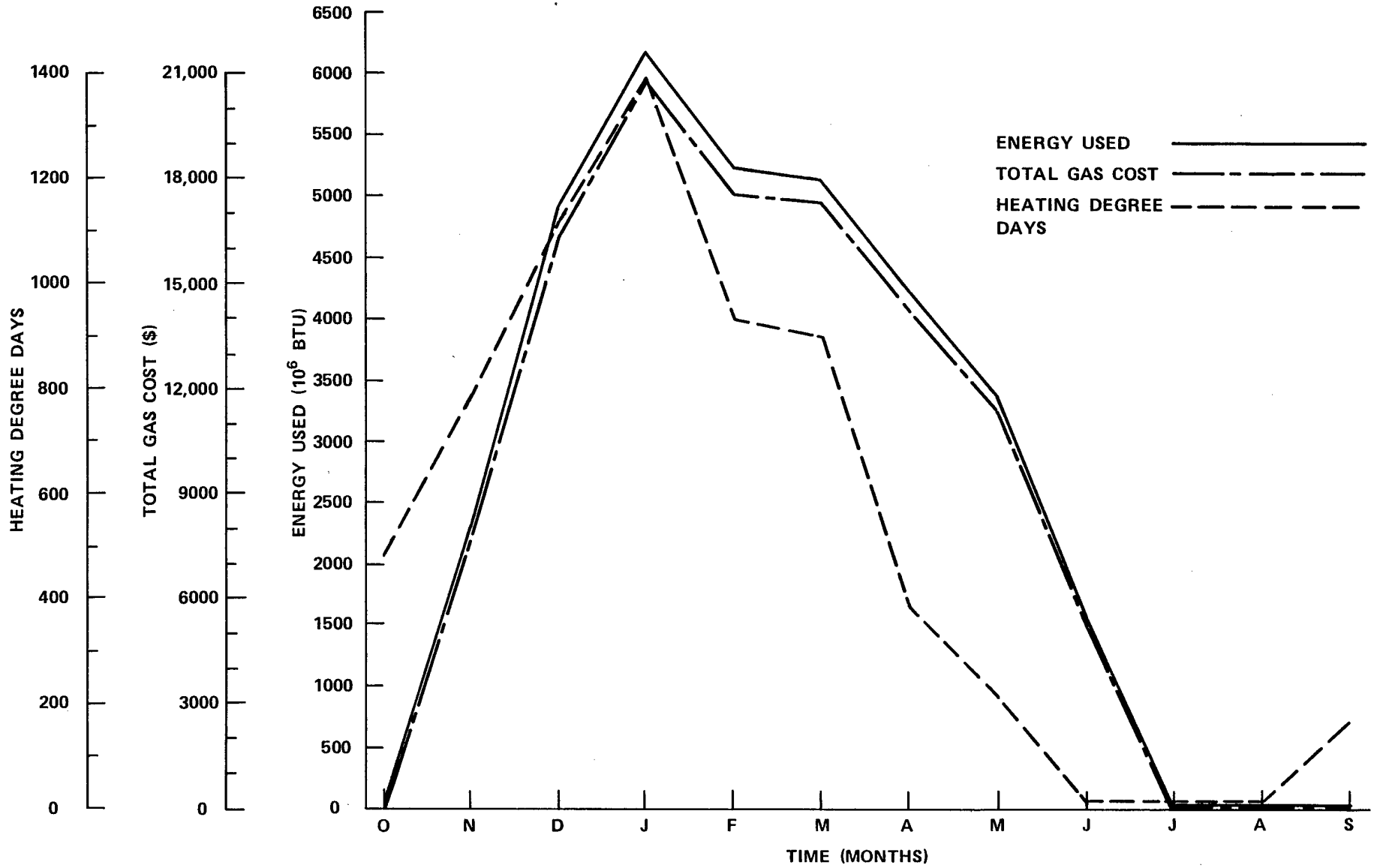

OAKDALE SUPPORT ELEMENT
NATURAL GAS
MAIN BASE: FY 1979
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL GAS COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
1400
2000
4000
6000
8000
10,000
12,000
14,000
16,000
1000
2000
3000
4000
5000
6000
7000
O
N
D
J
F
M
A
M
J
J
A
S


OAKDALE SUPPORT ELEMENT
NATURAL GAS
MAIN BASE: FY 1980
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
1200
1000
800
600
400
200
0
18,000
15,000
12,000
9000
6000
3000
0
6000
5000
4000
3000
2000
1000
0
O
N
D
J
F
M
A
M
J
J
A
S
TIME (MONTHS)
ENERGY USED
TOTAL GAS COST
HEATING DEGREE DAYS

OAKDALE SUPPORT ELEMENT

NATURAL GAS

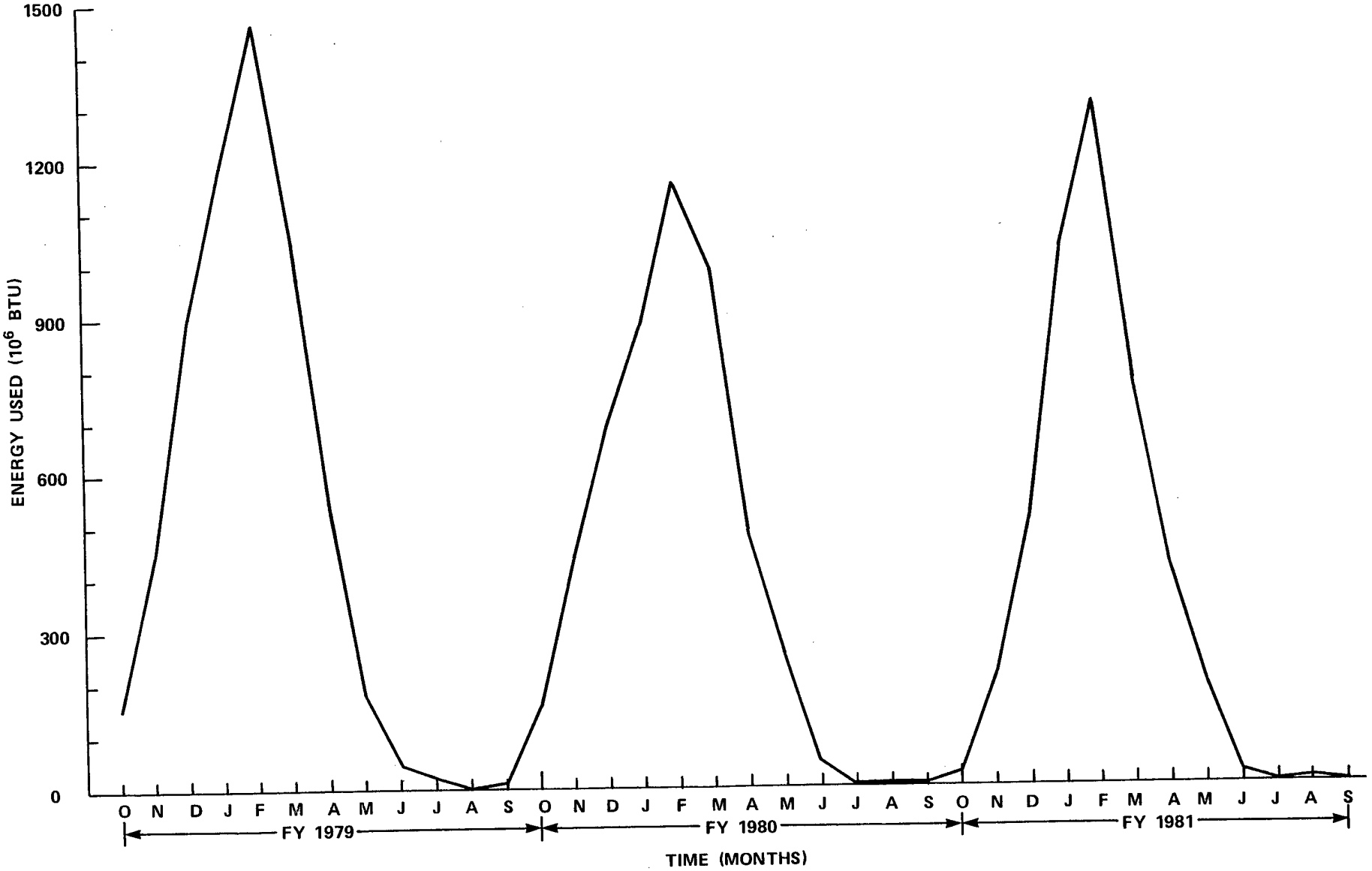
MAIN BASE: FY 1981



OAKDALE SUPPORT ELEMENT

NATURAL GAS

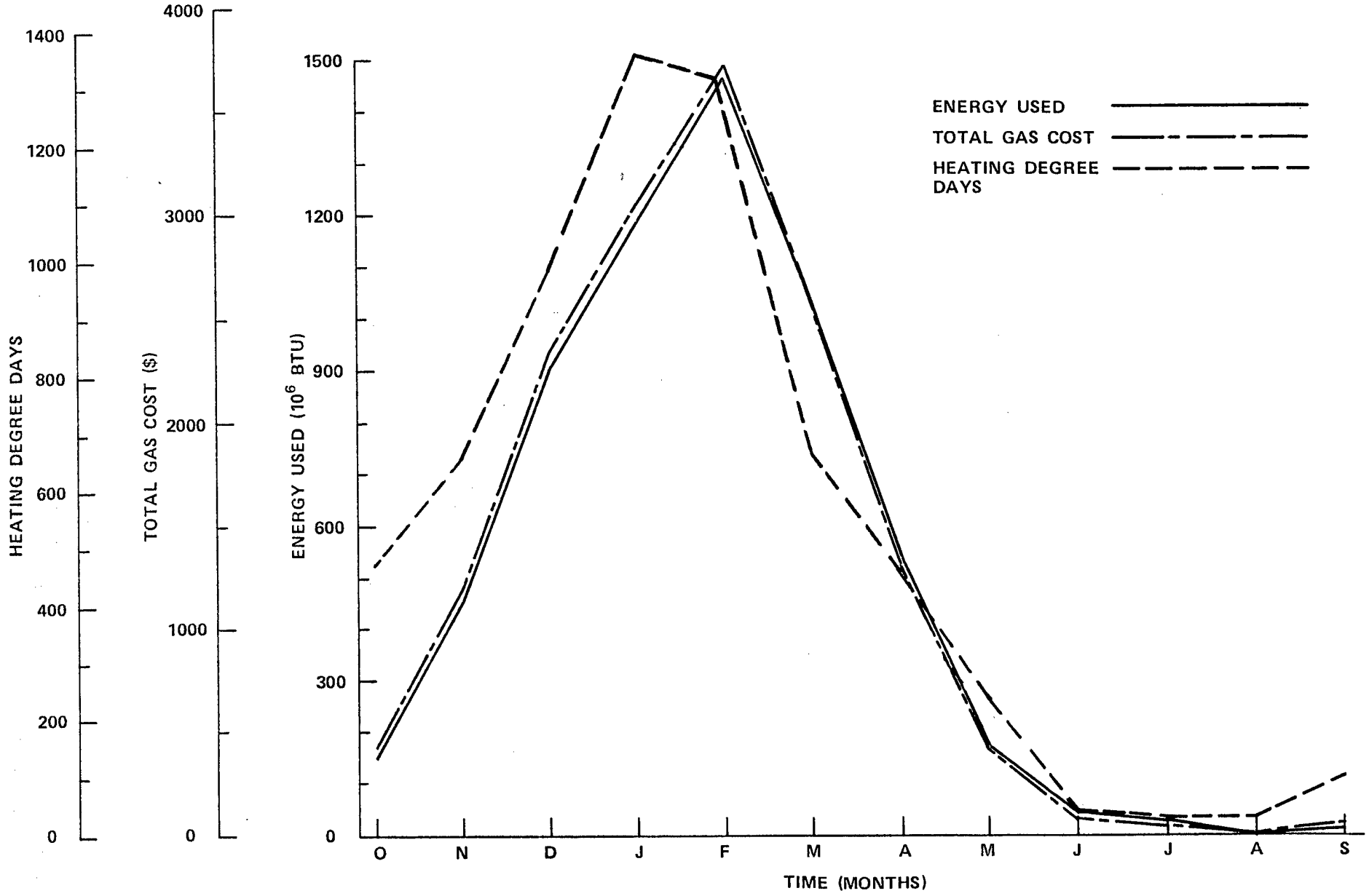
NEVILLE ISLAND: FY 1979 THROUGH 1981



OAKDALE SUPPORT ELEMENT

NATURAL GAS

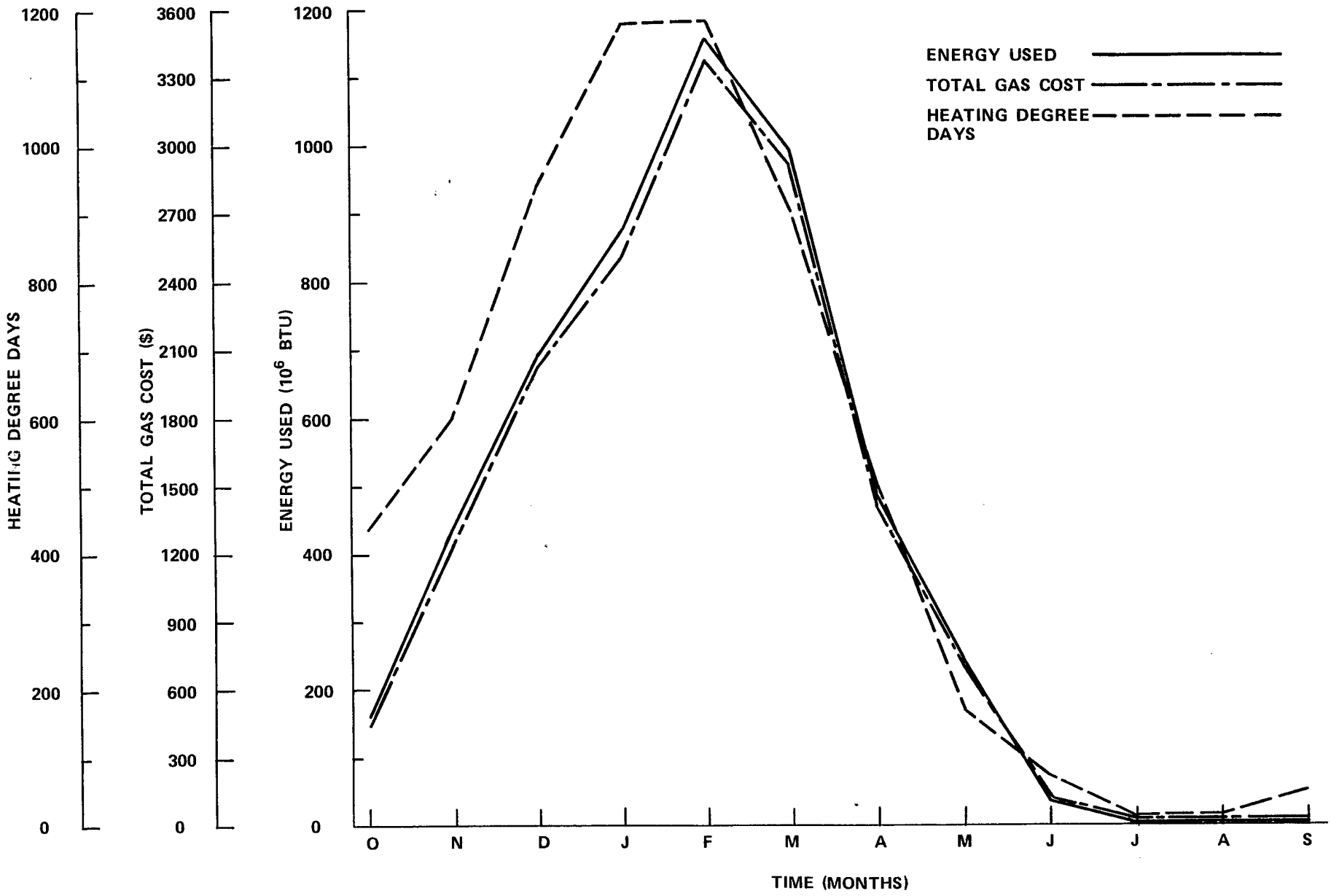
NEVILLE ISLAND: FY 1979

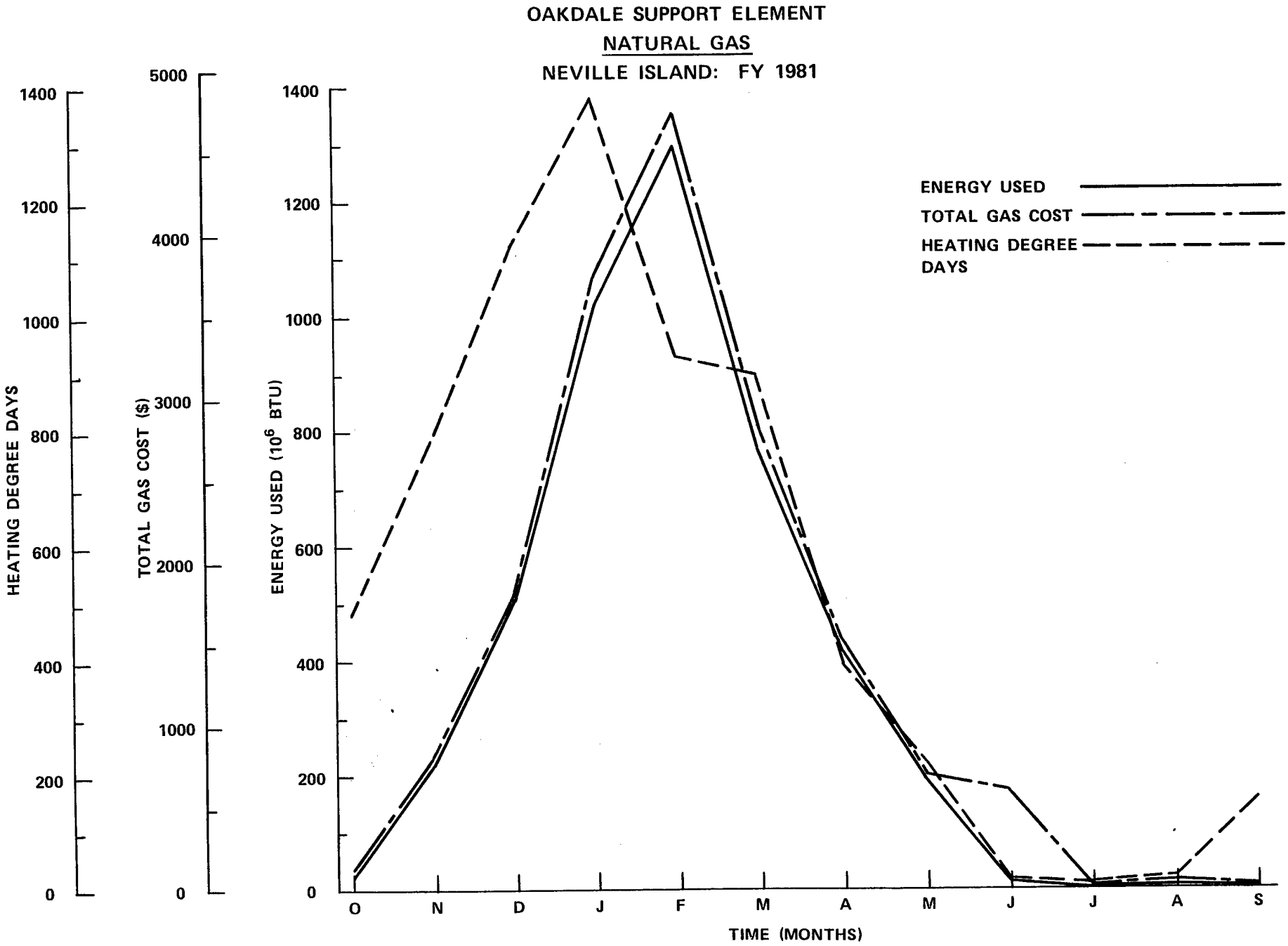


OAKDALE SUPPORT ELEMENT

NATURAL GAS

NEVILLE ISLAND: FY 1980

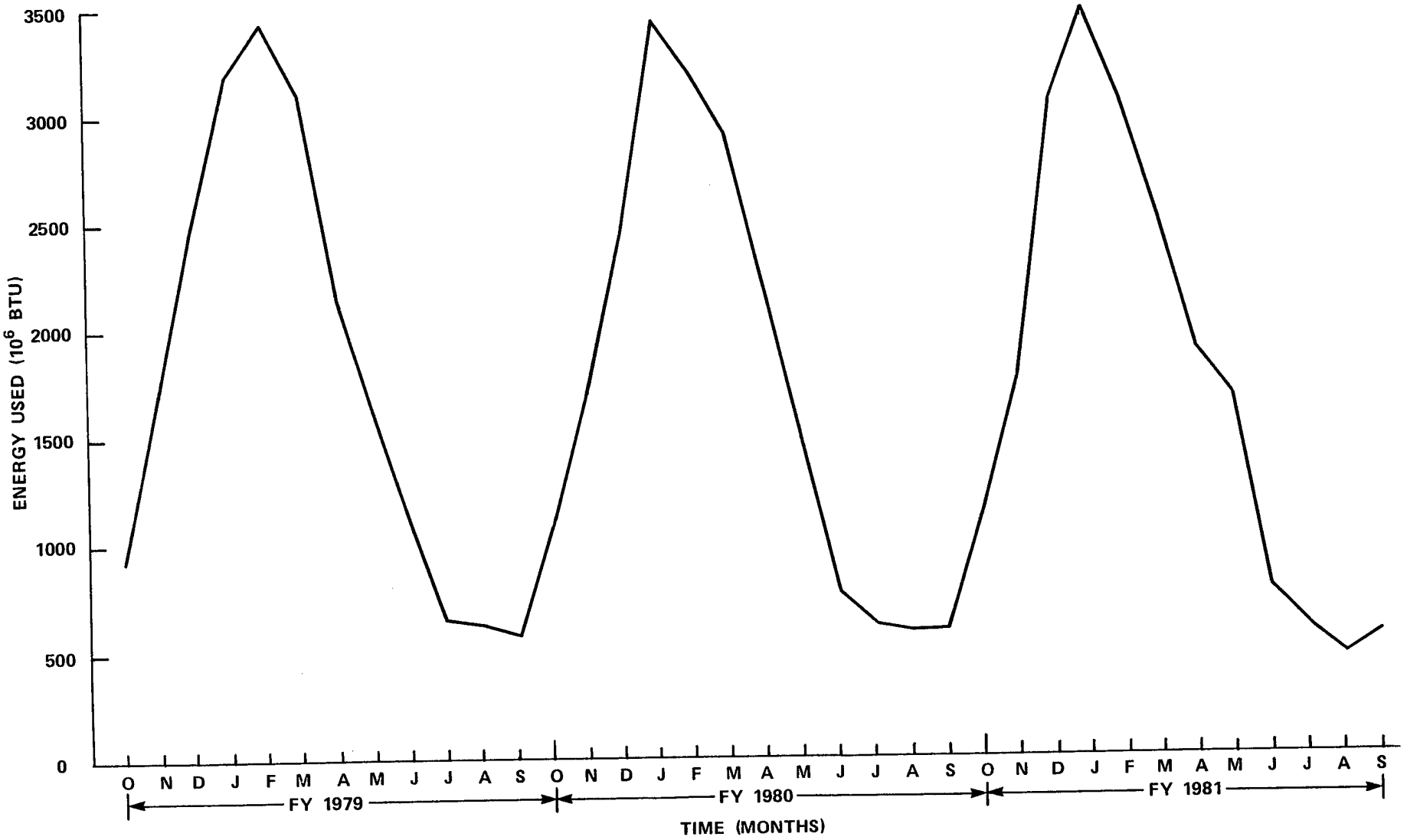



OAKDALE SUPPORT ELEMENT
NATURAL GAS
NEVILLE ISLAND: FY 1981
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
O
N
D
J
F
M
A
M
J
J
A
S
ENERGY USED
TOTAL GAS COST
HEATING DEGREE DAYS

OAKDALE SUPPORT ELEMENT

NATURAL GAS

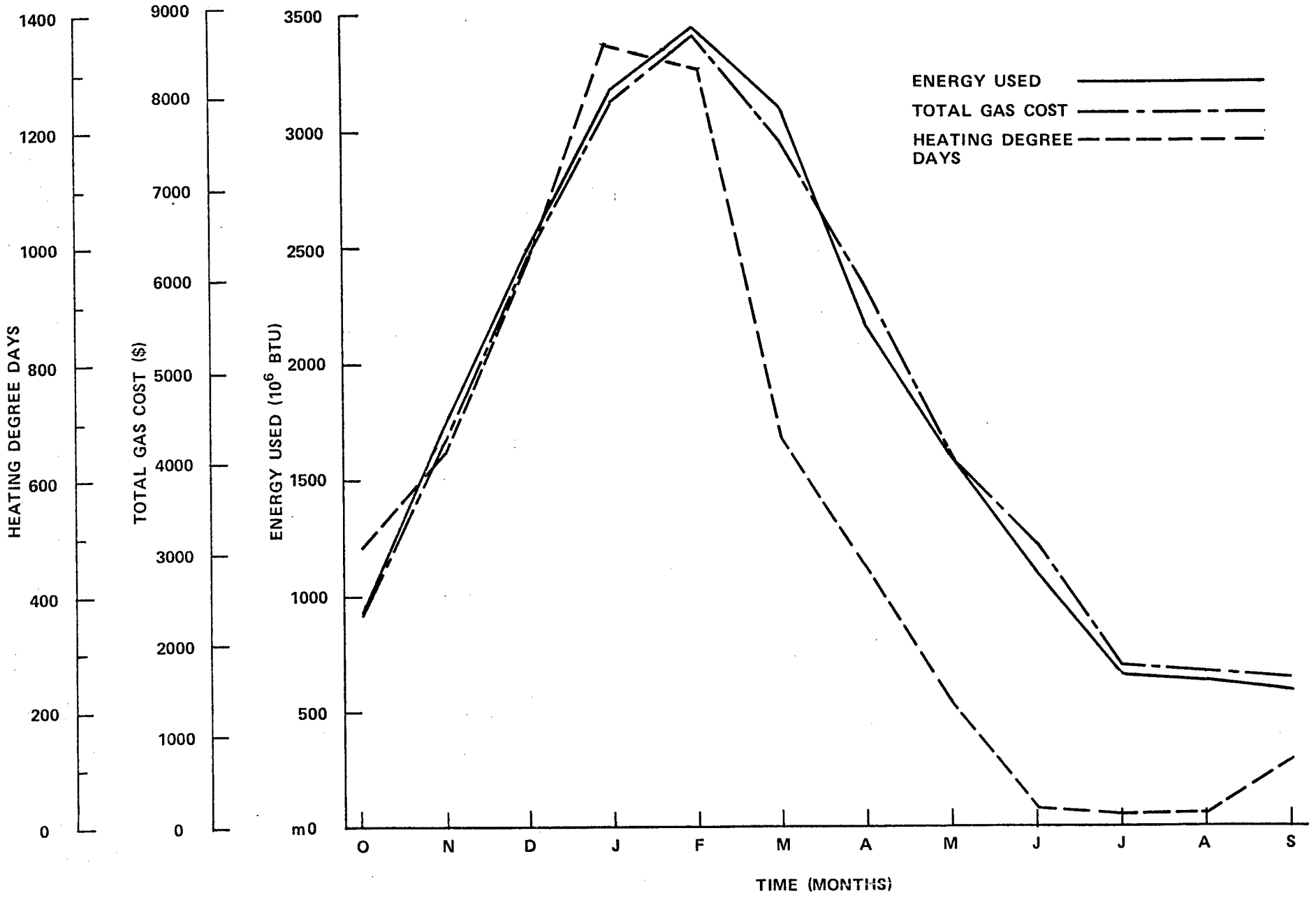
FAMILY HOUSING: FY 1979 THROUGH 1981

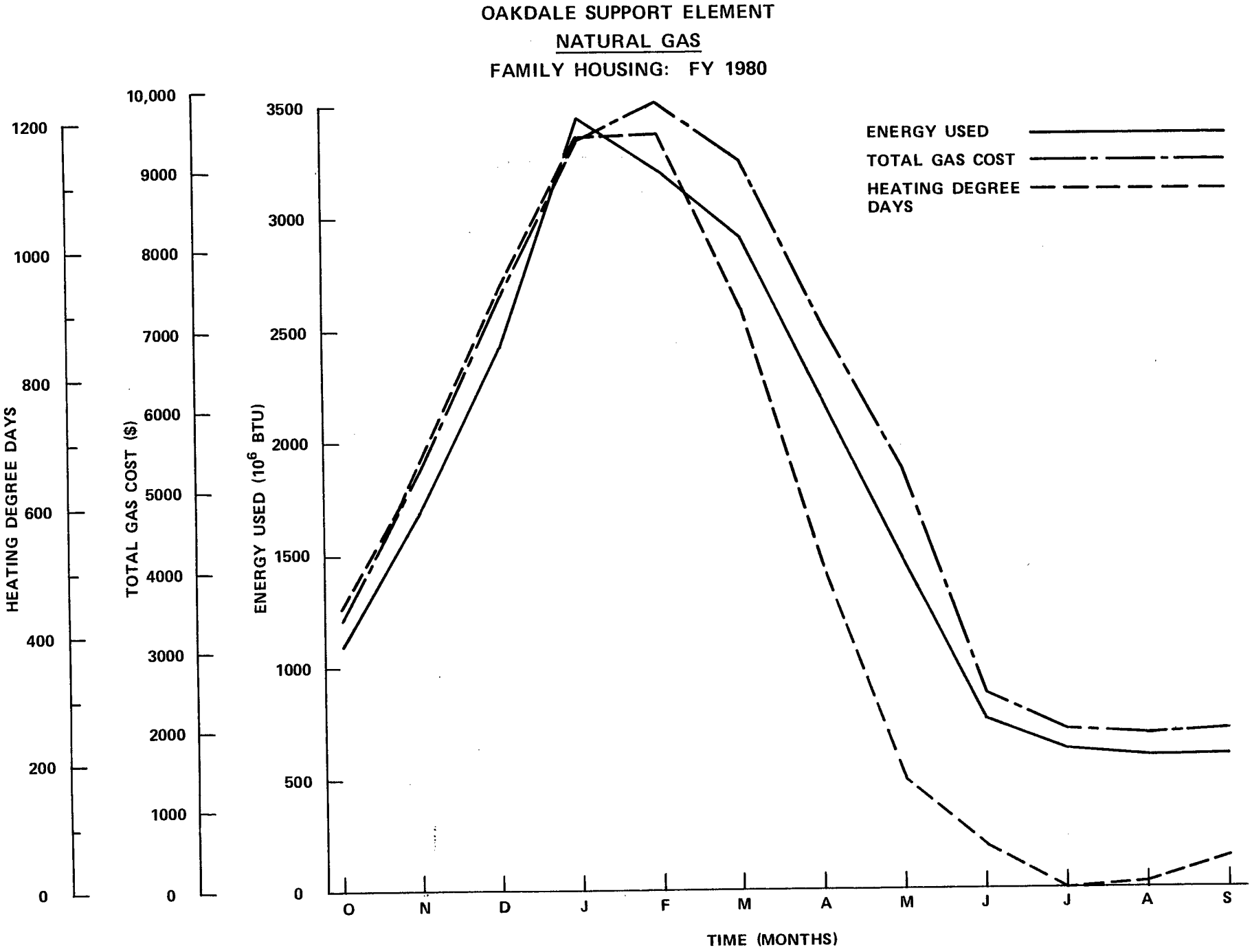


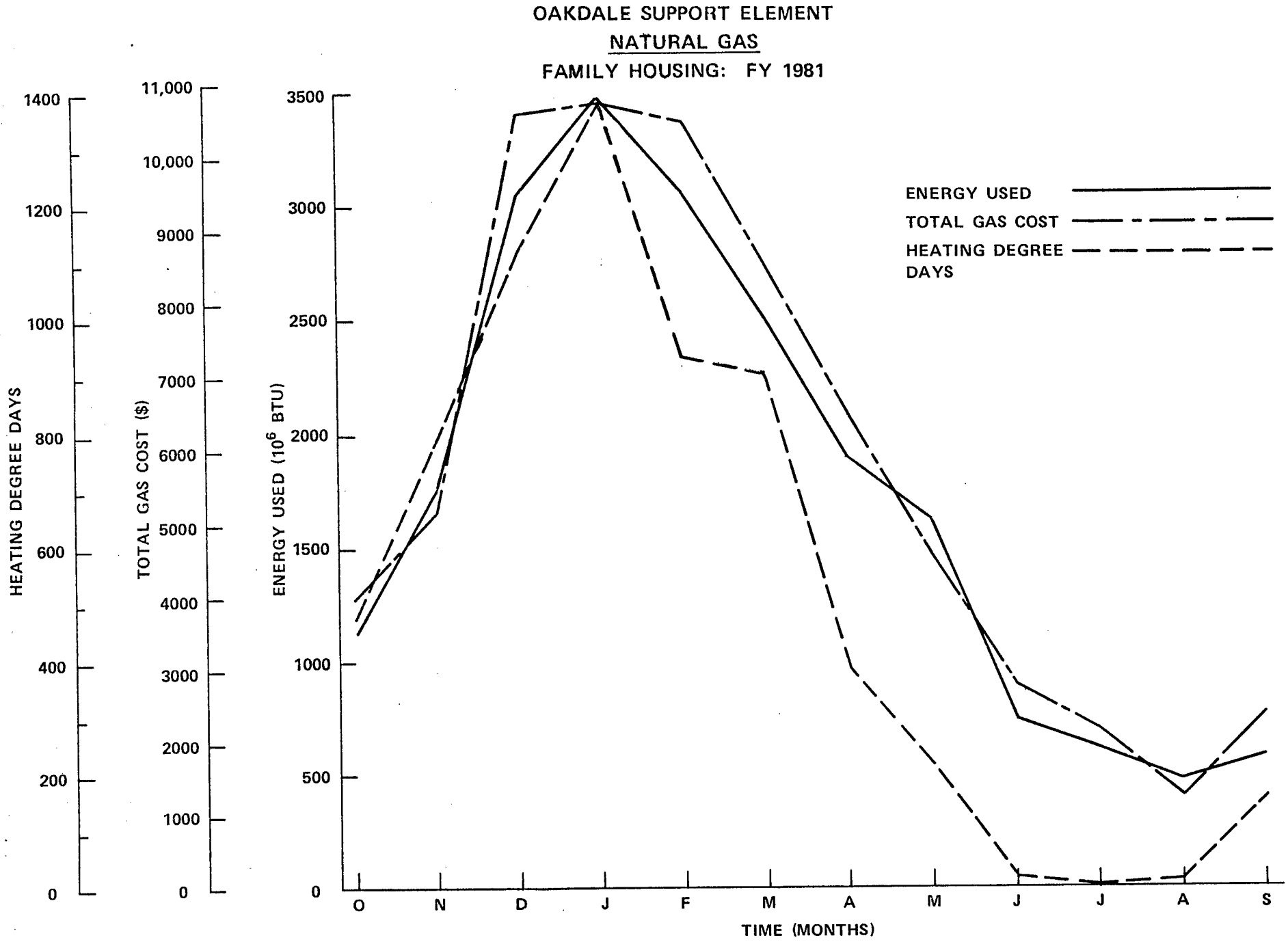
OAKDALE SUPPORT ELEMENT

NATURAL GAS

FAMILY HOUSING: FY 1979



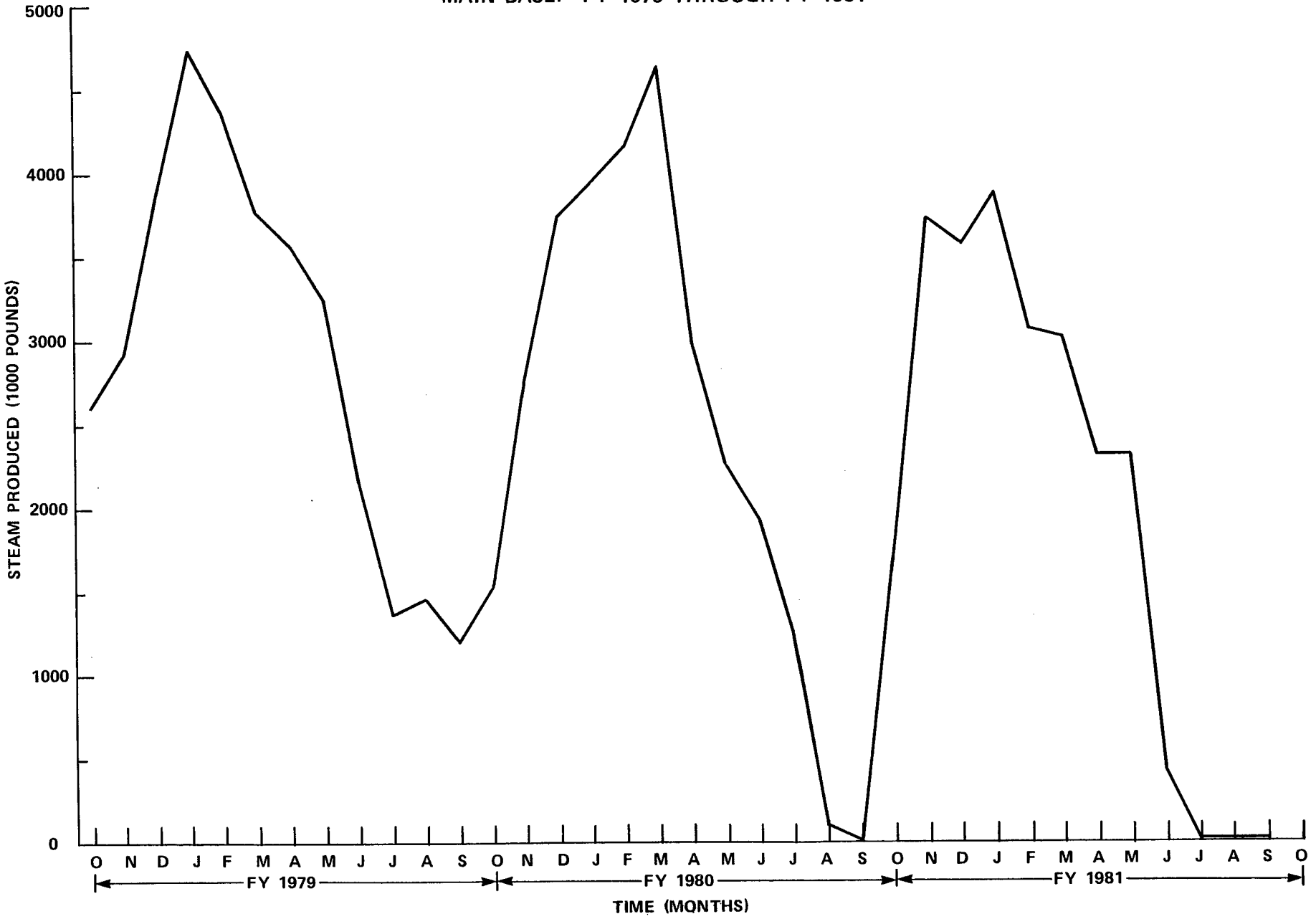

OAKDALE SUPPORT ELEMENT
NATURAL GAS
FAMILY HOUSING: FY 1980
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL GAS COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
0
500
1000
1500
2000
2500
3000
3500
O
N
D
J
F
M
A
M
J
J
A
S


OAKDALE SUPPORT ELEMENT
NATURAL GAS
FAMILY HOUSING: FY 1981
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL GAS COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
1400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
11,000
0
500
1000
1500
2000
2500
3000
3500
O
N
D
J
F
M
A
M
J
J
A
S

OAKDALE SUPPORT ELEMENT

STEAM

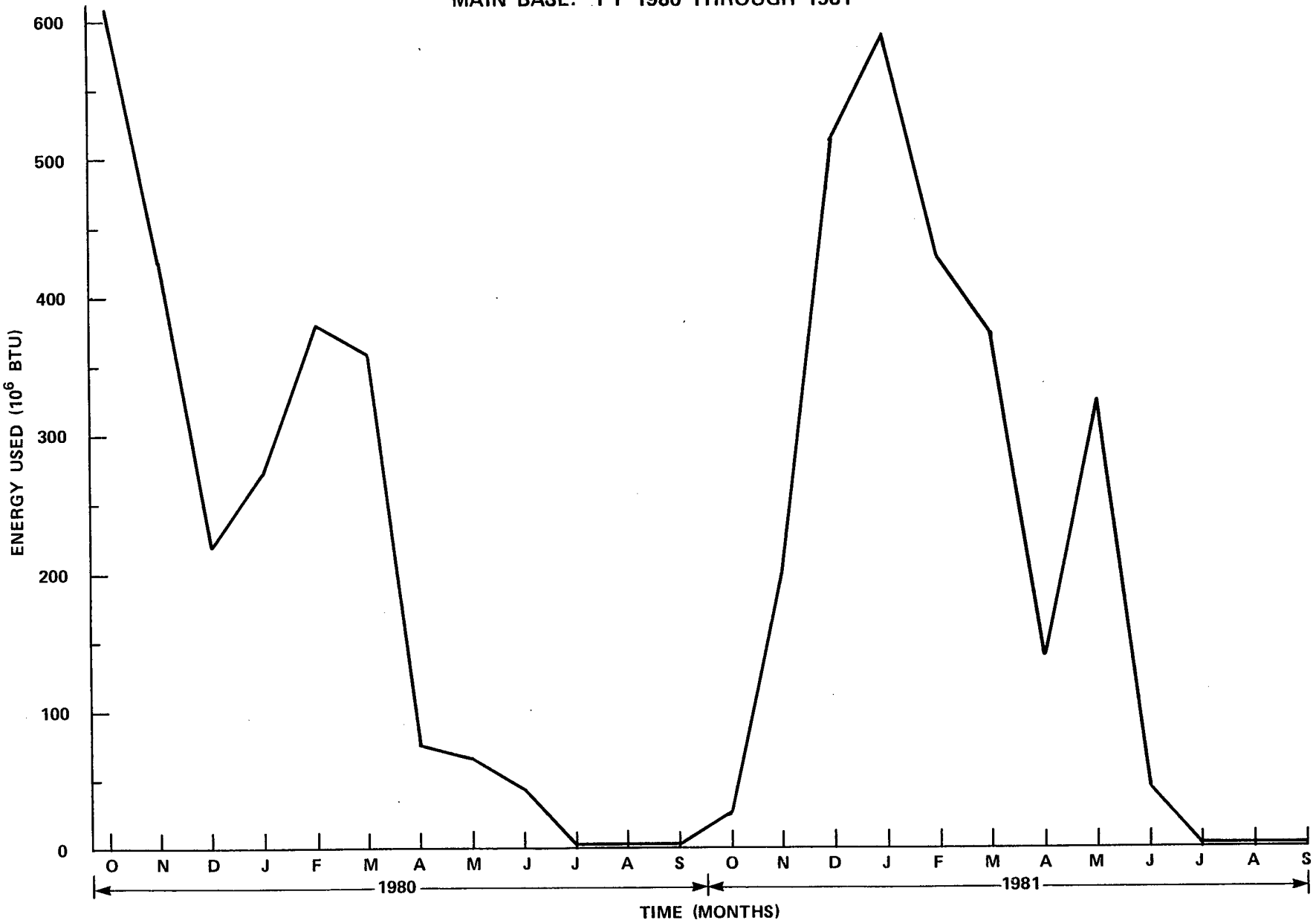
MAIN BASE: FY 1979 THROUGH FY 1981

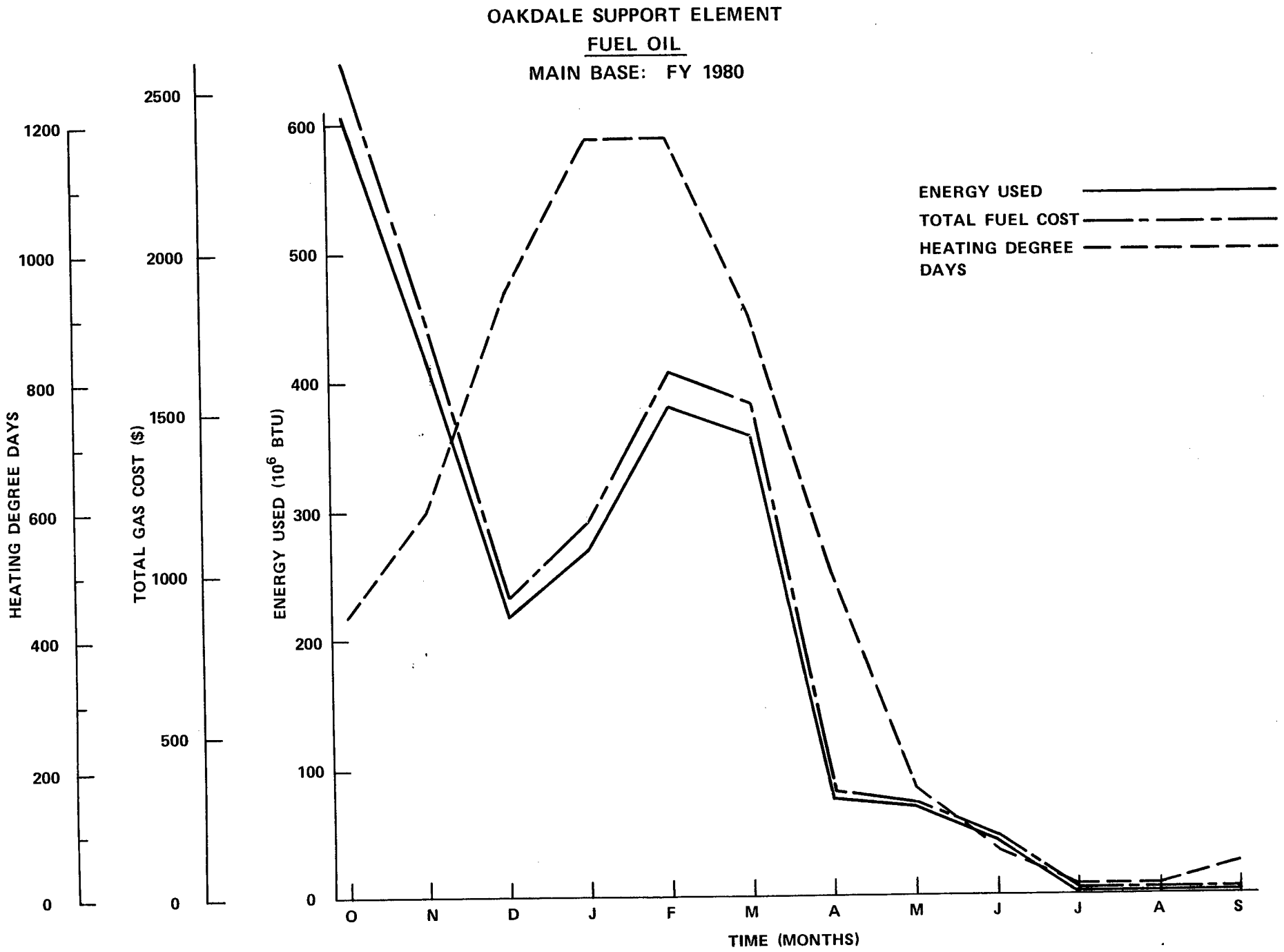


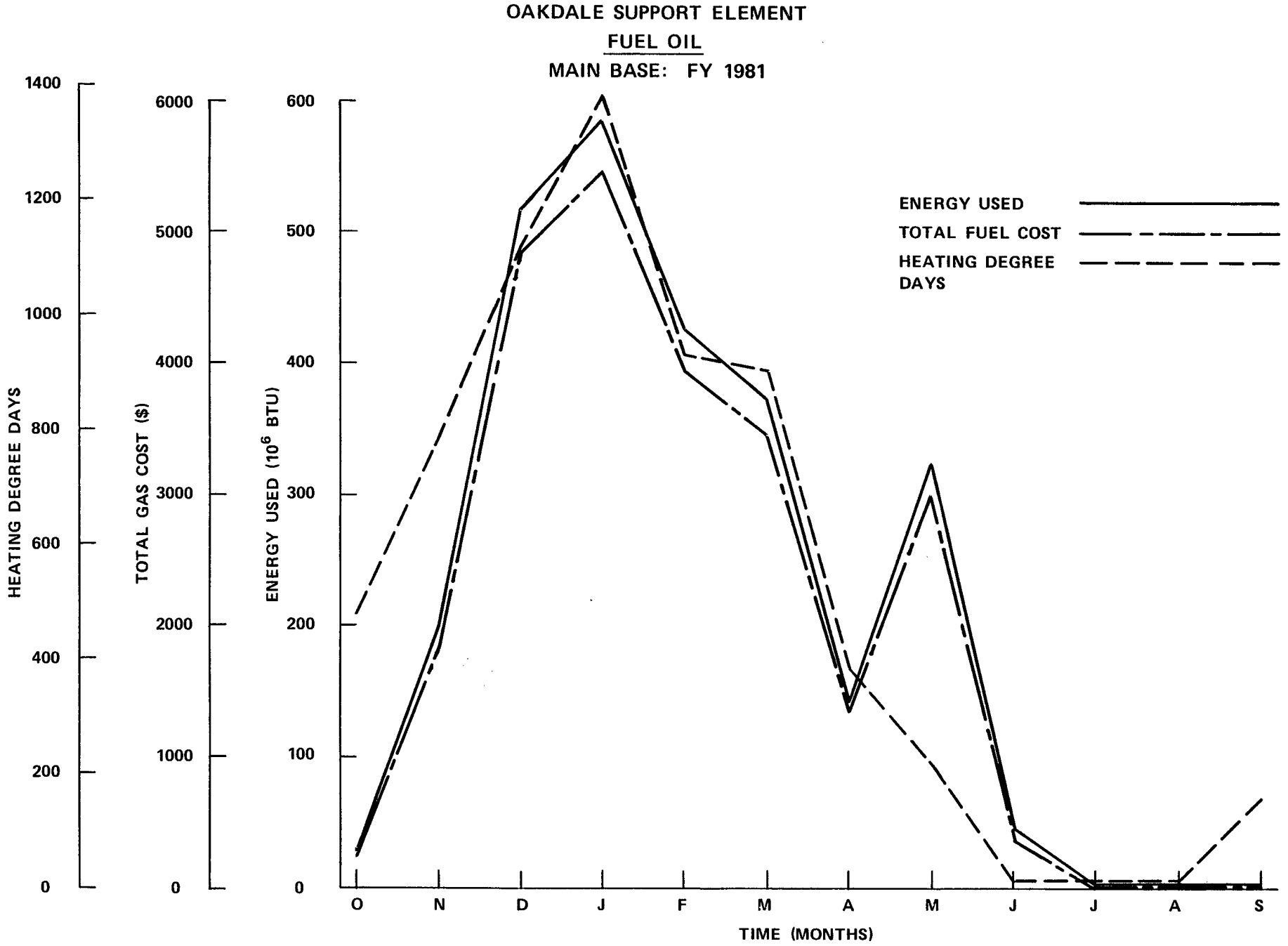
OAKDALE SUPPORT ELEMENT

FUEL OIL

MAIN BASE: FY 1980 THROUGH 1981



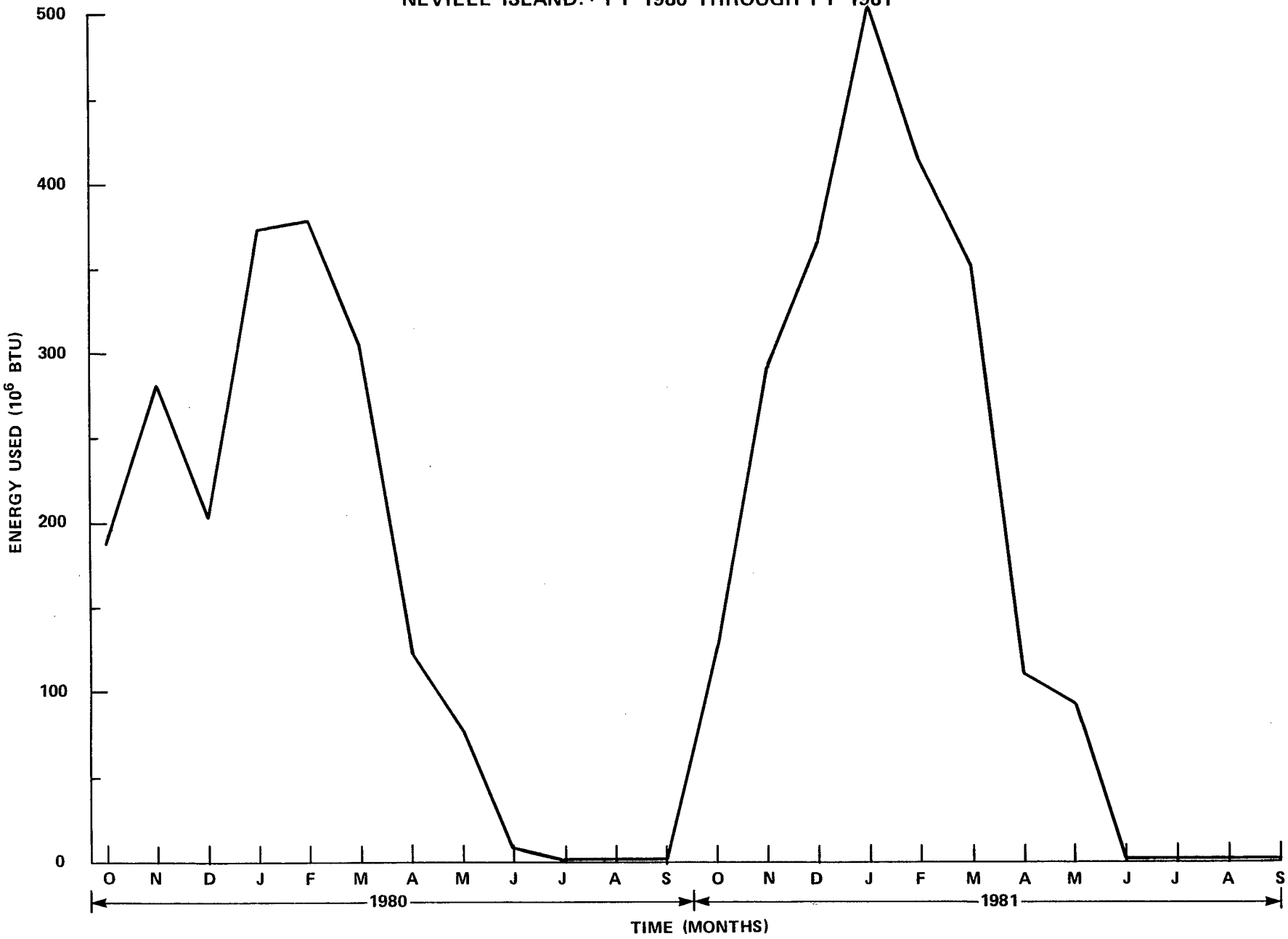

OAKDALE SUPPORT ELEMENT
FUEL OIL
MAIN BASE: FY 1980
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL FUEL COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
500
1000
1500
2000
2500
100
200
300
400
500
600
O
N
D
J
F
M
A
M
J
J
A
S


OAKDALE SUPPORT ELEMENT
FUEL OIL
MAIN BASE: FY 1981
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
1400
1200
1000
800
600
400
200
0
6000
5000
4000
3000
2000
1000
0
600
500
400
300
200
100
0
O
N
D
J
F
M
A
M
J
J
A
S
TIME (MONTHS)
ENERGY USED
TOTAL FUEL COST
HEATING DEGREE DAYS

OAKDALE SUPPORT ELEMENT

FUEL OIL

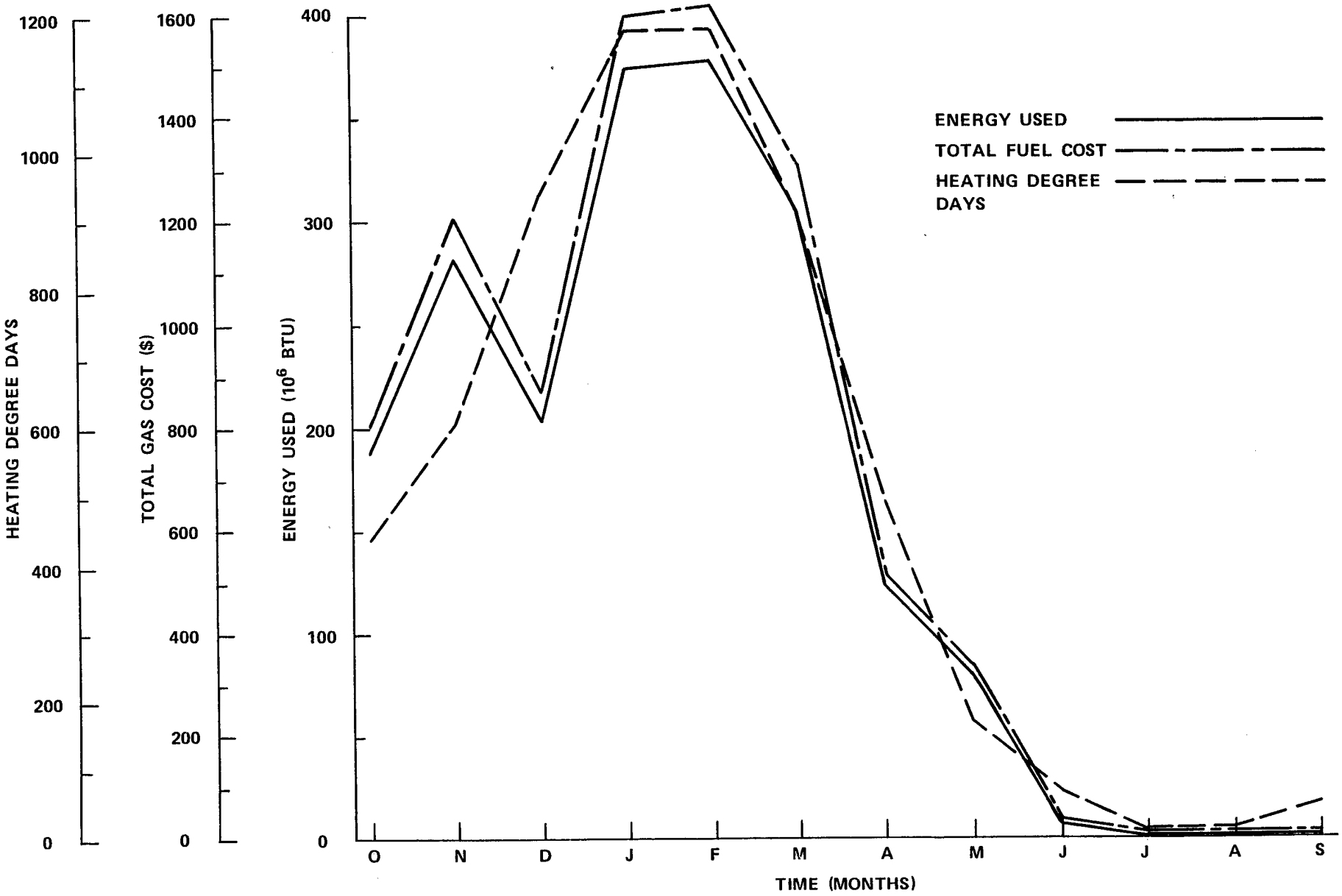
NEVILLE ISLAND: FY 1980 THROUGH FY 1981

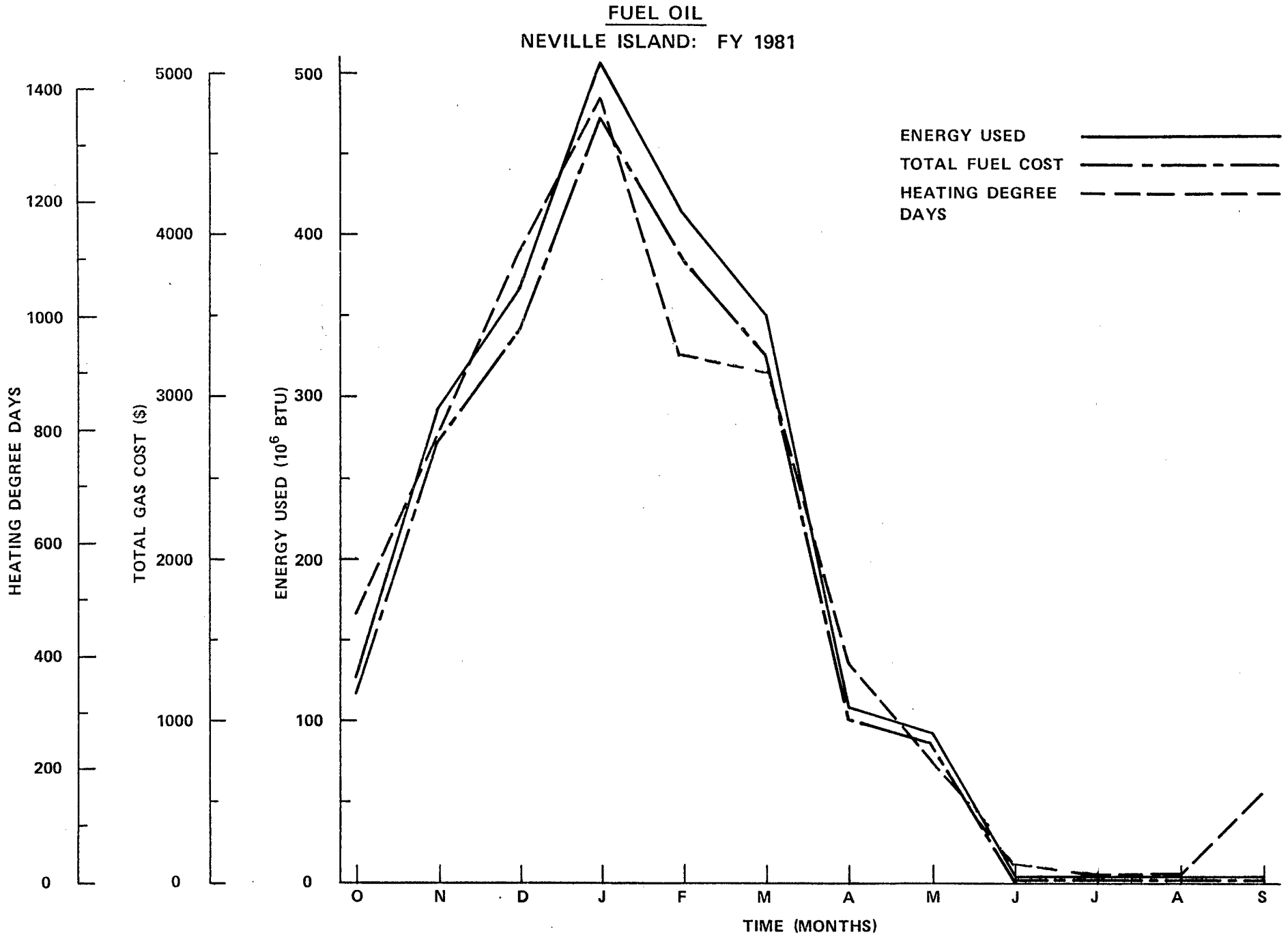


OAKDALE SUPPORT ELEMENT

FUEL OIL

NEVILLE ISLAND: FY 1980

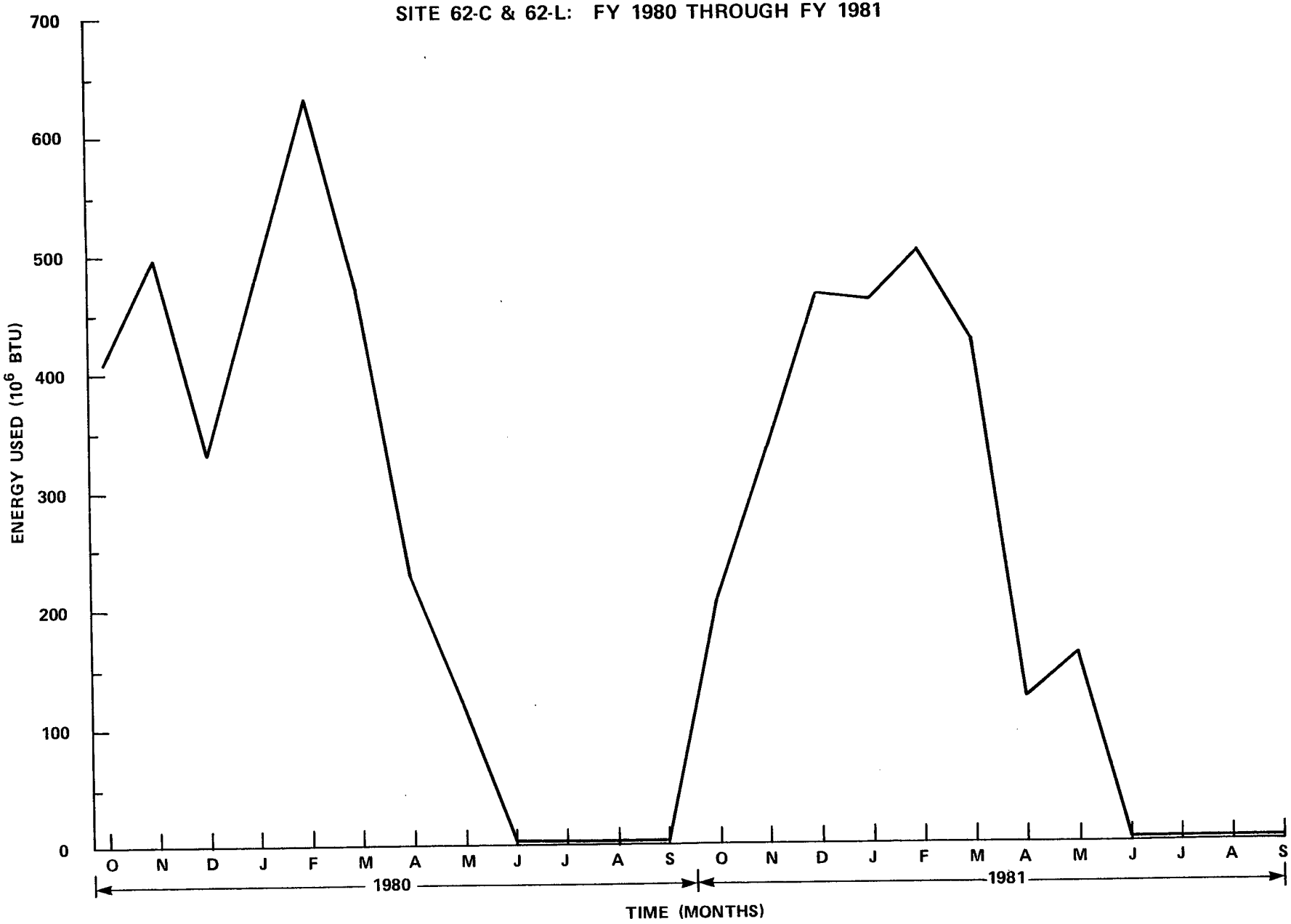


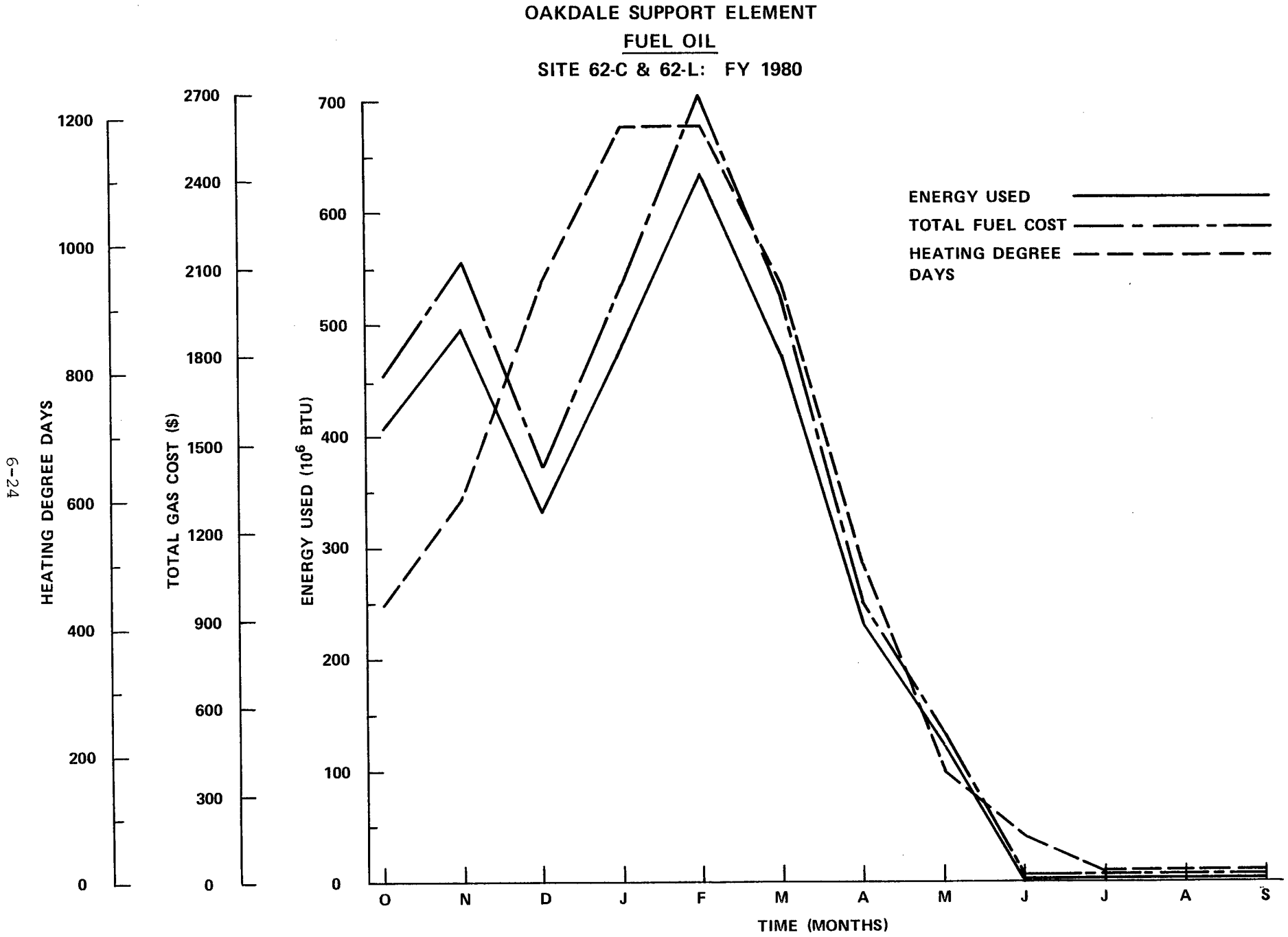

FUEL OIL
NEVILLE ISLAND: FY 1981
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL FUEL COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
1400
1000
2000
3000
4000
5000
100
200
300
400
500
O
N
D
J
F
M
A
M
J
J
A
S

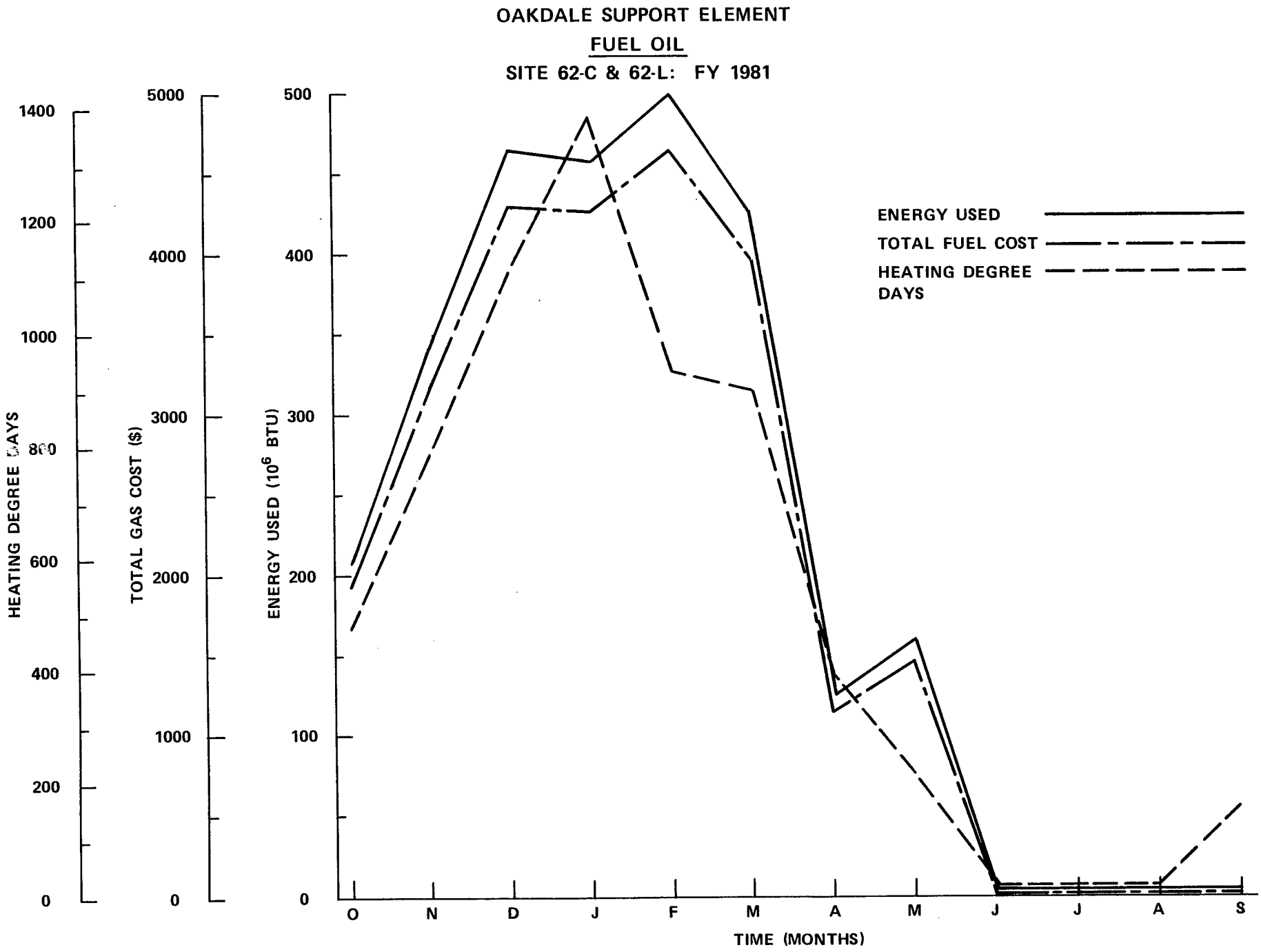
OAKDALE SUPPORT ELEMENT

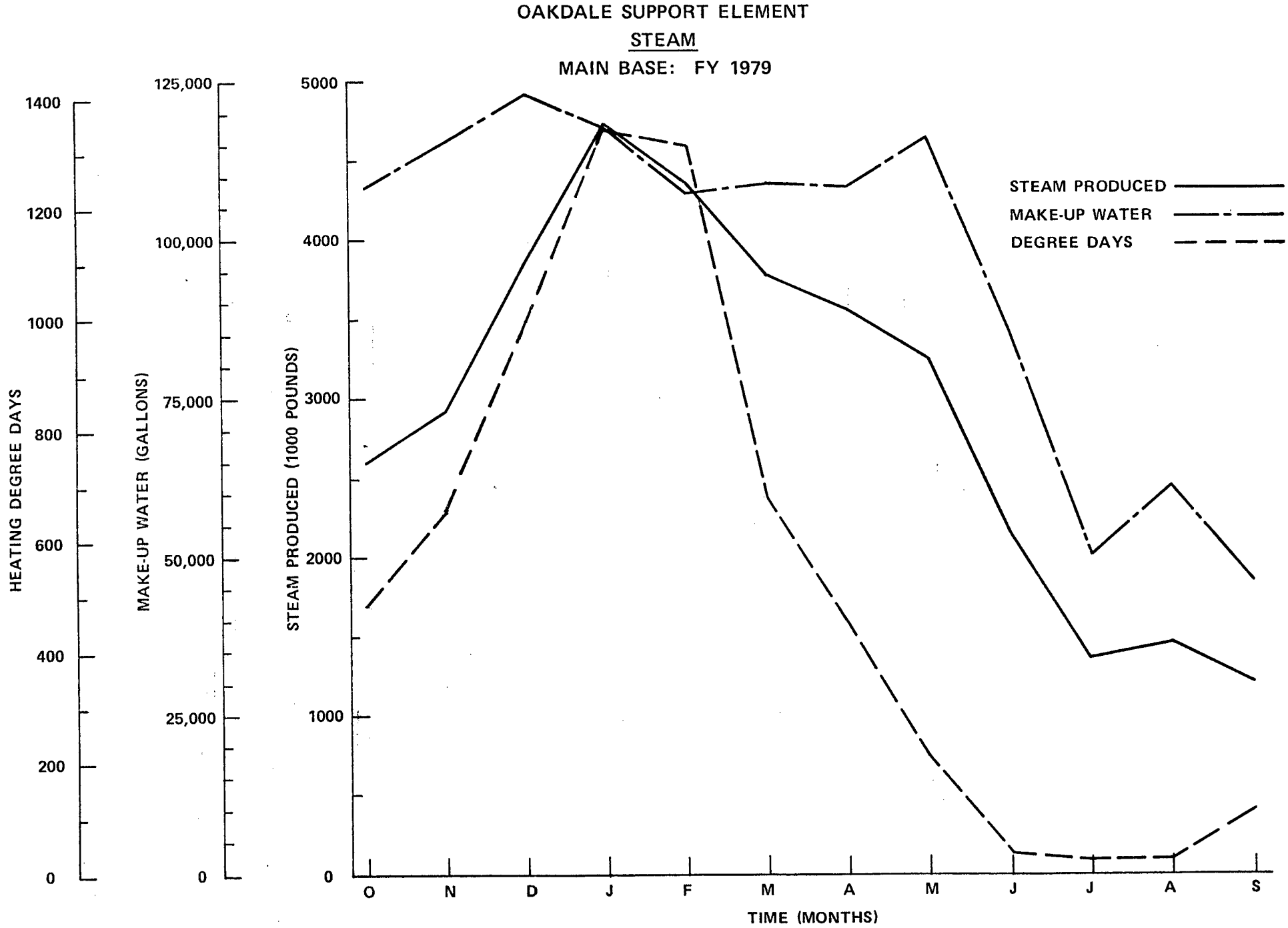
FUEL OIL

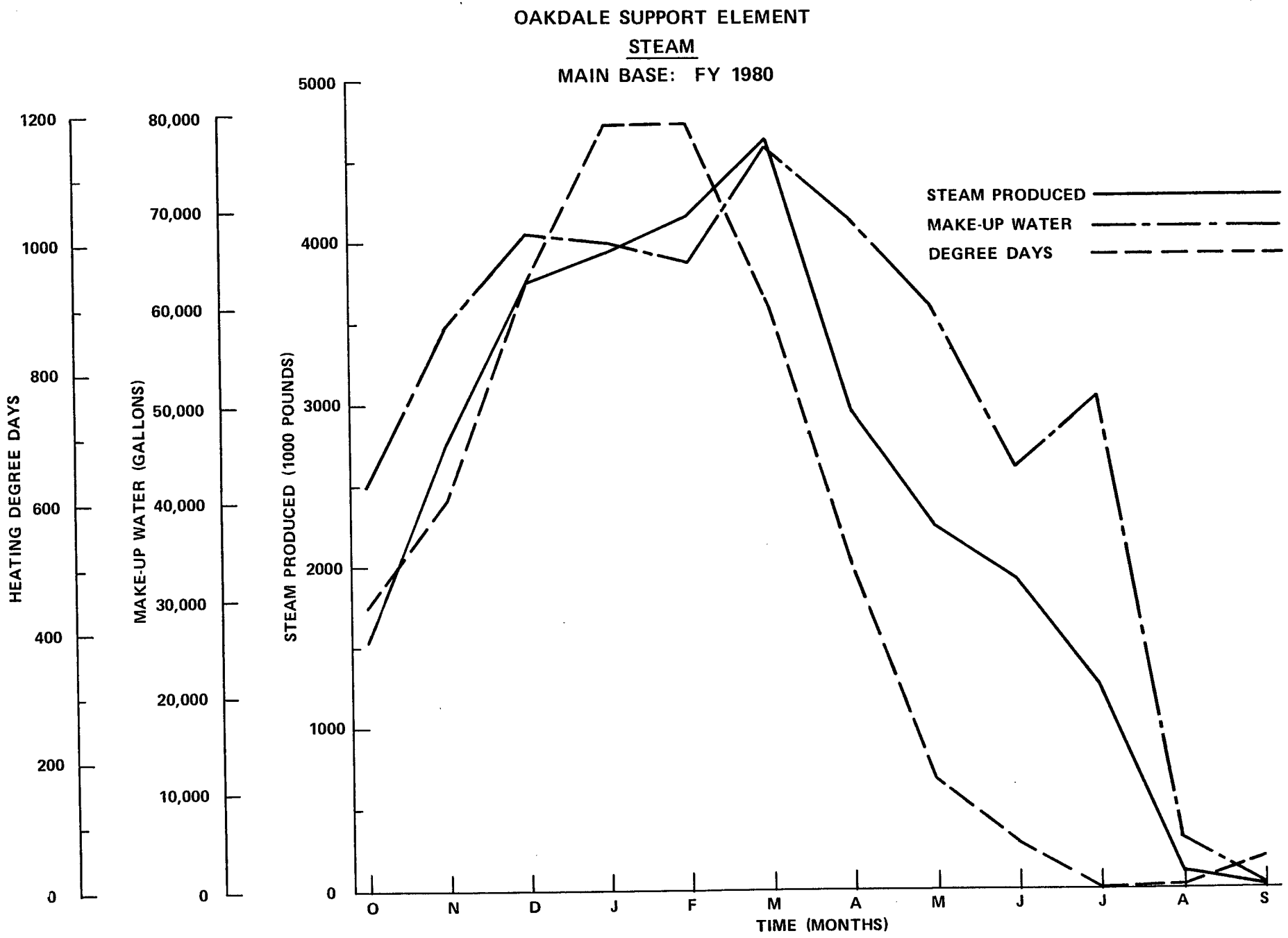
SITE 62-C & 62-L: FY 1980 THROUGH FY 1981




OAKDALE SUPPORT ELEMENT
FUEL OIL
SITE 62-C & 62-L: FY 1980
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL FUEL COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
0
300
600
900
1200
1500
1800
2100
2400
2700
0
100
200
300
400
500
600
700
O
N
D
J
F
M
A
M
J
J
A
S


OAKDALE SUPPORT ELEMENT
FUEL OIL
SITE 62-C & 62-L: FY 1981
HEATING DEGREE DAYS
TOTAL GAS COST ($)
ENERGY USED (10^6 BTU)
TIME (MONTHS)
ENERGY USED
TOTAL FUEL COST
HEATING DEGREE DAYS
0
200
400
600
800
1000
1200
1400
0
1000
2000
3000
4000
5000
0
100
200
300
400
500
O
N
D
J
F
M
A
M
J
J
A
S

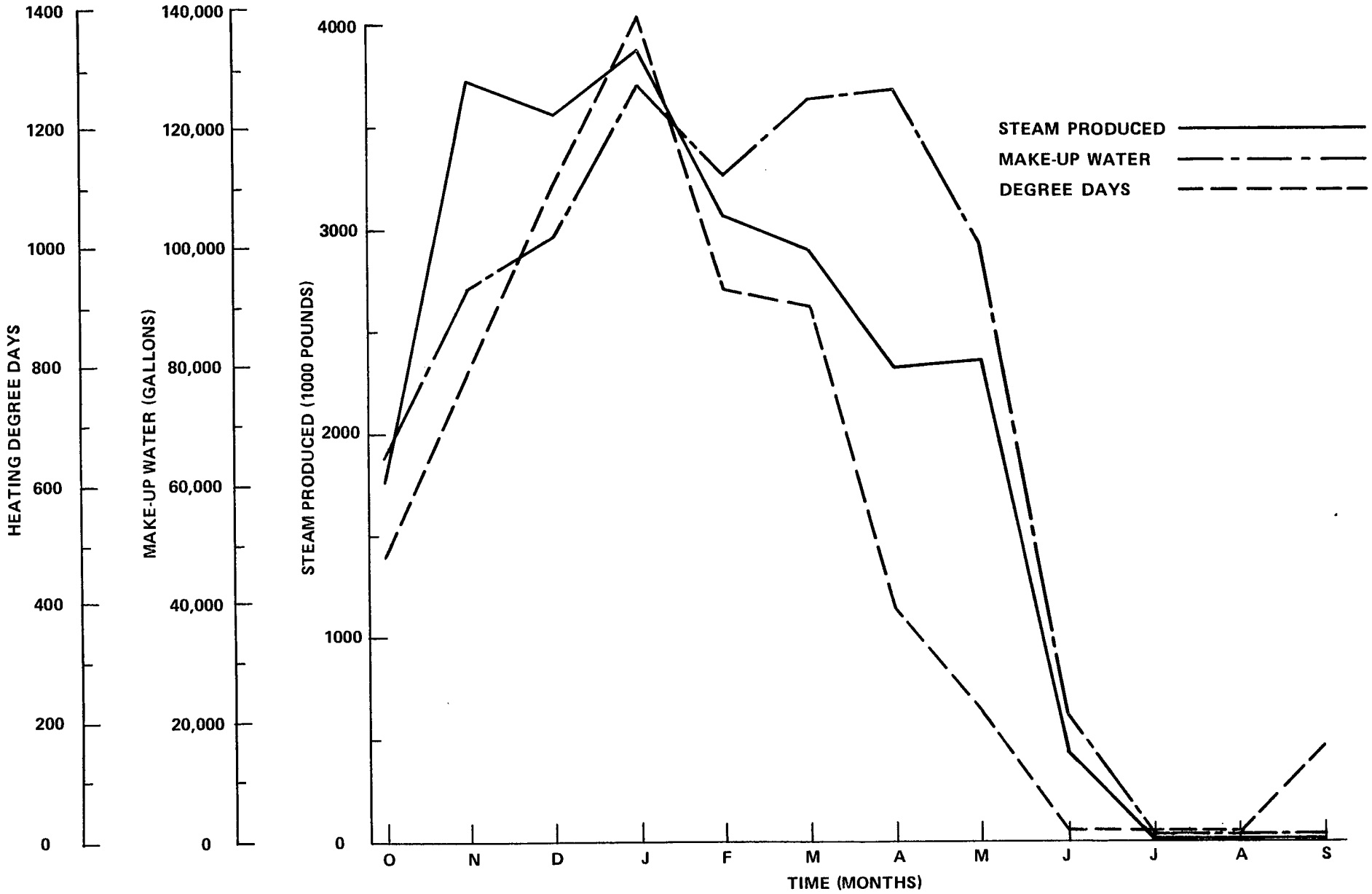

OAKDALE SUPPORT ELEMENT
STEAM
MAIN BASE: FY 1979
HEATING DEGREE DAYS
MAKE-UP WATER (GALLONS)
STEAM PRODUCED (1000 POUNDS)
TIME (MONTHS)
STEAM PRODUCED
MAKE-UP WATER
DEGREE DAYS
0
200
400
600
800
1000
1200
1400
0
25,000
50,000
75,000
100,000
125,000
0
1000
2000
3000
4000
5000
O
N
D
J
F
M
A
M
J
J
A
S

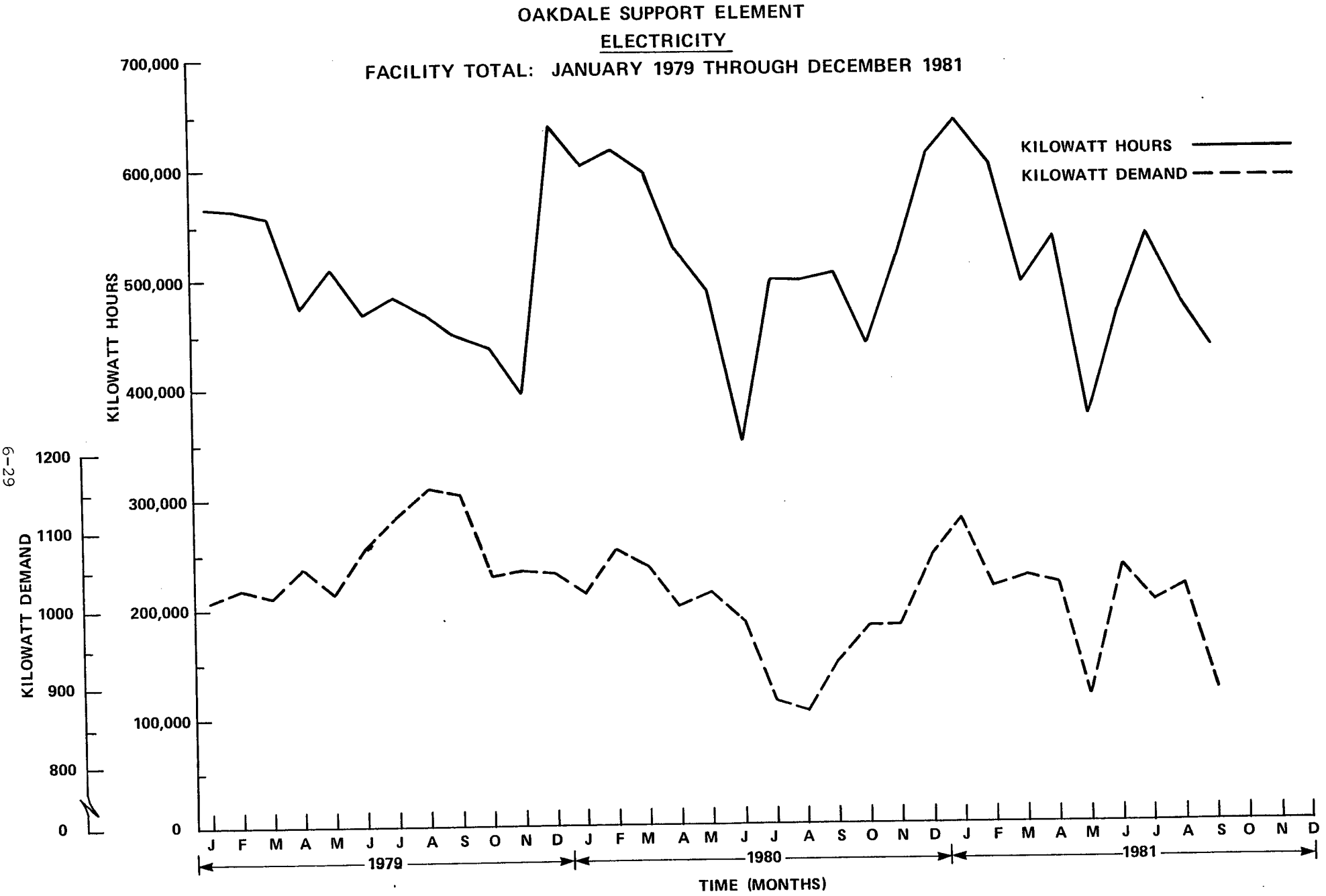

OAKDALE SUPPORT ELEMENT
STEAM
MAIN BASE: FY 1980
HEATING DEGREE DAYS
MAKE-UP WATER (GALLONS)
STEAM PRODUCED (1000 POUNDS)
TIME (MONTHS)
STEAM PRODUCED
MAKE-UP WATER
DEGREE DAYS
0
200
400
600
800
1000
1200
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
1000
2000
3000
4000
5000
O
N
D
J
F
M
A
M
J
J
A
S

OAKDALE SUPPORT ELEMENT

STEAM

MAIN BASE: FY 1981

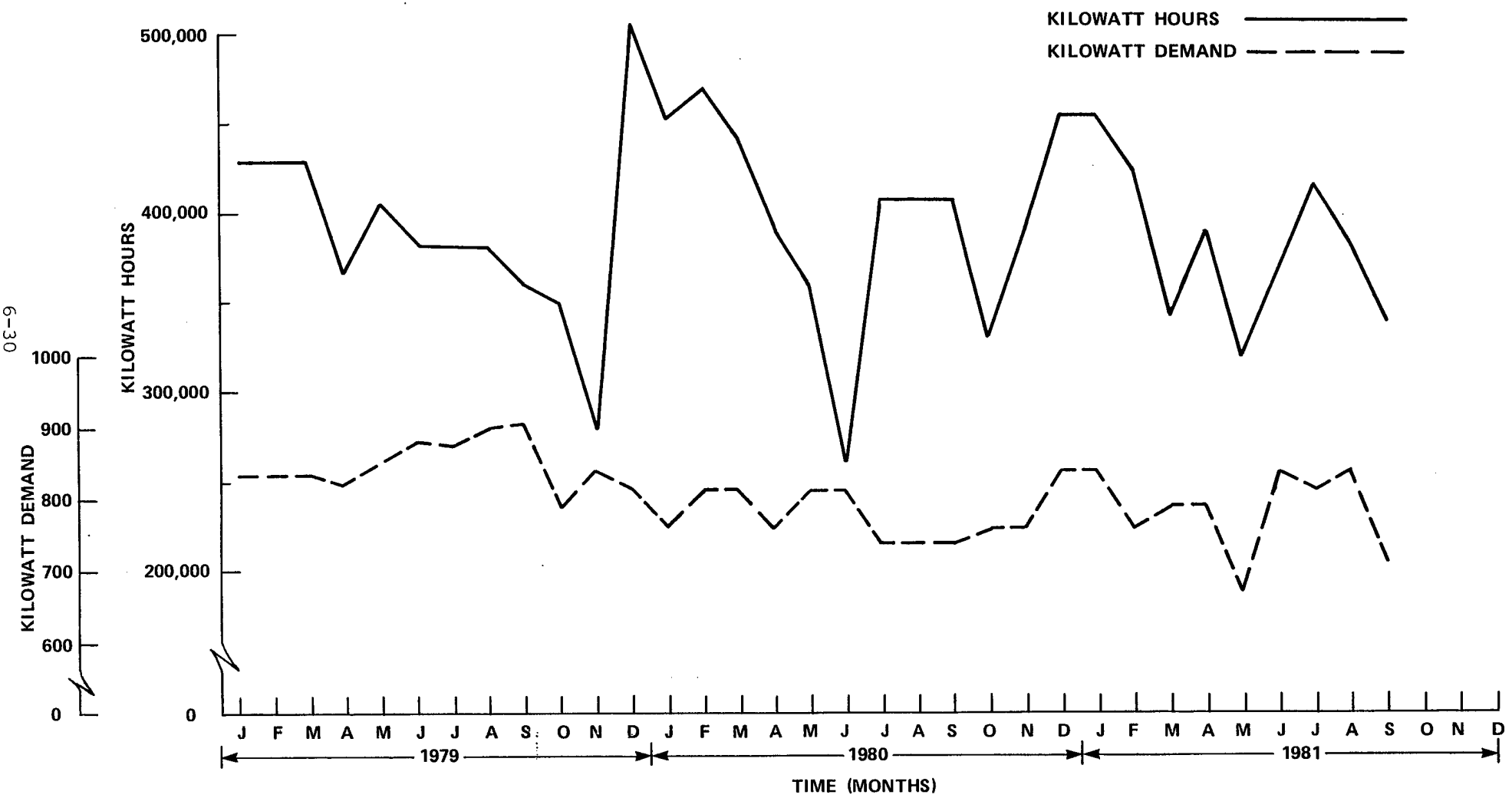



OAKDALE SUPPORT ELEMENT
ELECTRICITY
FACILITY TOTAL: JANUARY 1979 THROUGH DECEMBER 1981
KILOWATT HOURS
KILOWATT DEMAND
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1200
1100
1000
900
800
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1979
1980
1981
TIME (MONTHS)

OAKDALE SUPPORT ELEMENT

ELECTRICITY

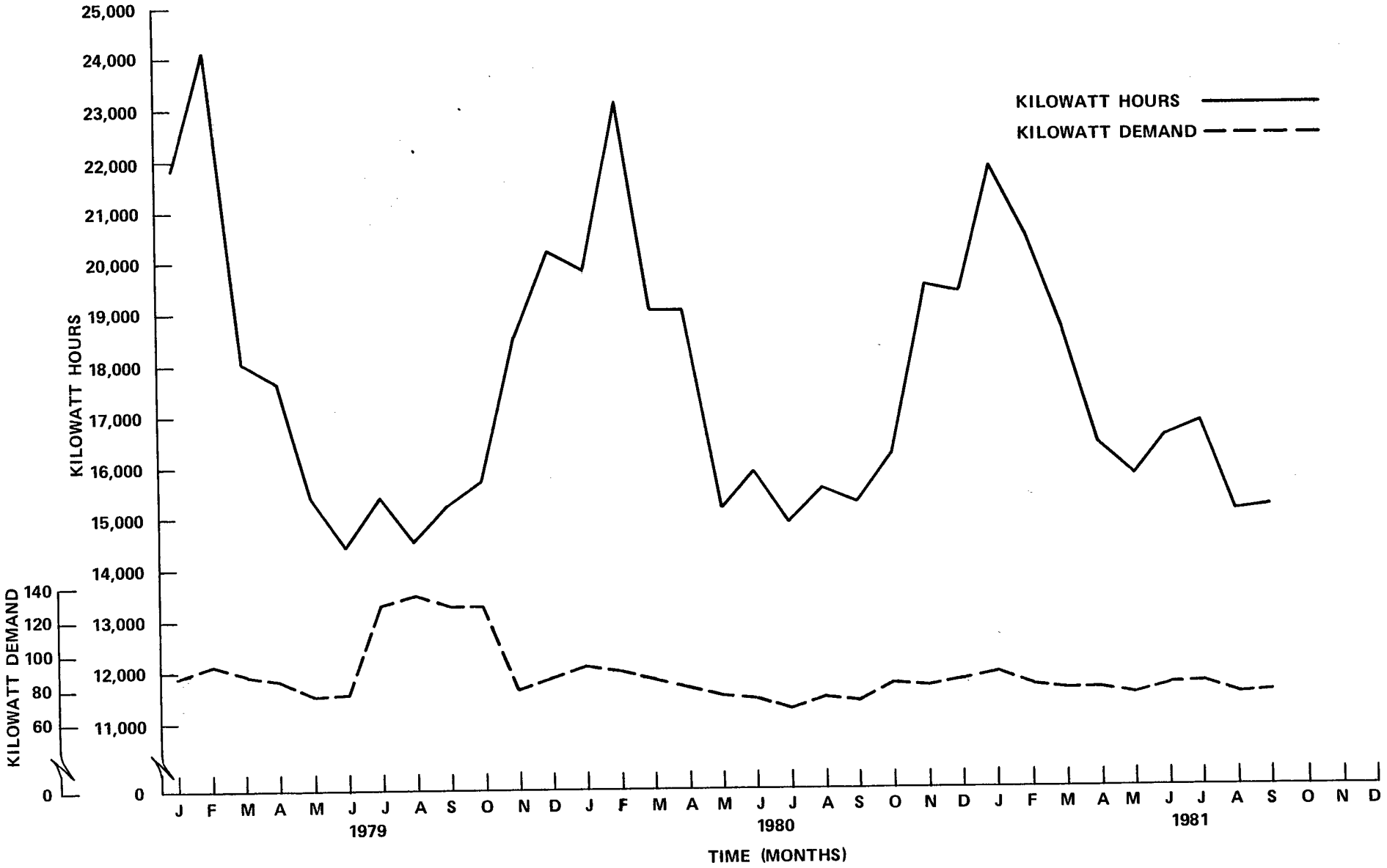
MAIN BASE: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

ELECTRICITY

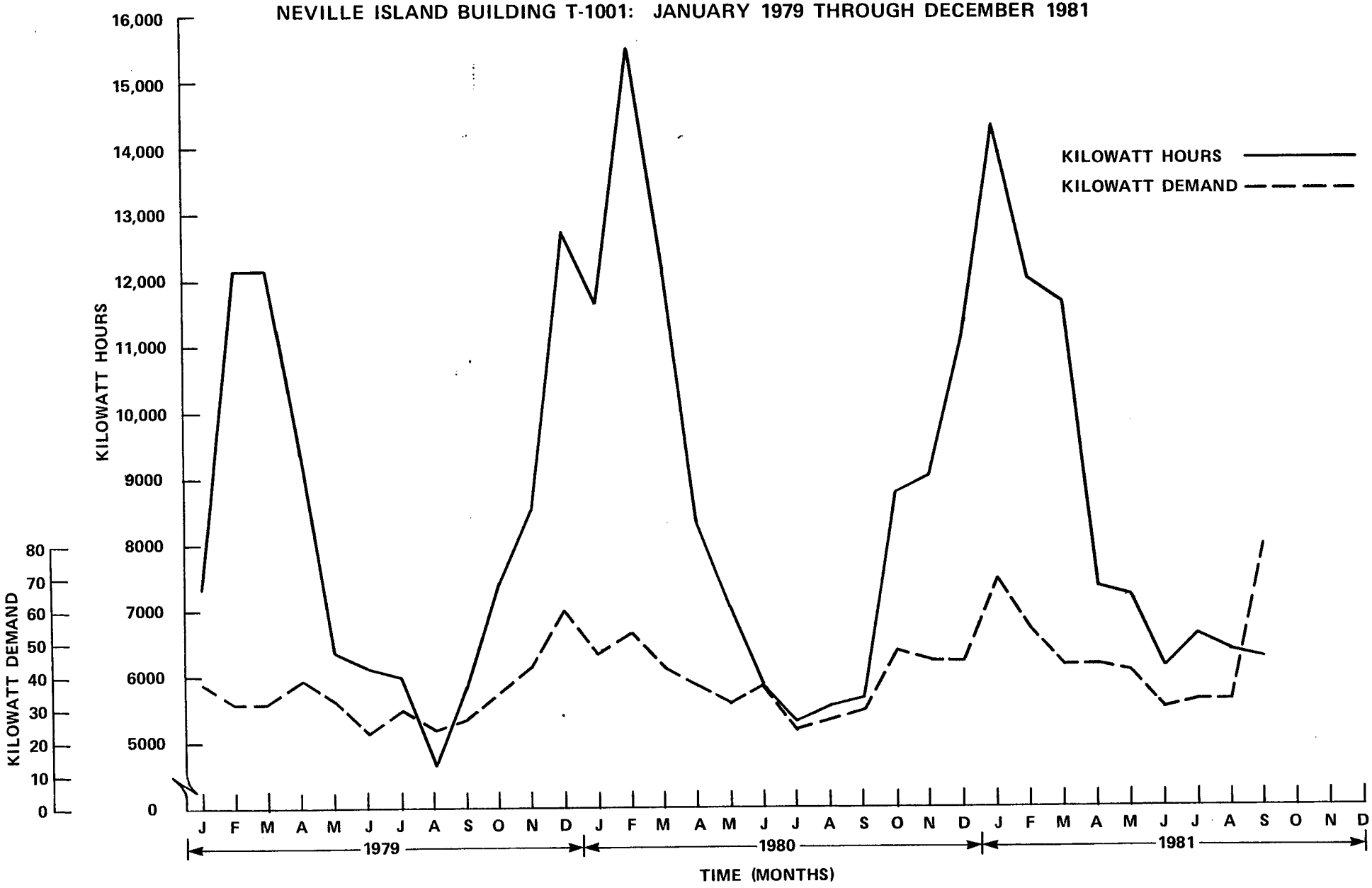
NEVILLE ISLAND BUILDING T-1002: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

ELECTRICITY

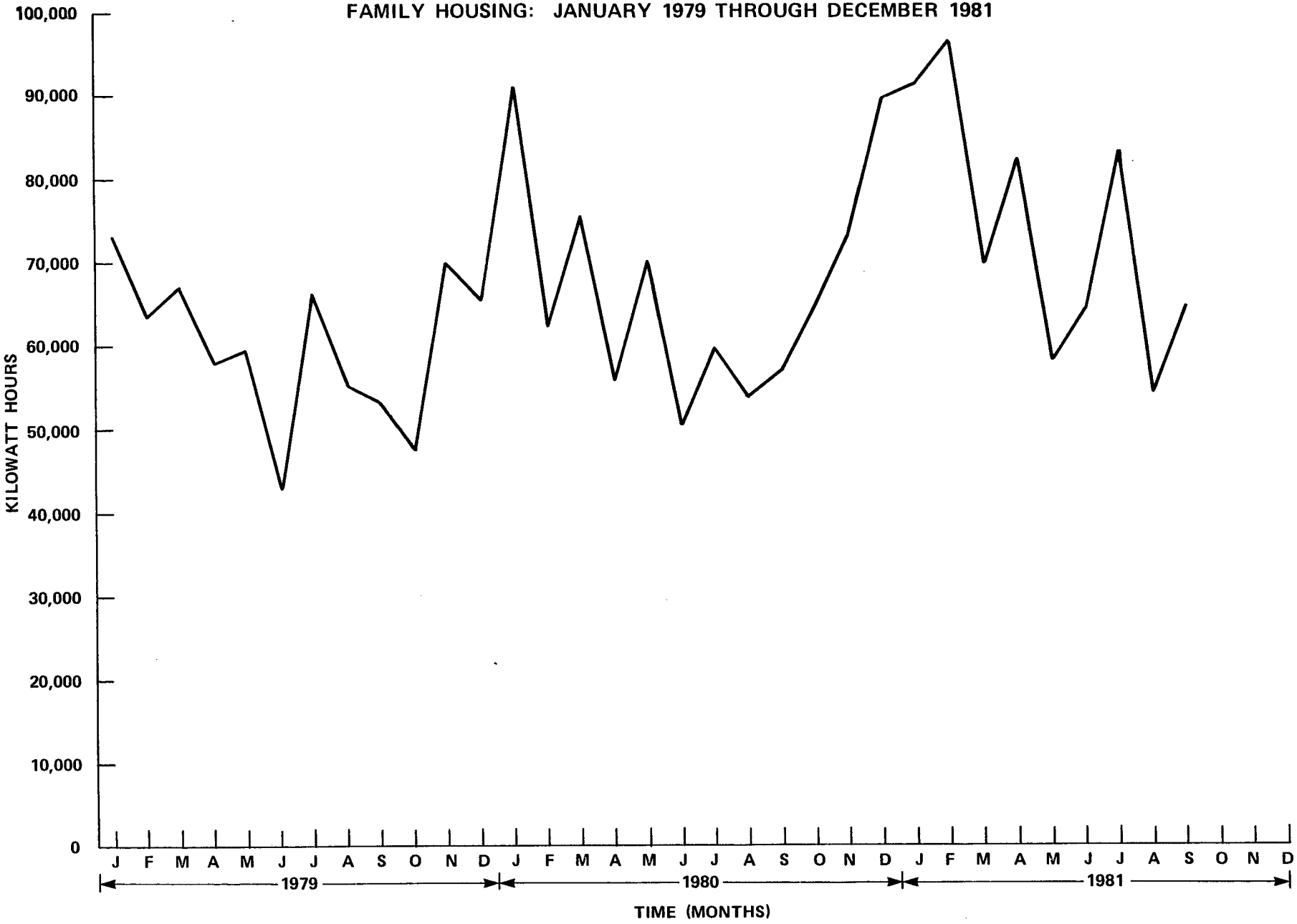
NEVILLE ISLAND BUILDING T-1001: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

ELECTRICITY

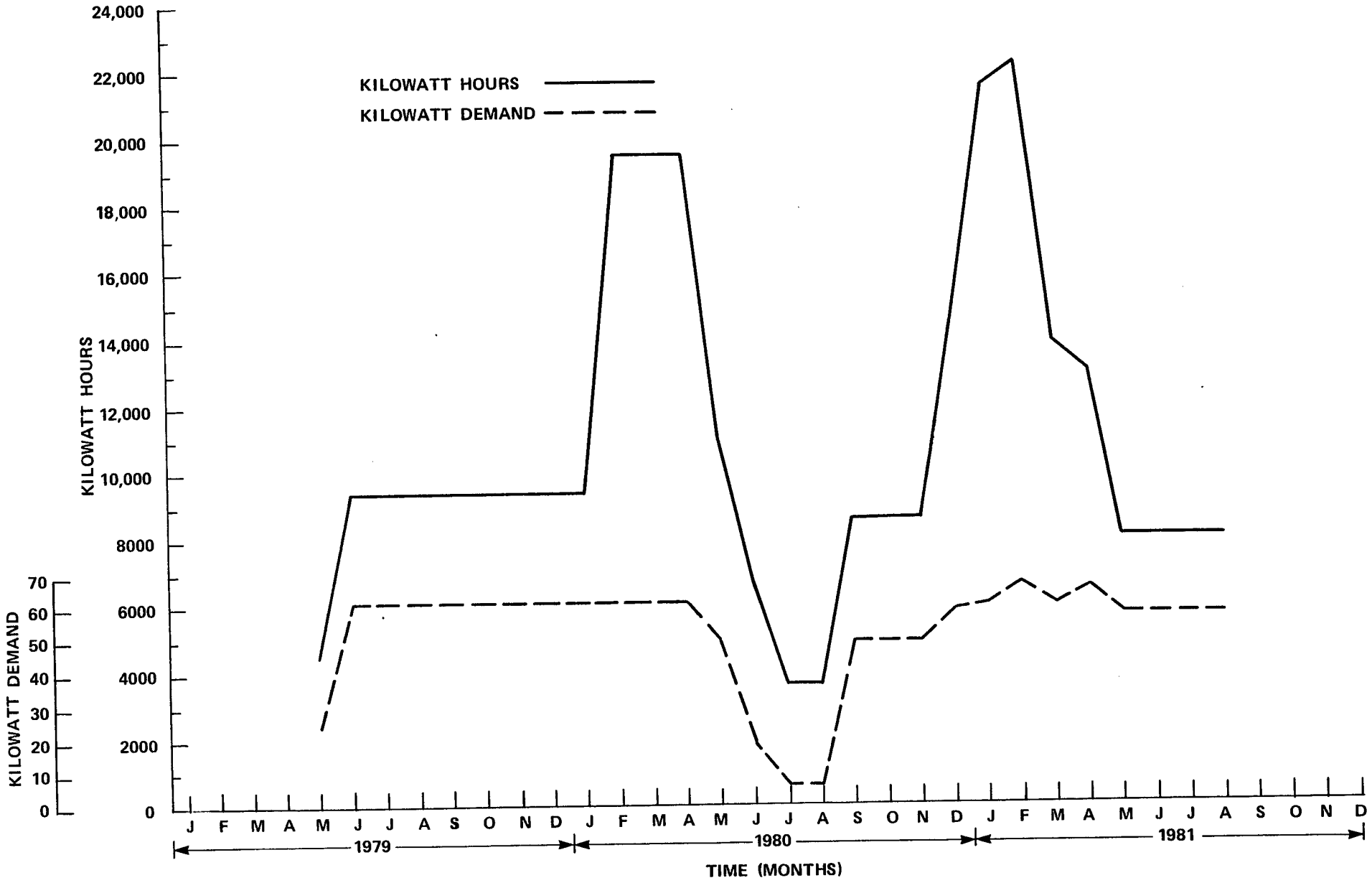
FAMILY HOUSING: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

ELECTRICITY

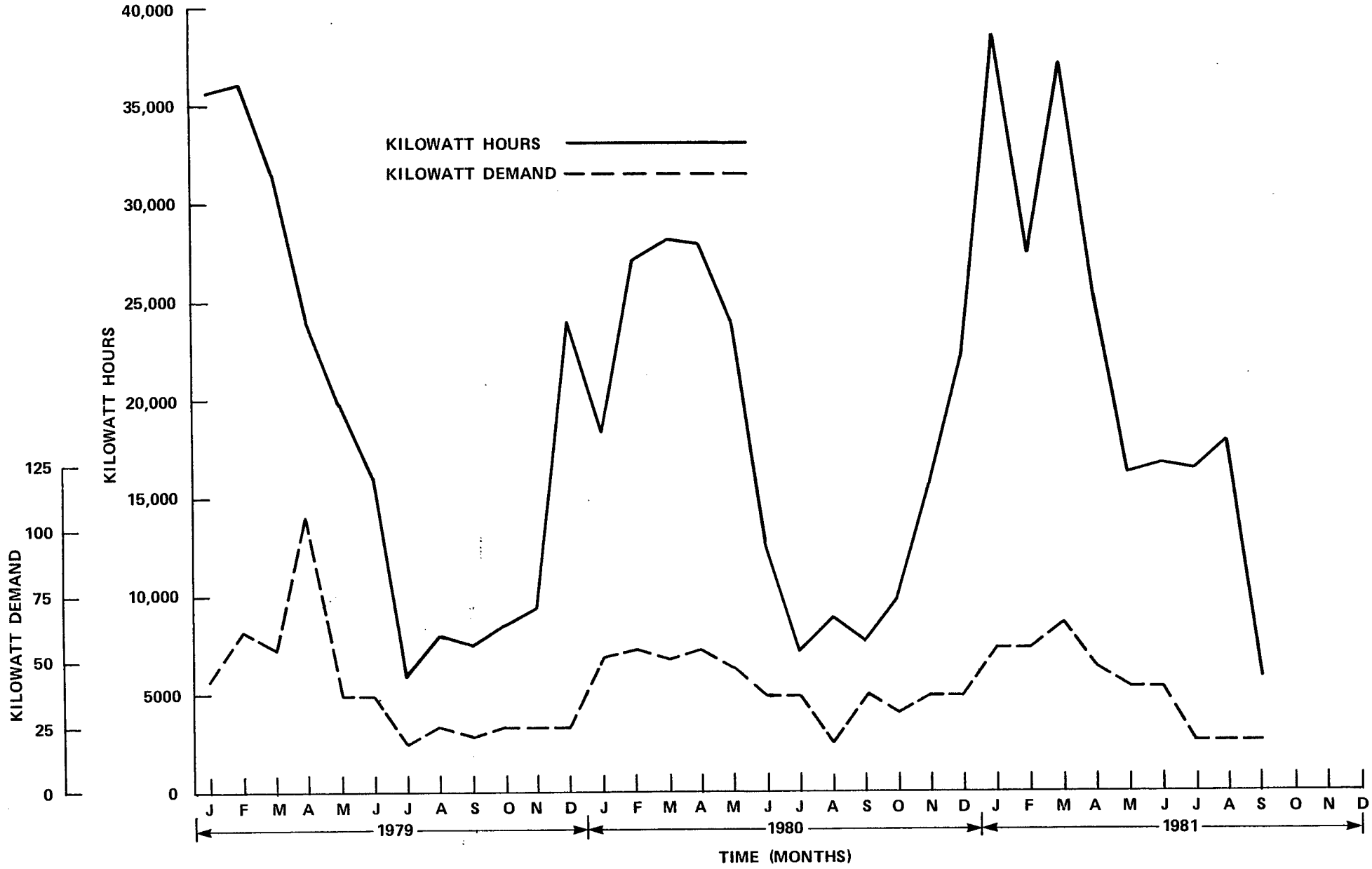
SITE 62C: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

ELECTRICITY

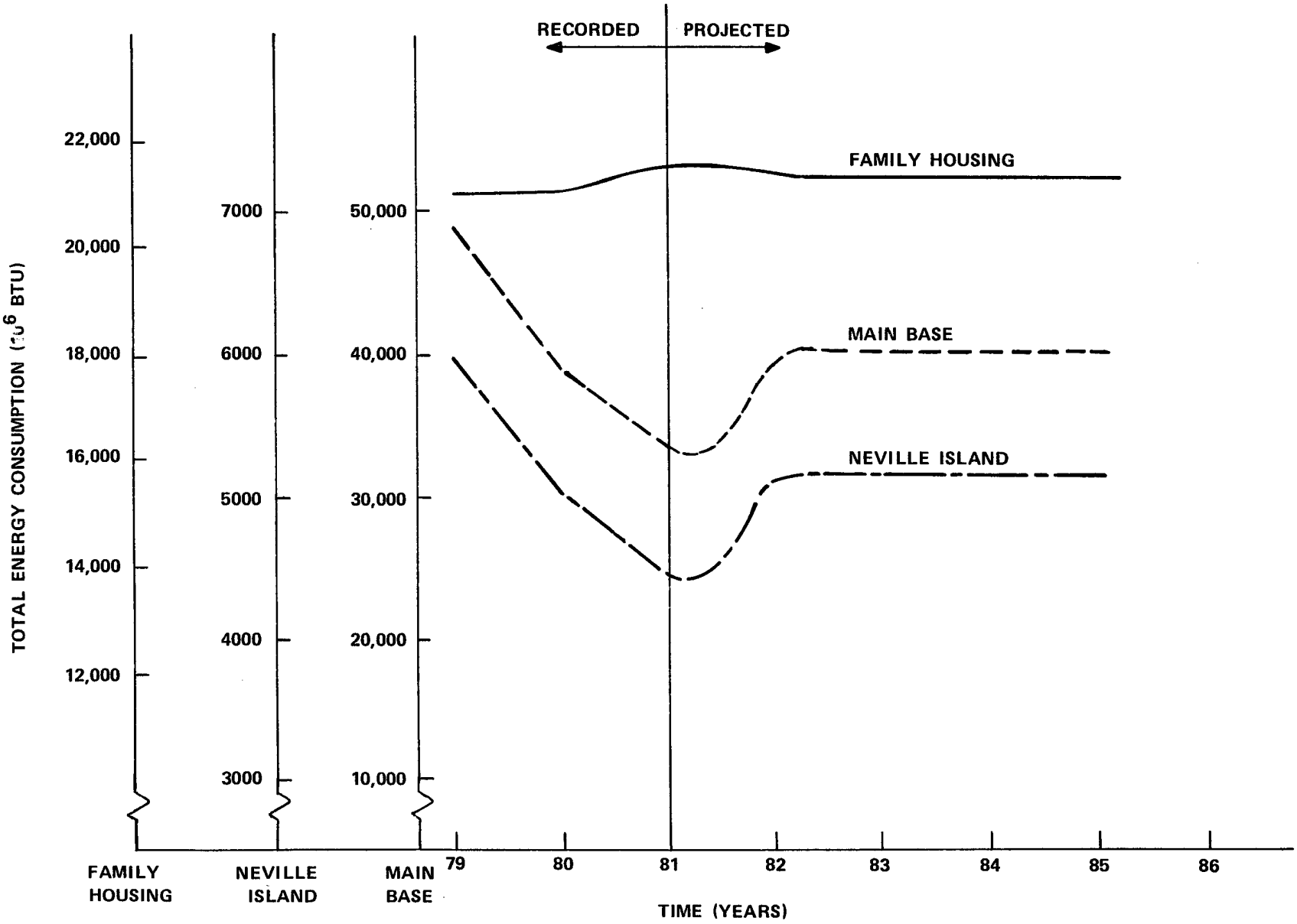
SITE 62L: JANUARY 1979 THROUGH DECEMBER 1981



OAKDALE SUPPORT ELEMENT

TOTAL YEARLY PROFILE: NATURAL GAS

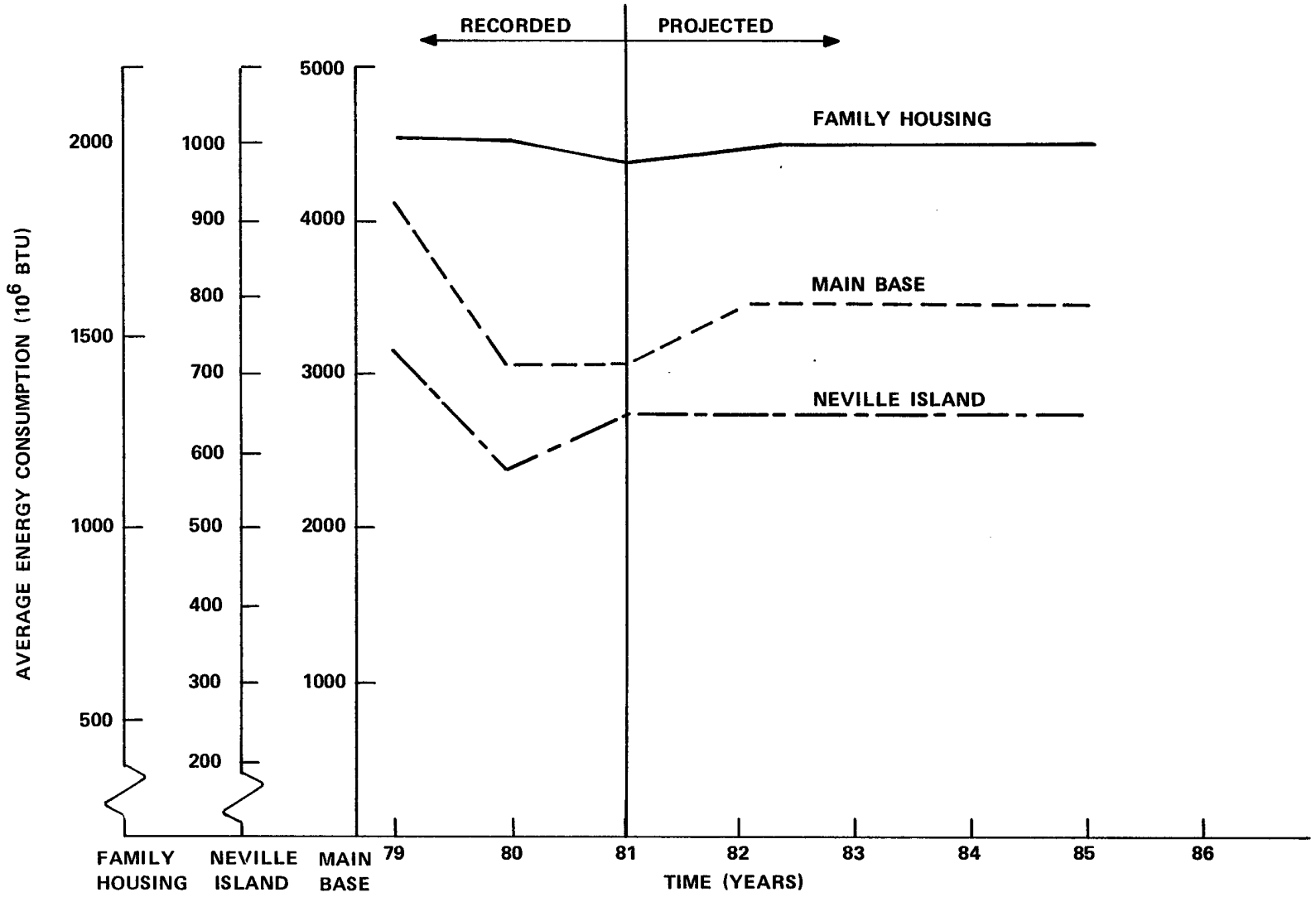
FY 1979 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

AVERAGE YEARLY PROFILE: NATURAL GAS

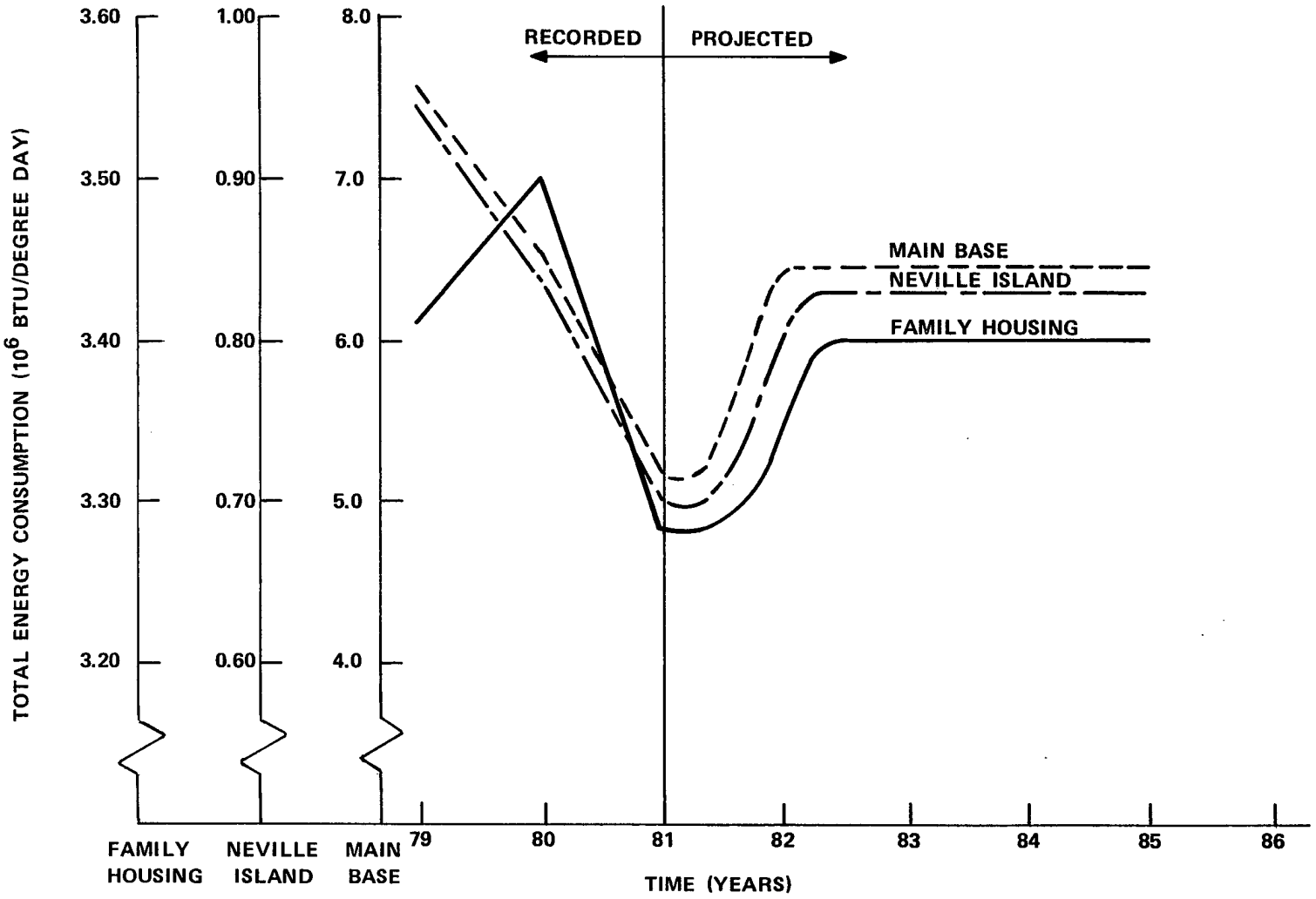
FY 1979 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

TOTAL YEARLY PROFILE PER DEGREE DAY: NATURAL GAS

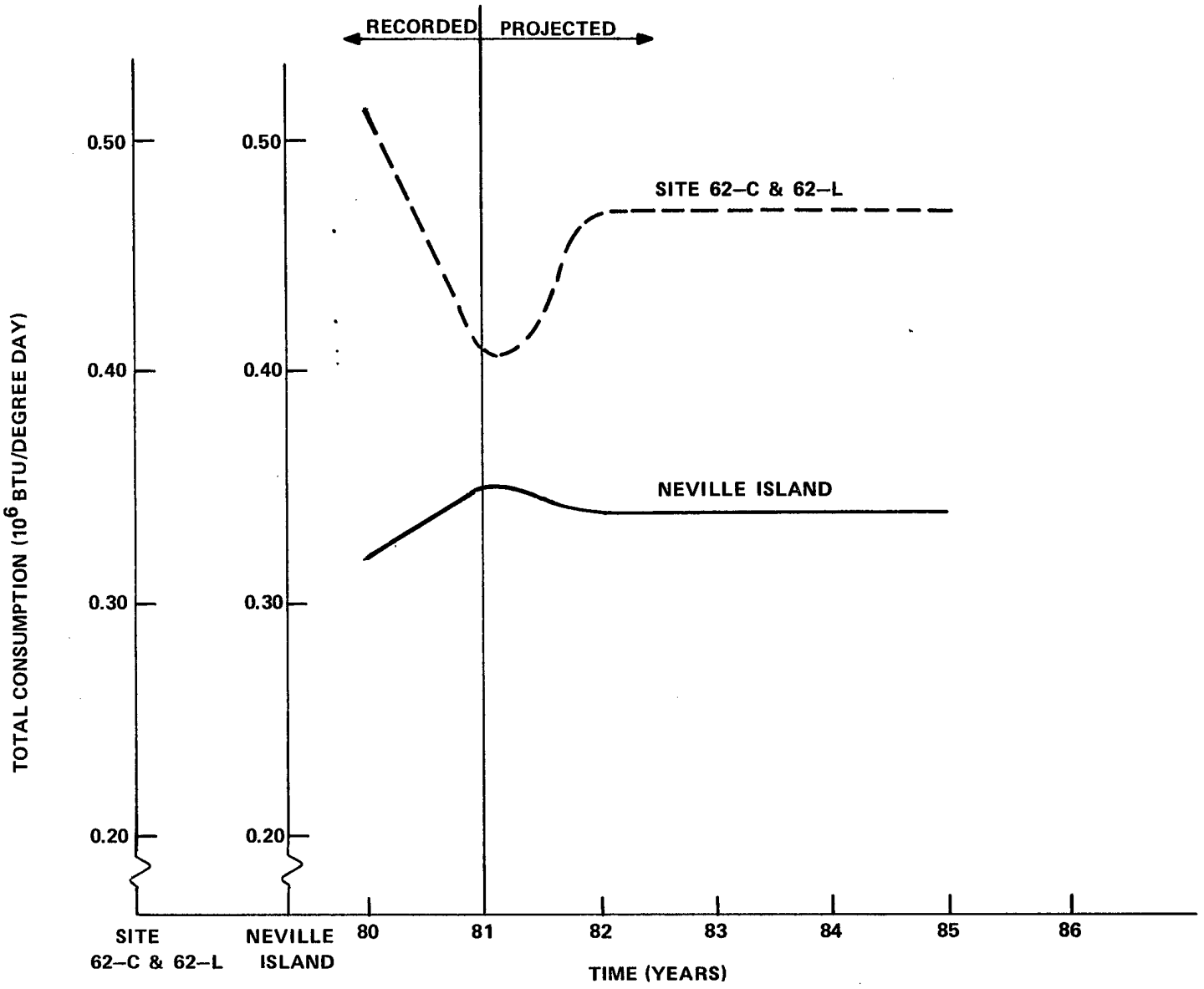
FY 1979 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

TOTAL YEARLY PROFILE PER DEGREE DAY: FUEL OIL

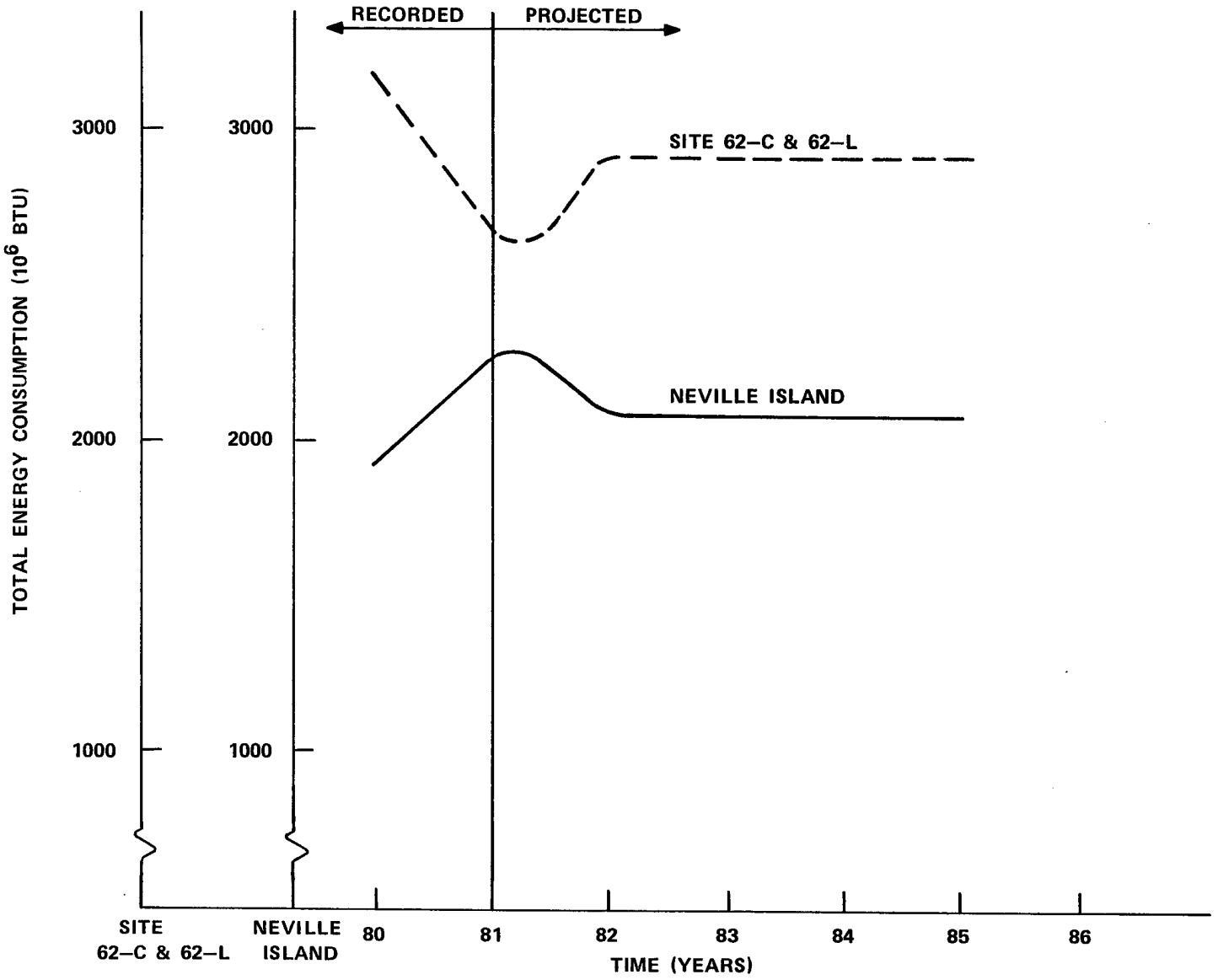
FY 1980 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

TOTAL YEARLY PROFILE: FUEL OIL

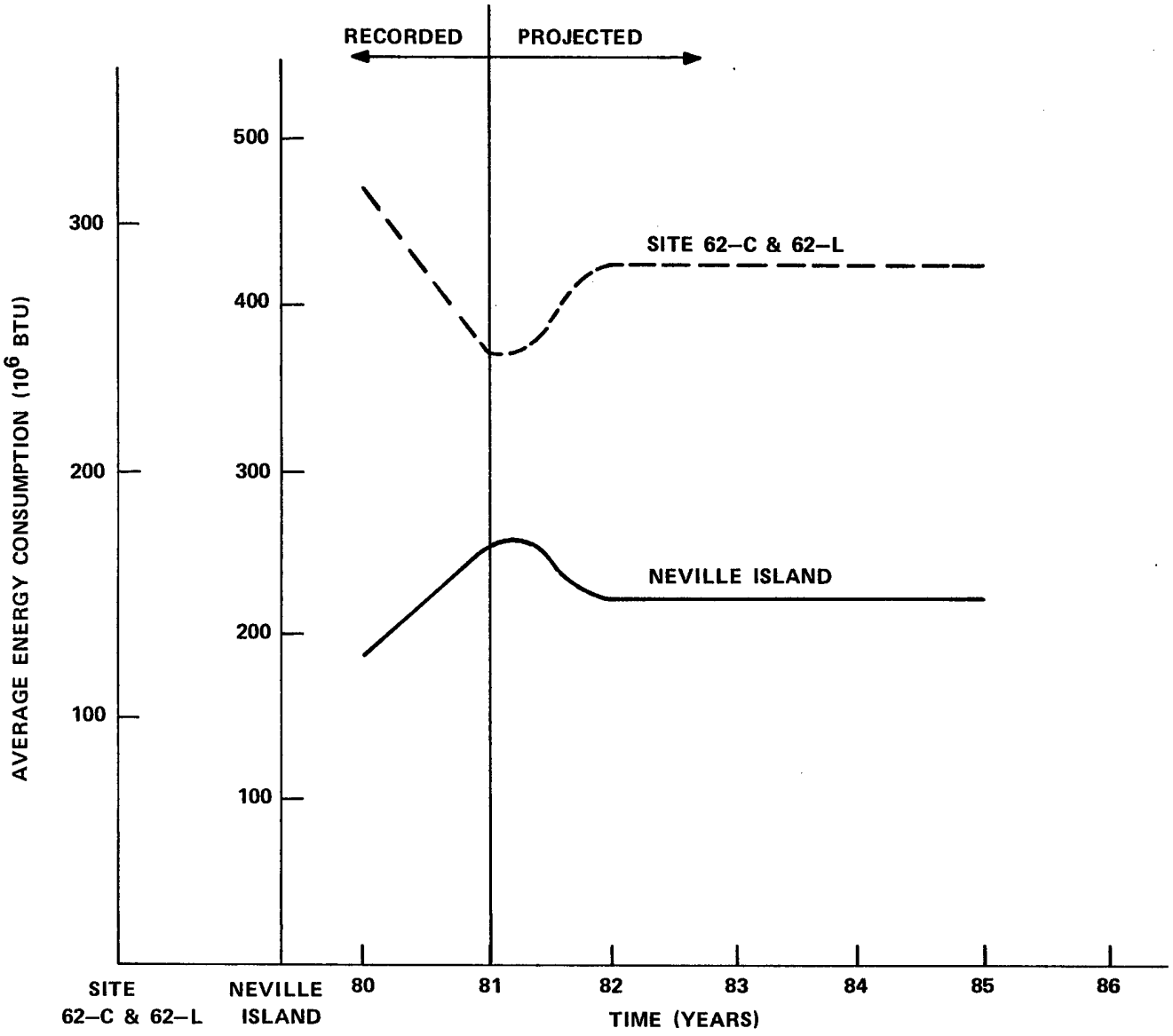
FY 1980 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

AVERAGE YEARLY PROFILE: FUEL OIL

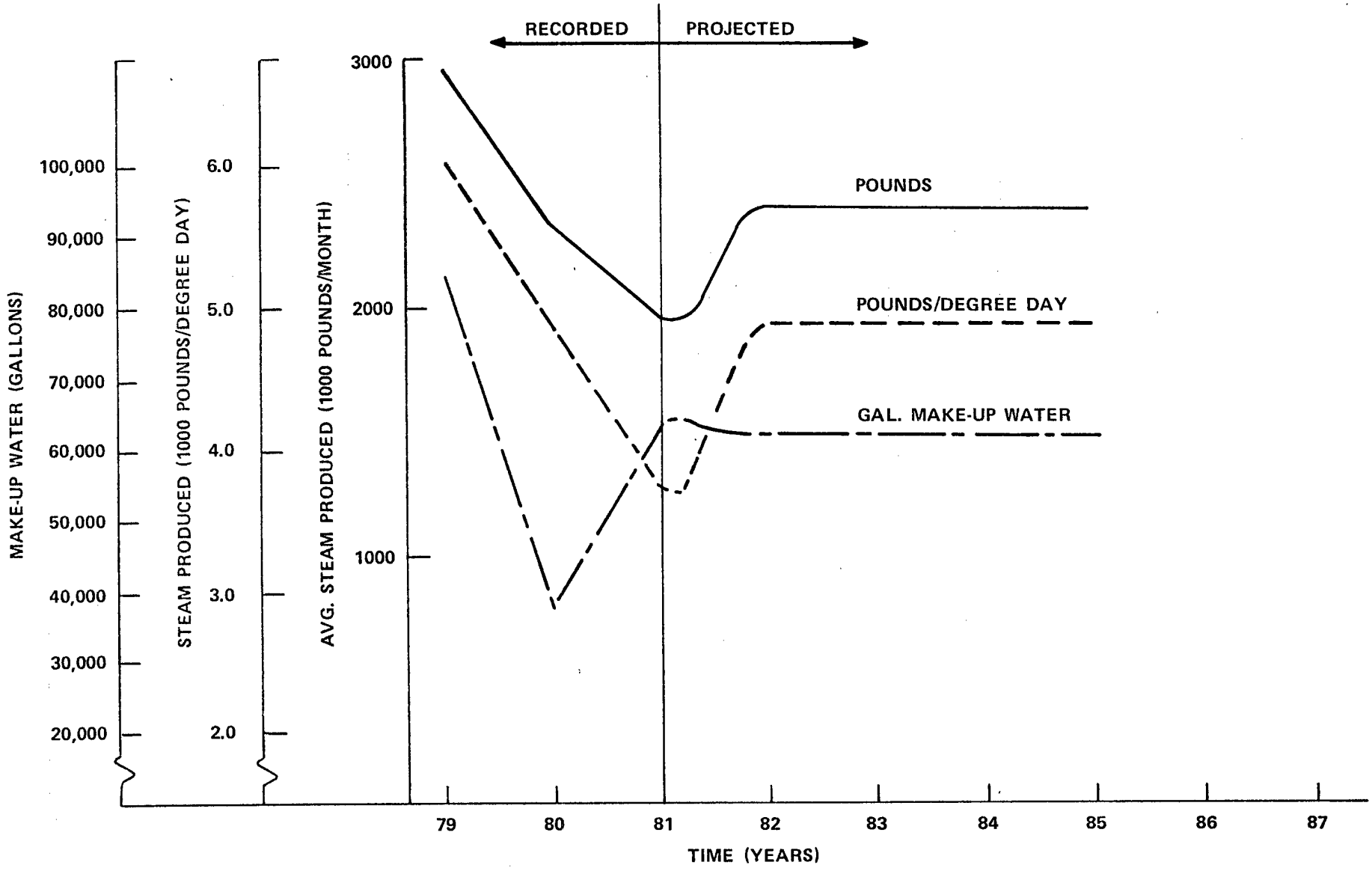
FY 1980 THROUGH FY 1985



OAKDALE SUPPORT ELEMENT

STEAM

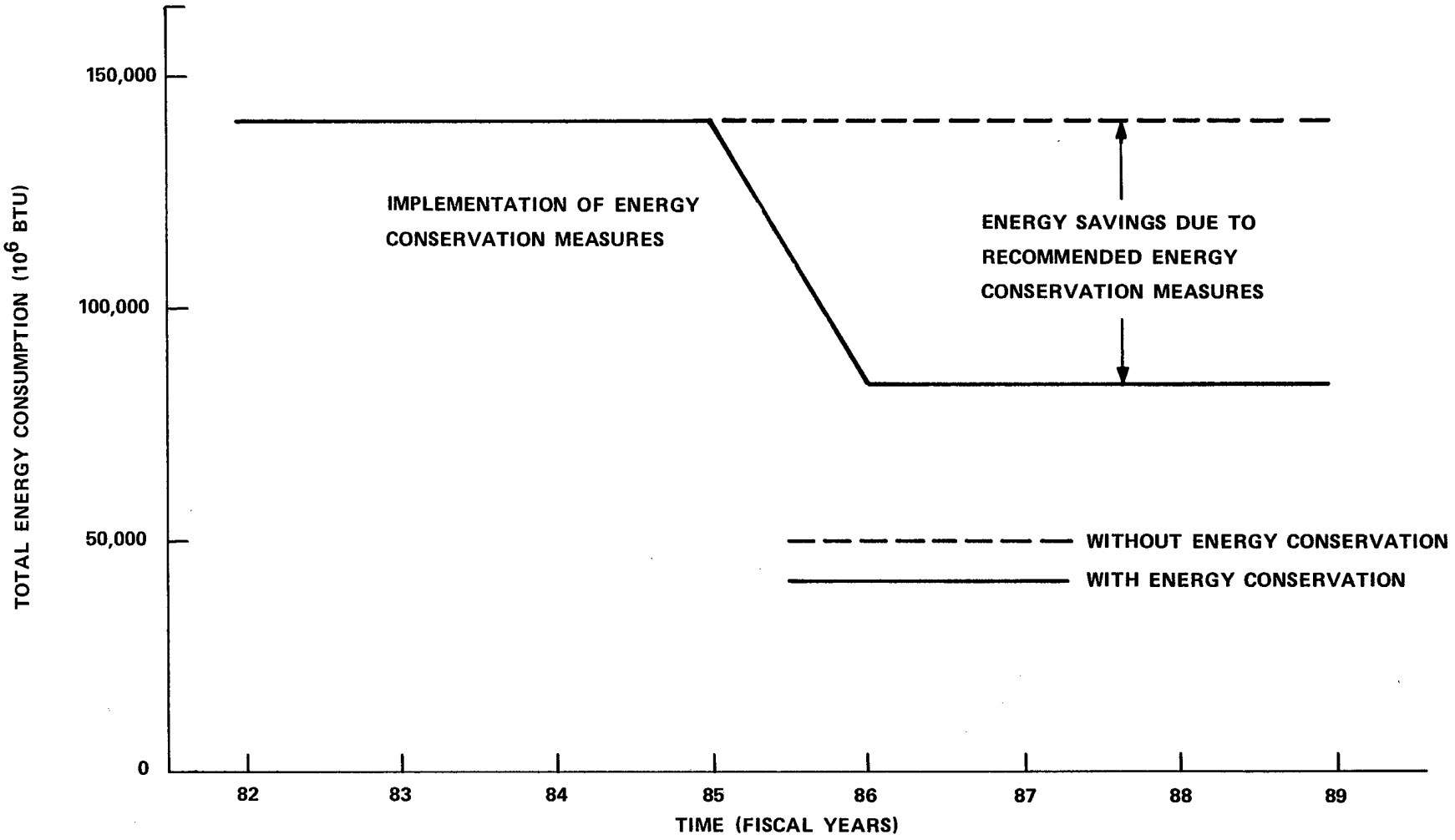
MAIN BASE: FY 1979 THROUGH FY 1988



OAKDALE SUPPORT ELEMENT

TOTAL ENERGY PROFILE: NATURAL GAS, FUEL OIL, ELECTRICITY

MAIN BASE, NEVILLE ISLAND, SITE 62-C, SITE 62-L, FAMILY HOUSING



7.0 APPENDIX-A

POWER FACTOR CORRECTION

Description of Existing Situation

The existing capacitor bank containing 3-50KVAR capacitors was struck by a lightning stroke in mid 1978 and was never placed back into service, and they have never been really missed.

The installation of these capacitors was probably effective in reducing the power company penalty which could not have been a great percentage of the power company bill. We must understand that these capacitors were installed during the Oakdale Mission as part of the Missile defense of the Greater Pittsburg area with heavy use of electronic equipment with an average power factor of 90% plus fluorescent and incandescent lighting loads of better than 96%. There were minimum motor loads which might have contributed to a poorer power factor.

The average power factor used for billing is defined by the power company as the cos. of the angle whose tangent is the ratio of the reactive kilovolt ampere hours to the kilowatt hours. Increased usage of kilowatt hours for a 24 hour period increases the denominator appreciably while the numerator or reactive kilovolt ampere hours remains substantially constant which is true of facilities with no heavy motor loads and consists primarily of transformer magnetizing current. This magnetizing current remains constant for fixed and varying loads and brings the tangent angle closer to 0^{o}, which brings the cosine or power factor closer to 1 or 100%. The ultimate result was to raise a comparatively good power factor into the realm of excellence. In all probability the capacitors were installed for improvement of voltage regulation which is generally necessary for heavy electronic usage and not for power factor correction.

In analyzing the need for power factor correction is is obvious from the table of recorded values that power factor is good to excellent. Although money can be saved there is a high probability that the addition of capacitors to the service can raise the voltage to dangerously high levels from an equipment life standpoint and burnout motors and lamps long before its useful life is complete.

Conclusion

Since the power factor penalty amounts to $1400/yr. which is 0.6% of the annual electrical bill, and the monthly power factor remains good it is recommended that no power factor correcting capacitors be installed.

POWER FACTOR CORRECTION

Projected Penalty In Power Factor

Estimated Demand = 786 KW/MO

$$\frac{\text{RKVAH}}{\text{KWH}} = \frac{143550}{389500} = .369$$

$$\text{Penalty Mult} = \frac{\text{RKVAH}}{\text{KWH}} \times 0.6 + 0.8 = 1.02$$

Billing Demand = Est. demand x penalty mult. = 786 x 1.02 = 802

Penalty Difference = 802 - 786 = 15.72KW = 16KW

Penalty Cost/Month = 16KW x $7.28 = $116.48

Penalty Cost/Year = 12 x $116.48 = $1397.76

$$\% \text{ of Total Electrical Coat} = \frac{\$1397.76 \times 100}{\$233573 \text{ (cost/yr)}} = .60\%$$

DATA FROM BILLING RECORDS

PERIOD	KWH	RKVAH	KW DEMAND	**PENALTY MULTIPLIER	BILLING DEMAND	AV. *PF (%)
9/18 - 10/19/79	350,400	132,000	792	1.03	816	94
10/19 - 11/21/79	279,600	140,400	840	1.10	924	89
11/21 - 12/19/79	508,800	116,400	816	1.00	816	98
12/19 - 1/22/80	453,600	144,600	768	1.00	768	95

1/22 - 2/25/80	469,200	132,000	816	1.00	816
2/25 - 3/21/80	342,000	102,000	816	1.00	816
3/21 - 5/7/80	591,600	216,000	792	1.02	808
5/7 - 6/20/80	519,600	213,600	816	1.05	857

PERIOD	KWH	RKVAH	KW DEMAND	PENALTY MULTIPLIER	BILLING DEMAND	AV. *PF (%)
6/20 - 9/22/80	1,221,600	550,800	744	1.07	797	91
9/22 - 10/21/80	330,000	108,000	768	1.00	768	95
10/21 - 11/20/80	391,200	112,800	768	1.00	768	96
11/20 - 1/23/81	907,200	560,400	840	1.17	983	85
1/23 - 2/23/81	422,400	98,400	768	1.00	768	97
2/23 - 3/20/81	340,800	76,800	792	1.00	792	98
3/20 - 4/22/81	393,600	115,200	792	1.00	792	96
4/22 - 5/20/81	319,000	96,000	672	1.00	672	96
5/20 - 6/19/81	367,200	142,000	840	1.03	865	93
6/19 - 7/21/81	414,000	170,400	816	1.05	857	93
7/21 - 8/20/81	385,200	151,200	840	1.04	874	93
8/20 - 9/18/81	340,800	210,000	720	1.17	842	85

* $PF = \cos\left[\tan^{-1}\frac{RKVAH}{KWH}\right]$

** Penalty Multiplier Applied to Demand (from power co. schedule GL)

Penalty Multiplier = $\frac{RKVAH}{KWH} \times .6 + .8$

PERIOD ENDING	KWH	COST	COST/KWH(¢/KWH
10/19/79	350,400	$13,653	3.9
11/21/79	279,600	12,369	4.42
12/19/79	508,800	17,531	3.45
01/22/80	453,600	15,920	3.51
02/25/80	469,200	16,742	3.57
03/21/80	342,000	13,719	4.01

05/07/80	591,600	22,947	3.88
06/20/80	519,600	21,624	4.16
09/22/80	1,221,600	49,270	4.03
10/21/80	330,000	14,331	4.34
11/20/80	391,200	16,257	4.16
01/23/81	907,200	38,905	4.29
02/23/81	422,400	17,310	4.10
03/20/81	340,800	15,641	4.59
04/22/81	393,600	16,845	4.28
05/20/81	319,200	14,786	4.63
06/19/81	367,200	17,443	4.75
07/21/81	414,000	19,175	4.63
08/20/81	385,200	19,571	5.08
09/18/81	340,800	17,926	5.26

Av. Cost = 85.04/20 = 4.25¢/KWH

On New Rate: (Av. Monthly for 24 Mo.) = 5.0¢

Average per Month

KWH	RKVA	DEMAND	PENALTY MULT.	BILLING DEMAND
$\frac{9,348,000}{24}$	$\frac{3,445,200}{24}$	$\frac{17,304}{20}$		
389,500	143,550	786	1.02	802

2 year energy cost on new schedule effective June 1981.

KWH = 389,500
RKVAH = 143,550
Billing Demand = 802KW

Capacity (Demand Charge)

300KW or less @		$3,010.00	
502KW @ $7.28/KW		$3,654.56	
Energy Charge @ 2.27¢/KWH = 389,500 x .0227	=	$8,841.65	
	TOTAL	$15,506.21	
Rider 9 Credit @ 2% of Total	=	$310.12	CR
PA Tax Adj. @ 4.74%		$720.30	
Energy Cost Rate @ .8350¢/KWH		$3,548.00	
	TOTAL AMOUNT	$19,464.39	

Present Cost/KWH = $\frac{19,464.39 \times 100}{389,500}$ = 5.0¢/KWH

Cost of Previous 24 Months	=	$391,965.00
Cost of Previous 24 Months on New Schedule	=	#467,145.36
New Energy Cost/Year = 467,145/2	=	$233,573/Yr

GLOSSARY

Ambient Temperature: Outside air temperature.

Boiler Capacity: The rate of heat output in BTU/hr measured at boiler outlet, at the design pressure and/or temperature, and rated fuel input at the site's elevation.

BTU - British Thermal Unit: The standard unit for measurement of the amount of heat energy. Equal to the amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit. Generally speading, one BTU is about equal to the amount of heat released by a burning wooden match.

MBTU: One Million British Thermal unit.

KBTU: One Thousand British Thermal unit.

Building Envelope: The elements of a building which enclose conditioned spaces and through which energy is transferred to or from the exterior.

CCF: One hundred cubic feet. Used by natural gas companies for billing purposes.

KCF: One thousand cubic feet.

CFM: Cubic feet per minute: Usually refers to air changes.

Degree Days, Cooling: The degree day value for any given day is the difference between the mean daily temperature and $65^{o}F$. For a mean daily temperature of $85^{o}F$, the number of cooling degree days is 85 - 65 = 20.

Degree Days, Heating: The degree day value for any given day is the difference between 65 and the mean daily temperature. Example: For a mean daily temperature of $50^{o}F$ the number of degree days is 65 minus 50 or 15. Degree days are a measuere of the severity of the entire season and are directly proportional to fuel consumption.

Demand Load: Electric power measured in kilowatts integrated in 15 minute intervals for commercial operations. The price of electricity is directly related to the level of this demand. The higher the demand, the higher the cost per electrical unit.

Enthalpy: For the purpose of air conditioning enthalpy is the total heat content of air, expressed in units of BTU/lb.

Foot Candle: A measurement of illumination; specifically, the illumination on a surface one square foot from the flux of one lumen.

Gross Square Feet: The total number of square feet contained in a building envelope using the floors as area to be measured.

Heat Exchanger: Any device that transfers heat from one fluid (liquid or gas) to another or to the environment.

Horsepower: British unit of power, 1 H.P. = 746 watts, 42.41 BTU's per minute, and 2545 BTU/hour.

HVAC: A system that provides heating, ventilating, and/or air conditioning within or associated with a building.

Infiltration: The flow of air into a building.

KW (kilowatt): A unit of power, equivalent to 1,000 watts.

KWH (kilowatt hour): A unit of electrical energy equivalent to the amount consumed at the rate of one kilowatt for one hour.

Life Cycle Cost: The total cost of new equipment for a lifetime period including anticipated dollar outputs for maintenance and operation.

Refrigeration, Ton of: Equivalent to the removal of heat at a rate of 200 BTU's per minute, 12,000 BTU/hr or 288,000 BTU/day.

Resistance (R-Value): Term used to measure a given thickness of an insulating material's resistance to the flow of heat in units of square feet x hour x ^{o}F per BTU; the reciprocal of thermal conductance. The reciprocal of the sum of R-values for a conposite barrier is the overall transmittance or U-value.

Retrofit: The capital improvement of existing buildings to make them more energy efficient.

RKVAH: Reactive kilovolt amp hours.

Setback: Reducing the level of heating from a system to the lowest practical point especially during periods when the activities or occupation patters allow it.

Service Electrical Energy: The BTU's of fossil or nuclear fuel necessary to generate one KWH of usable electrical energy. Defined by studies as 11,600 BTU's/KWH.

Simple Payback: The length of time required for an investment to pay for itself; determined by dividing initial investment by first year energy savings.

Therm: A unit of gas fuel containing 100,000 BTU's.

U-Value (Thermal Transmittance): Overall coefficient of heat transmission (air to air) expressed in BUT's per square foot per hour per degree F. The "U"-value applies to combinations of different materials used in series along the heat path flow, including air spaces, and surface air films on both sides. The lower the U-value, the less heat is transferred. Numerically, equivalent to the reciprocal of the sum of the R-values of materials in combination.

Ventilation: The forced introduction of air into a space by a controlled mechanical system or unit.

Vapor Barrier: A thin sheet, usually plastic or foil, attached to or over insullation on the warm side of a wall, to prevent moisture from entering the wall and condensing there, causing the insulation to lose its effectiveness.

Watt: A unit of power; produced when one ampere flows under an electromotive force of one volt in a load of unity power factor one-thousandth of a kilowatt.

ECIP	=	Energy Conservation Investment Program
E/C	=	Energy to Cost Ratio
B/C	=	Discounted Benefit/Cost Ratio
VAV	=	Variable Air Volume
PDB	=	Project Development Brochure
ECMS	=	Energy Control and Monitoring System

FY75 (Base Year) Natural Gas Consumption (For Heating)

Ref: Degree Day Method - ASHRAE, 1976 Systems, P. 43.8.

Monthly Natural Gas Consumption: (By Degree-Day Method).

$$E = \frac{HL \times D \times 24}{\Delta T \times EFF \times v} \times C_D \times C_F \qquad (1)$$

Where:

E = Monthly natural gas consumption (kcf/month)

H_L = Heat loss of buildings (MBTU/hr.)

D = Heating Degree-Days for the month.

ΔT = Design temperature difference (^oF) = $68^oF - 5^oF = 63^oF$ (For Oakdale)

EFF. = Rated full load efficiency = 0.8 (Nat. Gas equipment).

v = Heating value of natural gas = 1.031 MBTU/kcf.

C = Interim correction factor for heating effect vs. degree days = 0.71.

C_f = Part-load correction factor for fuel-fired equipment = 1.56.

$$E = \frac{HL \times D \times 24}{63 \times 0.8 \times 1.031} \times 0.71 \times 1.56 = 0.51 \times H_L \times D \text{ kcf/mth.} \qquad (2)$$

FY75 (Base Year) Natural Gas Consumption: Main Base

Degree-Day Method

Design Heat Loss (H_L) of natural gas consuming buildings in the main base = 10.3 MBtu/hr. This is calculated as the sum of all the heating equipment capacities in the buildings. Monthly heating degree-days are taken from 'NOAA - Local Climatological Data' for Pittsburgh.

NOTES: Col. 3 = 0.51 x 10.3 x Col. 2
Col. 4 = Col. 3 x 1.031 MBtu/kcf

Col. 1	Col. 2	Col. 3		Col 4	
Month	Heating Degree-Days (65°F base)-FY75	Natural Gas Consumption kcf/Month		Energy Consumption MBtu/Month	
1975 Jan.	997	5,237	(5,259)	5,399	(5,422)
Feb.	916	4,812	(4,834)	4,961	(4,984)
Mar.	881	4,628	(4,650)	4,771	(4,794)
Apr.	617	3,241	(3,263)	3,341	(3,364)
May	116	609	(631)	628	(651)
Jun.	48	-	(22)	-	(23)
July	0	-	(22)	-	(23)
Aug.	0	-	(22)	-	(23)
Sept.	192	-	(22)	-	(23)
1974 Oct.	384	2,017	(2,039)	2,080	(2,103)
Nov.	630	3,309	(3,331)	3,412	(3,435)
Dec.	1,001	5,258	(5,280)	5,421	(5,444)
Year	5,782	29,111	(29,375)	30,013	(30,289)

NOTE: Numbers in parenthesis are gas/energy consumption taking into account the estimated monthly hot water heating demand of 22 kcf/month (23 MBtu/month).

FY75 (Base Year) Natural Gas Consumption: Neville Island

Degree-Day Method

Natural gas is consumed only by Building T-1002 on Neville Island. Design heat loss = 4 MBtu/hr. This is based on heating capacities of gas heaters in the building. Monthly heating degree-days data is taken from 'NOAA - Local Climatological Data' for Pittsburgh. Natural gas consumption is only for space heating.

NOTES: Col. 3 = 0.51 x 4 x Col. 2

Col. 4 = Col. 3 x 1.031 MBtu/kcf

Col. 1	Col. 2	Col. 3	Col 4
Month	Heating Degree-Days (65°F base)-FY75	Natural Gas Consumption kcf/Month	Energy Consumption MBtu/Month
Jan.	997	2,034	2,097
Feb.	916	1,869	1,927
Mar.	881	1,797	1,853
Apr.	617	1,259	1,298
May	116	237	244
June	48	-	-
July	0	-	-
Aug.	0	-	-
Sept.	192	-	-
Oct.	384	783	807
Nov.	630	1,285	1,325
Dec.	1,001	2,042	2,105
Year	5,782	11,306	11,656

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. – MAIN BASE YEAR: FY 1979

TABLE NO. 6

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1979	JANUARY	6,215	6,113	6,408	6,302	34,167	33,602	15,694	9,414	1,346	997
	FEBRUARY	5,281	5,107	5,445	5,265	29,032	28,073	13,433	7,865	1,311	916
	MARCH	5,479	4,484	5,649	4,623	30,120	24,649	13,906	6,905	671	881
	APRIL	5,183	2,445	5,344	2,521	28,494	13,442	13,223	3,765	458	617
	MAY	4,336	1,225	4,470	1,263	23,834	6,734	11,065	1,887	219	116
	JUNE	4,230	22	4,361	23	23,252	123	10,794	34	38	48
	JULY	2,287	22	2,358	23	12,573	123	5,891	34	23	0
	AUGUST	1,790	22	1,845	23	9,837	123	4,642	34	26	0
	SEPTEMBER	1,929	22	1,989	23	10,605	123	5,804	34	111	192
1978	OCTOBER	2,212	2,029	2,281	2,092	12,162	11,154	5,150	3,125	485	384
	NOVEMBER	3,366	3,650	3,470	3,763	18,502	20,064	8,117	5,621	656	630
	DECEMBER	4,280	5,538	4,413	5,710	23,530	30,445	10,933	8,529	993	1,001
	TOTAL	46,588	30,679	48,033	31,631	256,108	168,655	118,652	47,247	6,337	5,782

CONVERSION FACTOR: 10^3 CUBIC FEET X 1.031 = 10^6 BTU BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - MAIN BASE YEAR: FY 1980

TABLE NO. 7

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	5,278	6,113	5,442	6,302	29,016	33,602	15,678	9,414	1,175	997
	FEBRUARY	4,770	5,107	4,918	5,265	26,222	28,073	14,187	7,865	1,177	916
	MARCH	5,786	4,484	5,965	4,623	31,805	24,649	17,124	6,905	906	881
	APRIL	5,030	2,445	5,186	2,521	27,651	13,442	14,949	3,765	500	617
	MAY	3,156	1,225	3,254	1,263	17,350	6,734	9,421	1,887	172	116
	JUNE	2,524	22	2,602	23	13,874	123	7,557	34	71	48
	JULY	1,990	22	2,052	23	10,941	123	5,983	34	0	0
	AUGUST	1,161	22	1,197	23	6,382	123	3,540	34	5	0
	SEPTEMBER	245	22	253	23	1,349	123	842	34	48	192
1979	OCTOBER	1,897	2,029	1,956	2,092	10,429	11,154	5,710	3,125	438	384
	NOVEMBER	2,031	3,650	2,094	3,763	11,165	20,064	6,112	5,621	601	630
	DECEMBER	4,269	5,538	4,401	5,710	23,466	30,445	12,718	8,529	935	1,001
	TOTAL	38,137	30,679	39,320	31,631	209,650	168,655	113,821	47,247	6,028	5,782

CONVERSION FACTOR: 10^3 CU. FT. X 1.031 = 10^6 BTU BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - MAIN BASE YEAR: FY 1981

TABLE NO. 8

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	6,019	6,113	6,206	6,302	33,090	33,602	20,679	9,414	1,372	997
	FEBRUARY	5,066	5,107	5,223	5,265	27,849	28,073	17,514	7,865	936	916
	MARCH	5,009	4,484	5,164	4,623	27,534	24,649	17,319	6,905	904	881
	APRIL	4,124	2,445	4,252	2,521	22,671	13,442	14,287	3,765	391	617
	MAY	3,300	1,225	3,402	1,263	18,139	6,734	11,453	1,887	223	116
	JUNE	1,541	22	1,589	23	8,472	123	5,410	34	18	48
	JULY	20	22	21	23	112	123	78	34	3	0
	AUGUST	20	22	21	23	112	123	78	34	10	0
	SEPTEMBER	17	22	18	23	96	123	74	34	159	192
1980	OCTOBER	54	2,029	56	2,092	299	11,154	185	3,125	476	384
	NOVEMBER	2,299	3,650	2,370	3,763	12,637	20,064	7,779	5,621	787	630
	DECEMBER	4,707	5,538	4,853	5,710	25,876	30,445	16,313	8,529	1,117	1,001
	TOTAL	32,176	30,679	33,175	31,631	176,887	168,655	111,169	47,247	6,396	5,782

CONVERSION FACTOR: 10^3 CU. FT. x 1.031 = 10^6 BTU

BASE YEAR: FY1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - NEVILLE ISLAND. YEAR: FY 1979

TABLE NO. 9

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1979	JANUARY	1,150	1,537	1,186	1,585	38,013	50,801	3,047	2,444	1,346	997
	FEBRUARY	1,416	1,284	1,460	1,324	46,795	42,436	3,730	2,042	1,311	916
	MARCH	1,000	1,126	1,031	1,161	33,045	37,212	2,543	1,790	671	881
	APRIL	520	612	536	631	17,180	20,224	1,328	973	458	617
	MAY	165	305	170	314	5,449	10,064	426	485	219	116
	JUNE	36	0	37	0	1,186	0	96	0	38	48
	JULY	19	0	20	0	641	0	52	0	23	0
	AUGUST	0	0	0	0	0	0	0	0	26	0
	SEPTEMBER	9	0	9	0	288	0	30	0	111	192
1978	OCTOBER	152	507	157	523	5,032	16,763	415	806	485	384
	NOVEMBER	442	916	456	944	14,615	30,256	1,197	1,456	656	630
	DECEMBER	873	1,393	900	1,436	28,846	46,026	2,326	2,215	993	1,001
	TOTAL	5,782	7,650	5,962	7,918	191,090	253,782	15,190	12,211	6,337	5,782

CONVERSION FACTOR: 10^3 CU.FT X 1.031 = 10^6 BTU BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - NEVILLE ISLAND YEAR: FY 1980

TABLE NO. 10

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	849	1,537	875	1,585	28,045	50,801	2,568	2,444	1,175	997
	FEBRUARY	1,122	1,284	1,157	1,324	37,083	42,436	3,384	2,042	1,177	916
	MARCH	960	1,126	990	1,161	31,731	37,212	2,903	1,790	906	891
	APRIL	474	612	489	631	15,673	20,224	1,434	973	500	617
	MAY	239	305	246	314	7,885	10,064	724	485	172	116
	JUNE	35	0	36	0	1,154	0	109	0	71	48
	JULY	0	0	0	0	0	0	0	0	0	0
	AUGUST	0	0	0	0	0	0	0	0	5	0
	SEPTEMBER	0	0	0	0	0	0	0	0	48	192
1979	OCTOBER	155	507	160	523	5,128	16,763	471	806	438	384
	NOVEMBER	419	916	432	944	13,846	30,256	1,269	1,456	601	630
	DECEMBER	668	1,393	689	1,436	22,083	46,026	2,021	2,215	935	1,001
	TOTAL	4,921	7,680	5,074	7,918	162,628	253,782	14,883	12,211	6,028	5,782

CONVERSION FACTOR: 10^3 CU. FT. X 1.031 = 10^6 BTU BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - NEVILLE ISLAND YEAR: FY 1981

TABLE NO. 11

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	990	1,537	1,021	1,585	32,724	50,801	3,724	2,444	1,372	997
	FEBRUARY	1,261	1,284	1,300	1,324	41,667	42,436	4,725	2,042	936	916
	MARCH	744	1,126	767	1,161	24,583	37,212	2,800	1,790	904	881
	APRIL	404	612	417	631	13,365	20,224	1,522	973	391	617
	MAY	186	305	192	314	6,154	10,064	702	485	223	116
	JUNE	15	0	16	0	513	0	60	0	18	48
	JULY	0	0	0	0	0	0	0	0	3	0
	AUGUST	5	0	5	0	160	0	22	0	10	0
	SEPTEMBER	0	0	0	0	0	0	0	0	159	192
1980	OCTOBER	27	507	28	523	897	16,763	105	806	476	384
	NOVEMBER	211	916	218	944	6,987	30,256	797	1,456	787	630
	DECEMBER	495	1,393	510	1,436	16,346	46,026	1,864	2,215	1,117	1,001
	TOTAL	4,338	7,680	4,474	7,918	143,396	253,782	16,321	12,211	6,396	5,782

CONVERSION FACTOR: 10^3 CU.FT. X 1.031 = 10^6 BTU

BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA.- FAMILY HOUSING YEAR: FY 1979

TABLE NO. 12

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1979	JANUARY	3,088	2,819	3,184	2,906	23,280	21,247	7,985	4,111	1,346	997
	FEBRUARY	3,337	2,867	3,440	2,956	25,152	21,613	8,654	4,925	1,311	916
	MARCH	3,006	2,664	3,099	2,747	22,658	20,085	7,520	4,106	671	881
	APRIL	2,112	2,429	2,177	2,504	15,917	18,308	5,957	3,911	458	617
	MAY	1,551	1,431	1,599	1,475	11,691	10,785	4,007	2,380	219	116
	JUNE	1,073	724	1,106	746	8,087	5,454	2,870	1,273	38	48
	JULY	634	506	654	522	4,782	3,817	1,736	914	23	0
	AUGUST	613	524	632	540	4,621	3,948	1,716	921	26	0
	SEPTEMBER	572	551	590	568	4,314	4,153	1,602	970	111	192
1978	OCTOBER	908	928	936	957	6,844	6,997	2,391	1,223	485	384
	NOVEMBER	1,675	1,527	1,727	1,574	12,627	11,508	4,313	2,304	656	630
	DECEMBER	2,418	2,421	2,493	2,496	18,228	18,250	6,331	3,632	993	1001
	TOTAL	20,987	19,391	21,637	19,991	158,201	146,165	55,082	30,670	6,337	5,782

CONVERSION FACTOR: 10^3 CU.FT X 1.031 = 10^6 BTU BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE, PA. - FAMILY HOUSING YEAR: FY 1980

TABLE NO. 13

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	3,332	2,819	3,435	2,906	25,115	21,247	9,386	4,111	1,175	997
	FEBRUARY	3,102	2,867	3,198	2,956	23,382	21,613	9,795	4,925	1,177	916
	MARCH	2,828	2,664	2,916	2,747	21,320	20,085	9,092	4,106	906	881
	APRIL	2,139	2,429	2,205	2,504	16,122	18,308	7,030	3,911	500	617
	MAY	1,431	1,431	1,475	1,475	10,785	10,785	5,239	2,380	172	116
	JUNE	754	724	777	746	5,681	5,454	2,481	1,273	71	48
	JULY	609	506	628	522	4,592	3,817	1,998	914	0	0
	AUGUST	577	524	595	540	4,350	3,948	1,969	921	5	0
	SEPTEMBER	580	551	598	568	4,372	4,153	1,995	970	48	192
1979	OCTOBER	1,063	928	1,096	957	8,013	6,997	3,393	1,223	438	384
	NOVEMBER	1,661	1,527	1,713	1,574	12,525	11,508	5,237	2,304	601	630
	DECEMBER	2,361	2,421	2,434	2,496	17,796	18,250	7,444	3,632	935	1001
	TOTAL	20,437	19,391	21,070	19,991	154,053	146,165	65,059	30,670	6,028	5,782

CONVERSION FACTOR: 10^3 CU. FT. X 1.031 = 10^6 BTU

BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: NATURAL GAS

FACILITY: OAKDALE SUPPORT ELEMENT, OAKDALE PA. - FAMILY HOUSING YEAR: FY 1981

TABLE NO. 14

	MONTH	GAS USED (10^3 CUBIC FEET)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL GAS COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	3,377	2,819	3,482	2,906	25,459	21,247	10,817	4,111	1,372	997
	FEBRUARY	2,977	2,867	3,069	2,956	22,439	21,613	10,485	4,925	936	916
	MARCH	2,424	2,664	2,499	2,747	18,272	20,085	8,567	4,106	904	881
	APRIL	1,850	2,429	1,907	2,504	13,943	18,308	6,508	3,911	391	617
	MAY	1,635	1,431	1,686	1,475	12,327	10,785	4,577	2,380	223	116
	JUNE	751	724	774	746	5,659	5,454	2,781	1,273	18	48
	JULY	578	506	596	522	4,358	3,817	2,179	914	3	0
	AUGUST	455	524	469	540	3,429	3,948	1,794	921	10	0
	SEPTEMBER	565	551	583	568	4,263	4,153	2,345	970	159	192
1980	OCTOBER	1,089	928	1,123	957	8,211	6,997	3,990	1,223	476	384
	NOVEMBER	1,704	1,527	1,757	1,574	12,846	11,508	5,162	2,304	787	630
	DECEMBER	2,970	2,421	3,062	2,496	22,388	18,250	10,590	3,632	1117	1001
	TOTAL	20,375	19,391	21,007	19,991	153,594	146,165	69,795	30,670	6,396	5,782

CONVERSION FACTOR: 10^3 CU. FT. X 1.031 = 10^6 BTU

BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA : MAIN BASE YEAR: FY 1980

TABLE NO. 15

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	1963	NOT AVAILABLE	272	NOT AVAILABLE	THIS IS CALCULATED FOR STAND-BY FUEL.	NOT	1164	NOT AVAILABLE	1175	997
	FEBRUARY	2740		380				1625		1177	916
	MARCH	2581		358				1531		906	881
	APRIL	533		74				316		500	617
	MAY	480		67				285		172	116
	JUNE	300		42				178		71	48
	JULY	0		0				0		0	0
	AUGUST	0		0				0		5	0
	SEPTEMBER	0		0.				0		48	192
1979	OCTOBER	4394		609				2606		438	384
	NOVEMBER	3041		422				1803		601	630
	DECEMBER	1589		220				942		935	1001
	TOTAL	17,621		2444				10,450		6028	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR: FY 1975

NOTE: FUEL OIL IS USED AS A STAND-BY FUEL AT THE MAIN BASE.

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA : MAIN BASE YEAR: FY 1981

TABLE NO. 16

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	4218	NOT AVAILABLE	585	NOT AVAILABLE	THIS IS NOT CALCULATED FOR STAND-BY FUEL.		5441	NOT AVAILABLE	1372	997
	FEBRUARY	3069		426				3959		936	916
	MARCH	2690		373				3470		904	881
	APRIL	1004		139				1295		391	617
	MAY	2336		324				3013		223	116
	JUNE	315		44				406		18	48
	JULY	0		0				0		3	0
	AUGUST	0		0				0		10	0
	SEPTEMBER	0		0				0		159	192
1980	OCTOBER	190		26				245		476	384
	NOVEMBER	1433		199				1849		787	630
	DECEMBER	3709		514				4785		1117	1001
	TOTAL	18,964		2630				24,463		6396	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR: FY 1975

NOTE: FUEL OIL IS USED AS A STAND-BY FUEL AT THE MAIN BASE.

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA : NEVILLE ISLAND YEAR: FY 1980

TABLE NO. 17

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	2688	NOT AVAILABLE	373	NOT AVAILABLE	19,370	NOT AVAILABLE	1594	NOT AVAILABLE	1175	997
	FEBRUARY	2722		378		19,610		1614		1177	916
	MARCH	2209		306		15,920		1310		906	881
	APRIL	873		121		6290		518		500	617
	MAY	562		78		4050		333		172	116
	JUNE	50		7		360		30		71	48
	JULY	0		0		0		0		0	0
	AUGUST	0		0		0		0		5	0
	SEPTEMBER	0		0		0		0		48	192
1979	OCTOBER	1353		188		9750		802		438	384
	NOVEMBER	2027		281		14,600		1202		601	630
	DECEMBER	1460		203		10,520		866		935	1001
	TOTAL	13,944		1935		100,470		8269		6028	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA : NEVILLE ISLAND YEAR: FY 1981

TABLE NO. 18

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	3649	NOT AVAILABLE	506	NOT AVAILABLE	24,290	NOT AVAILABLE	4707	NOT AVAILABLE	1372	997
	FEBRUARY	2976		413		21,440		3839		936	916
	MARCH	2522		350		18,170		3253		904	881
	APRIL	786		109		5660		1014		391	617
	MAY	671		93		4840		866		223	116
	JUNE	0		0		0		0		18	48
	JULY	0		0		0		0		3	0
	AUGUST	0		0		0		0		10	0
	SEPTEMBER	0		0		0		0		159	192
1980	OCTOBER	916		127		6600		1182		476	384
	NOVEMBER	2106		292		15,170		2717		787	630
	DECEMBER	2639		366		19,010		3404		1117	1001
	TOTAL	16,265		2256		117,180		20,982		6396	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR : FY 1975

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA: SITE 62-C & 62-L YEAR: FY 1980

TABLE NO. 19

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	3437	NOT AVAILABLE	477	NOT AVAILABLE	19,620	NOT AVAILABLE	2038	NOT AVAILABLE	1175	997
	FEBRUARY	4544		630		25,940		2695		1177	916
	MARCH	3380		469		19,290		2004		906	881
	APRIL	1634		227		9330		969		580	617
	MAY	868		120		4950		515		172	116
	JUNE	0		0		0		0		71	48
	JULY	0		0		0		0		0	0
	AUGUST	0		0		0		0		5	0
	SEPTEMBER	0		0		0		0		48	192
1979	OCTOBER	2931		407		16,730		1738		438	384
	NOVEMBER	3579		496		20,430		2122		601	630
	DECEMBER	2381		330		13,590		1412		935	1001
	TOTAL	22,754		3156		129,880		13,493		6028	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: FUEL OIL

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA: SITE 62-C & 62-L YEAR: FY 1981

TABLE NO. 20

	MONTH	FUEL USED (GALLONS)		ENERGY USED (10^6 BTU)		ENERGY USED (BTU/SQUARE FOOT)		TOTAL FUEL COST ($)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	3299	NOT AVAILABLE	458	NOT AVAILABLE	18,830	NOT AVAILABLE	4256	NOT AVAILABLE	1372	997
	FEBRUARY	3598		499		20,540		4641		936	916
	MARCH	3074		426		17,550		3965		904	881
	APRIL	886		123		5060		1143		391	617
	MAY	1143		159		6520		1474		223	116
	JUNE	0		0		0		0		18	48
	JULY	0		0		0		0		3	0
	AUGUST	0		0		0		0		10	0
	SEPTEMBER	0		0		0		0		159	192
1980	OCTOBER	1493		207		8520		1926		476	384
	NOVEMBER	2457		341		14,020		3170		787	630
	DECEMBER	3329		462		19,000		4294		1117	1001
	TOTAL	19,279		2675		110,040		24,870		6396	5782

CONVERSION FACTOR: #2 FUEL OIL - 138,700 BTU/GAL. BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: STEAM

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA (MAIN BASE) YEAR: FY 1979

TABLE NO. 21

	MONTH	STEAM PRODUCED (1000 POUNDS)		PRESSURE (PSIG)		MAKE-UP WATER (GALLONS)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1979	JANUARY	4730	NOT AVAILABLE	80	NOT AVAILABLE	118,000	NOT AVAILABLE	1346	997
	FEBRUARY	4369		80		107,500		1311	916
	MARCH	3776		80		108,900		671	881
	APRIL	3567		80		108,000		458	617
	MAY	3244		80		116,600		219	116
	JUNE	2147		80		86,100		38	48
	JULY	1357		80		50,700		23	0
	AUGUST	1450		80		61,300		26	0
	SEPTEMBER	1201		80		46,300		111	192
1978	OCTOBER	2604		80		108,500		485	384
	NOVEMBER	2920		80		115,700		656	630
	DECEMBER	3863		80		123,000		493	1001
	TOTAL	35,228		80		1,150,600		5837	5782

CONVERSION FACTOR: — Not Applicable —

BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: STEAM

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA (MAIN BASE) YEAR: FY 1980

TABLE NO. 22

	MONTH	STEAM PRODUCED (1000 POUNDS)		PRESSURE (PSIG)		MAKE-UP WATER (GALLONS)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1980	JANUARY	3938	NOT AVAILABLE	80	NOT AVAILABLE	66,400	NOT AVAILABLE	1175	997
	FEBRUARY	4144		80		64,600		1177	916
	MARCH	4630		80		76,500		906	881
	APRIL	2965		80		69,000		500	617
	MAY	2245		80		60,000		172	116
	JUNE	1914		80		43,400		71	48
	JULY	1248		80		50,300		0	0
	AUGUST	98		80		5400		5	0
	SEPTEMBER	0		0		0		48	192
1979	OCTOBER	1529		80		41,500		438	384
	NOVEMBER	2758		80		57,900		601	630
	DECEMBER	3737		80		67,300		935	1001
	TOTAL	29,206		80		602,300		6028	5782

CONVERSION FACTOR: - Not Applicable - BASE YEAR: FY 1975

NUS CORPORATION

ENERGY DATA FORM: STEAM

FACILITY: OAKDALE SUPPORT ELEMENT - OAKDALE, PA (MAIN BASE) YEAR: FY 1981

TABLE NO. 23

	MONTH	STEAM PRODUCED (1000 POUNDS)		PRESSURE (PSIG)		MAKE-UP WATER (GALLONS)		HEATING DEGREE DAYS	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
1981	JANUARY	3878	NOT AVAILABLE	80	NOT AVAILABLE	126,800	NOT AVAILABLE	1372	997
	FEBRUARY	3073		80		111,800		936	916
	MARCH	2914		80		124,300		904	881
	APRIL	2310		80		126,200		391	617
	MAY	2339		80		105,500		223	116
	JUNE	428		80		21,400		18	48
	JULY	NOT AVAILABLE		NOT AVAILABLE		NOT AVAILABLE		3	0
	AUGUST							10	0
	SEPTEMBER							159	192
1980	OCTOBER	1776		80		64,200		476	384
	NOVEMBER	3737		80		93,800		787	630
	DECEMBER	3571		80		108,800		1117	1001
	TOTAL	24,026		80		882,800		6396	5782

CONVERSION FACTOR: — Not Applicable — BASE YEAR: FY1975

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: MAIN BASE - OAKDALE SUPPORT ELEMENT, OAKDALE, PA. YEAR: FY 1979

TABLE NO. E-1

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
*	JANUARY	429,200	NA	840	NA	4,979	NA	* 16,410	NA
*	FEBRUARY	429,200		840		4,979		* 16,410	
*	MARCH	429,200		840		4,979		* 16,410	
	APRIL	367,200		824		4,260		* 14,040	
	MAY	405,600		856		4,705		* 15,510	
*	JUNE	382,800		881		4,440		* 14,640	
*	JULY	382,800		881		4,440		* 14,640	
	AUGUST	379,200		906		4,399		* 14,500	
	SEPTEMBER	360,000		906		4,176		* 13,770	
	OCTOBER	350,400		792		4,065		13,650	
	NOVEMBER	279,600		840		3,243		12,370	
	DECEMBER	508,800		816		5,902		17,530	
	TOTAL	4,704,000 Avg = 392,000		Avg = 852		54,566 Avg = 4,547		179,880 Avg = 14,990	

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr.

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: MAIN BASE - OAKDALE SUPPORT ELEMENT, OAKDALE, PA. YEAR: FY 1980

TABLE NO. E-2

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
	JANUARY	453,600	NA	768	NA	5,262	NA	15,920	NA
	FEBRUARY	469,200		816		5,443		16,740	
*	MARCH	442,000		816		5,127		17,600	
*	APRIL	391,600		768		4,543		15,200	
*	MAY	359,800		816		4,174		14,700	
*	JUNE	259,800		816		3,014		10,810	
*	JULY	407,200		744		4,724		16,420	
*	AUGUST	407,200		744		4,724		16,420	
*	SEPTEMBER	407,200		744		4,724		16,420	
	OCTOBER	330,000		768		3,823		14,330	
	NOVEMBER	391,200		768		4,538		16,260	
*	DECEMBER	453,600		840		5,262		19,450	
	TOTAL	4,771,600 Avg = 397,600		Avg = 788		55,350 Avg = 4,613		190,270 Avg = 15,860	

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr.

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: MAIN BASE - OAKDALE SUPPORT ELEMENT, OAKDALE, PA. YEAR: FY 1981

TABLE NO. E-3

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	453,600	NA	840	NA	5,262	NA	19,450	NA
FEBRUARY	422,400		768		4,900		17,310	
MARCH	340,800		792		3,953		15,640	
APRIL	393,600		792		4,566		16,840	
MAY	319,200		672		3,703		14,790	
JUNE	367,200		840		4,260		17,440	
JULY	414,000		816		4,802		19,180	
AUGUST	385,200		840		4,468		19,570	
SEPTEMBER	340,800		720		3,953		17,930	
OCTOBER	NA		NA		NA		NA	
NOVEMBER								
DECEMBER								
TOTAL	3,436,900 Avg = 381,900		Avg = 787		39,867 Avg = 4,430		158,150 Avg = 17,570	

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWH

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62 - LAUNCH (63) YEAR: FY 1979

TABLE NO. E-4

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	36,180	NA	43	NA	419.7	NA	NA	NA
FEBRUARY	36,540		61		423.9			
MARCH	31,500		54		365.4			
APRIL	23,940		105		277.7			
MAY	19,800		36		229.7			
JUNE	16,020		36		185.8			
JULY	5,760		18		66.8			
AUGUST	7,740		25		89.8			
SEPTEMBER	7,200		22		83.5			
OCTOBER	8,100		25		94.0			
NOVEMBER	9,000		25		104.4			
DECEMBER	23,940		25		277.7			
TOTAL	225,720 Avg = 18,810		Avg = 40		2,618 Avg = 218			

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/kwhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62 - LAUNCH (63) YEAR: FY 1980

TABLE NO. E-5

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	18,360	NA	51	NA	213.0	NA	NA	NA
FEBRUARY	27,000		54		313.2			
MARCH	28,080		51		325.7			
APRIL	27,720		54		321.6			
MAY	23,760		47		275.6			
JUNE	12,600		36		146.2			
JULY	7,020		36		81.4			
AUGUST	8,820		18		102.3			
SEPTEMBER	7,560		36		87.7			
OCTOBER	9,900		29		114.8			
NOVEMBER	15,660		36		181.7			
DECEMBER	21,960		36		254.7			
TOTAL	208,440 Avg = 17,370		Avg = 40		2,418 Avg = 201			

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62 - LAUNCH (63) YEAR: FY 1981

TABLE NO. E-6

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	38,340	NA	54	NA	444.7	NA	NA	NA
FEBRUARY	27,000		54		313.2			
MARCH	36,900		65		428.0			
APRIL	25,200		47		292.3			
MAY	16,200		40		187.9			
JUNE	6,660		40		77.3			
JULY	6,300		18		73.1			
AUGUST	7,920		18		91.9			
SEPTEMBER	5,760		18		66.8			
OCTOBER	NA		NA		NA			
NOVEMBER	↓		↓		↓			
DECEMBER	↓		↓		↓			
TOTAL	170,280 Avg = 18,920	↓	Avg = 39	↓	1,975 Avg = 219	↓	↓	↓

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr.

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62C YEAR: FY 1979

TABLE NO. E-7

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
	JANUARY	NA	NA	NA	NA	NA	NA	NA	NA
	FEBRUARY	↓	↓	↓	↓	↓	↓	↓	↓
	MARCH	↓	↓	↓	↓	↓	↓	↓	↓
	APRIL	↓	↓	↓	↓	↓	↓	↓	↓
	MAY	4,500	↓	24	↓	52.2	↓	↓	↓
*	JUNE	9,410	↓	61	↓	109.2	↓	↓	↓
*	JULY	9,410	↓	61	↓	109.2	↓	↓	↓
*	AUGUST	9,410	↓	61	↓	109.2	↓	↓	↓
*	SEPTEMBER	9,410	↓	61	↓	109.2	↓	↓	↓
*	OCTOBER	9,410	↓	61	↓	109.2	↓	↓	↓
*	NOVEMBER	9,410	↓	61	↓	109.2	↓	↓	↓
*	DECEMBER	9,410	↓	61	↓	109.2	↓	↓	↓
	TOTAL	70,370 Avg = 8,800	↓	Avg = 56	↓	816 Avg = 102	↓	↓	↓

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62C YEAR: FY 1980

TABLE NO. E-8

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
*	JANUARY	9,410	NA	61	NA	109.2	NA	NA	NA
*	FEBRUARY	19,500		61		226.2			
*	MARCH	19,500		61		226.2			
*	APRIL	19,500		61		226.2			
	MAY	10,950		49		127.0			
	JUNE	6,600		18		76.6			
*	JULY	3,600		6		41.8			
*	AUGUST	3,600		6		41.8			
*	SEPTEMBER	8,550		49		99.2			
*	OCTOBER	8,550		49		99.2			
*	NOVEMBER	8,550		49		99.2			
	DECEMBER	14,530		58		168.5			
	TOTAL	132,840 Avg = 11,070		Avg = 44		1,541 Avg = 128			

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/kWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SITE 62C YEAR: FY 1981

Acr. # 415-951206-1

TABLE NO. E-9

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
	JANUARY	21,450	NA	60	NA	248.8	NA	NA	NA
	FEBRUARY	22,200		66		257.5			
	MARCH	14,850		60		172.3			
	APRIL	13,050		65		151.4			
*	MAY	7,950		57		92.2			
*	JUNE	7,950		57		92.2			
*	JULY	7,950		57		92.2			
*	AUGUST	7,950		57		92.2			
	SEPTEMBER	NA		NA		NA			
	OCTOBER								
	NOVEMBER								
	DECEMBER								
	TOTAL	103,350 Avg = 12,920		Avg = 60		1,199 Avg = 150			

* ESTIMATE

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU / kWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND BLDG. T-1103 (T-1001) YEAR: FY 1979

TABLE NO. E-10

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
	JANUARY	7,320	NA	38	NA	84.91	NA	NA	NA
*	FEBRUARY	12,120		32		140.59			
*	MARCH	12,120		32		140.59			
	APRIL	9,360		38		108.59			
	MAY	6,360		32		73.78			
	JUNE	6,120		23		70.99			
	JULY	6,000		29		69.60			
	AUGUST	4,680		24		54.29			
	SEPTEMBER	5,880		27		68.21			
	OCTOBER	7,440		35		86.30			
	NOVEMBER	8,520		43		98.83			
	DECEMBER	12,720		59		147.55			
	TOTAL	98,640 Avg: 8,220		Avg = 34		1,144 Avg = 95			

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND BLDG. T-1103 (T-1001) YEAR: FY 1980

TABLE NO. E-11

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	11,640	NA	47	NA	135.02	NA	NA	NA
FEBRUARY	15,480	↓	53	↓	179.57	↓	↓	↓
MARCH	12,120	↓	42	↓	140.59	↓	↓	↓
APRIL	8,280	↓	37	↓	96.05	↓	↓	↓
MAY	7,080	↓	32	↓	82.13	↓	↓	↓
JUNE	5,880	↓	37	↓	68.21	↓	↓	↓
JULY	5,280	↓	25	↓	61.25	↓	↓	↓
AUGUST	5,520	↓	26	↓	64.03	↓	↓	↓
SEPTEMBER	5,640	↓	29	↓	65.42	↓	↓	↓
OCTOBER	8,760	↓	47	↓	101.62	↓	↓	↓
NOVEMBER	9,000	↓	44	↓	104.40	↓	↓	↓
DECEMBER	11,160	↓	44	↓	129.46	↓	↓	↓
TOTAL	105,840 Avg = 882	↓	Avg = 39	↓	1,228 Avg = 102	↓	↓	↓

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND BLDG. T-1103 (T-1001) YEAR: FY 1981

TABLE NO. E-12

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	14,280	NA	68	NA	165.65	NA	NA	NA
FEBRUARY	12,000		54		139.20			
MARCH	11,640		43		135.02			
APRIL	7,320		43		84.91			
MAY	7,200		41		83.52			
JUNE	6,120		30		70.99			
JULY	6,600		32		76.56			
AUGUST	6,360		32		73.78			
SEPTEMBER	6,240		79		72.38			
OCTOBER	NA		NA		NA			
NOVEMBER								
DECEMBER								
TOTAL	70,560 Avg = 7,840		Avg = 47		818 Avg = 90.9			

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND BLDG. T-1104 (T-1002) YEAR: FY 1979

TABLE NO. E-13

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	21,780	NA	87	NA	252.6	NA	NA	NA
FEBRUARY	24,180		92		208.5			
MARCH	18,060		88		209.5			
APRIL	17,640		84		204.6			
MAY	15,420		74		178.9			
JUNE	14,460		76		167.7			
JULY	15,420		128		178.9			
AUGUST	14,580		134		169.1			
SEPTEMBER	15,240		128		176.8			
OCTOBER	15,660		128		181.7			
NOVEMBER	18,480		78		214.4			
DECEMBER	20,160		84		233.9			
TOTAL	211,080 Avg = 17,590		Avg = 98		2,448 Avg = 204			

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND T-1104 (T-1002) YEAR: FY 1980

TABLE NO. E-14

	MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
		CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
	JANUARY	19,800	NA	91	NA	229.7	NA	NA	NA
	FEBRUARY	23,100		89		268.0			
*	MARCH	19,020		83		220.6			
*	APRIL	19,020		79		220.6			
	MAY	15,120		74		175.4			
	JUNE	15,840		72		183.7			
	JULY	14,880		68		172.6			
	AUGUST	15,480		71		179.6			
	SEPTEMBER	15,240		70		176.8			
	OCTOBER	16,140		80		182.7			
	NOVEMBER	19,440		79		225.5			
	DECEMBER	19,320		82		224.1			
	TOTAL	212,400 Avg = 17,700		Avg = 78		2,463 Avg = 205			

* ESTIMATED

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: NEVILLE ISLAND BLDG. T-1104 (T-1002) YEAR: FY 1981

TABLE NO. E-15

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	21,720	NA	86	NA	252.0	NA	NA	NA
FEBRUARY	20,040	↓	79	↓	232.5	↓	↓	↓
MARCH	18,600	↓	77	↓	215.8	↓	↓	↓
APRIL	16,320	↓	77	↓	189.3	↓	↓	↓
MAY	15,780	↓	74	↓	183.0	↓	↓	↓
JUNE	16,500	↓	79	↓	191.4	↓	↓	↓
JULY	16,740	↓	79	↓	194.2	↓	↓	↓
AUGUST	15,000	↓	73	↓	174.0	↓	↓	↓
SEPTEMBER	15,120	↓	74	↓	175.4	↓	↓	↓
OCTOBER	NA	↓	NA	↓	NA	↓	↓	↓
NOVEMBER	↓	↓	↓	↓	↓	↓	↓	↓
DECEMBER	↓	↓	↓	↓	↓	↓	↓	↓
TOTAL	155,820 Avg = 17,310	↓	Avg = 78	↓	1,808 Avg = 201	↓	↓	↓

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING YEAR: FY 1979

TABLE NO. E-16

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	73,000	NA	NA	NA	842	NA	3,500	NA
FEBRUARY	63,600				738		3,193	
MARCH	67,200				780		3,410	
APRIL	57,900				672		2,980	
MAY	59,500				690		2,880	
JUNE	43,000				499		2,230	
JULY	66,000				765		3,070	
AUGUST	55,700				646		2,820	
SEPTEMBER	53,200				617		2,760	
OCTOBER	47,700				554		2,480	
NOVEMBER	70,100				813		3,570	
DECEMBER	65,600				761		3,320	
TOTAL	722,500 Avg = 60,200				8,382 Avg = 699		36,210 Avg = 3,020	

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING YEAR: FY 1980

TABLE NO. E-17

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	90,900	NA	NA	NA	1,050	NA	4,220	NA
FEBRUARY	62,000				719		3,190	
MARCH	75,100				872		3,630	
APRIL	56,200				652		2,910	
MAY	70,300				816		3,410	
JUNE	50,200				583		2,670	
JULY	59,600				692		3,040	
AUGUST	53,600				621		2,850	
SEPTEMBER	57,200				663		2,950	
OCTOBER	64,700				571		3,380	
NOVEMBER	73,300				850		3,750	
DECEMBER	89,500				1,040		4,590	
TOTAL	802,600 Avg = 66,900				9,129 Avg = 761		40,590 Avg = 3,383	

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWHr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING YEAR: FY 1981

TABLE NO. E-18

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	91,000	NA	NA	NA	1,060	NA	4,770	NA
FEBRUARY	96,100				1,120		4,870	
MARCH	69,600				807		3,940	
APRIL	82,100				952		4,340	
MAY	58,000				673		3,260	
JUNE	64,400				747		3,440	
JULY	82,700				959		4,530	
AUGUST	53,900				626		3,160	
SEPTEMBER	64,400				747		3,600	
OCTOBER	NA				NA		NA	
NOVEMBER								
DECEMBER								
TOTAL	662,200 Avg = 73,600				7,691 Avg = 855		35,910 Avg = 3,990	

NA - NOT AVAILABLE

CONVERSION FACTOR: 11,600 BTU/KWhr

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING - AVG/HOUSE YEAR: FY 1979

TABLE NO. E-19

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	589		NA				28.25	
FEBRUARY	513						25.75	
MARCH	542						27.50	
APRIL	467						24.00	
MAY	480						23.25	
JUNE	347						18.00	
JULY	532						24.75	
AUGUST	449						22.75	
SEPTEMBER	429						22.25	
OCTOBER	385						20.00	
NOVEMBER	565						28.75	
DECEMBER	529						26.75	
TOTAL								

NA - NOT APPLICABLE

CONVERSION FACTOR: _____

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING - AVG/HOUSE YEAR: FY 1980

TABLE NO. E-20

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	733		NA				34.00	
FEBRUARY	500						25.75	
MARCH	606						29.25	
APRIL	453						23.50	
MAY	567						27.50	
JUNE	405						21.50	
JULY	481						24.50	
AUGUST	432						23.00	
SEPTEMBER	461						23.75	
OCTOBER	522						27.25	
NOVEMBER	591						30.25	
DECEMBER	722						37.00	
TOTAL								

NA - NOT APPLICABLE

CONVERSION FACTOR: _____

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, FAMILY HOUSING - AVG/HOUSE YEAR: FY 1981

TABLE NO. E-21

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	734		NA				38.50	
FEBRUARY	775						39.25	
MARCH	561						31.75	
APRIL	662						35.00	
MAY	468						26.25	
JUNE	519						27.75	
JULY	667						36.50	
AUGUST	435						25.50	
SEPTEMBER	519						29.00	
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

CONVERSION FACTOR: _____

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, BASEWIDE CONSUMPTION YEAR: 1979

TABLE NO. E-22

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	567,480		1008					
FEBRUARY	565,640		1025					
MARCH	558,080		1014					
APRIL	476,090		1051					
MAY	511,180		1022					
JUNE	471,810		1077					
JULY	485,390		1117					
AUGUST	471,310		1150					
SEPTEMBER	450,930		1144					
OCTOBER	438,710		1041					
NOVEMBER	395,110		1047					
DECEMBER	640,630		1045					
TOTAL								

CONVERSION FACTOR: _____

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, BASEWIDE CONSUMPTION YEAR: 1980

TABLE NO. E-23

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	603,710		1018					
FEBRUARY	616,280		1073					
MARCH	595,820		1053					
APRIL	522,320		999					
MAY	487,010		1018					
JUNE	350,920		979					
JULY	497,580		879					
AUGUST	494,220		865					
SEPTEMBER	501,390		928					
OCTOBER	438,050		973					
NOVEMBER	517,150		976					
DECEMBER	610,070		1060					
TOTAL								

CONVERSION FACTOR: _____

NUS CORPORATION

ENERGY DATA FORM: ELECTRICITY

FACILITY: OAKDALE SUPPORT ELEMENT, BASEWIDE CONSUMPTION YEAR: 1981

TABLE NO. E-24

MONTH	ENERGY USED (KILOWATT HOURS)		ACTUAL DEMAND (KILOWATTS)		SOURCE ENERGY USED (MBTU'S)		TOTAL COST ($)	
	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE	CURRENT	BASE
JANUARY	640,390		1108					
FEBRUARY	599,740		1021					
MARCH	492,390		1037					
APRIL	537,590		1024					
MAY	372,130		884					
JUNE	468,830		1046					
JULY	534,290		1002					
AUGUST	476,330		1020					
SEPTEMBER	432,320		891					
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

CONVERSION FACTOR: _____

NUS CORPORATION

Duquesne Light
435 Sixth Avenue
Pittsburgh, Pa.
15219
(412) 456-6000

November 18, 1981

Mr. G. L. Goldsmith
N.U.F. Corp.
4 Research Place
Rockville, MD 20850

RE: ELECTRIC RATES
RESIDENTIAL
SMALL GENERAL SERVICE
MEDIUM GENERAL SERVICE
LARGE GENERAL SERVICE

Dear Mr. Goldsmith:

Attached are copies of the current electric rates as they are applied to the various U. S. Army Bases in this area. Riders 10 and 15 are applied to all of the rates. Rider 5 can only be applied to the rates indicated as applicable.

If I can be of further service to you regarding any of the contracts that you are investigating, please call.

Very truly yours,

Raymond J. Wiehagen
GOVERNMENTAL REPRESENTATIVE

RJW:kmp

Attachment

RATE RS - RESIDENTIAL SERVICE

(The Water Heating provision is applicable only to present customers served hereunder on July 15, 1979 and continuously thereafter at the same location, and locations not then served but for which definite commitments had been made as of that date)

AVAILABILITY

Available to customers using the Company's standard single-phase service through a single meter for all general household purposes or for combined general household and farm purposes, where such service is supplied directly by the Company to a single-family dwelling or to an individual dwelling unit in a multiple-dwelling structure.

MONTHLY RATE (I)

Customer Charge - $4.95
All kilowatt-hours at 6.33 cents per kilowatt-hour

WATER HEATING

When customer uses electric energy as the only means of water heating the first 350 kilowatt-hours supplied will be billed at the above rate and the next 350 kilowatt-hours will be billed at 4.63¢ per kilowatt-hour and the remainder at the above rate. (I)

MINIMUM CHARGE

The Minimum Charge shall be $4.95. (I)

RIDERS

Bills rendered under this schedule are subject to the charges stated in any applicable rider.

LATE PAYMENT CHARGE

Bills will be calculated on the rates stated herein, and are due and payable on or before twenty days from the date of mailing of the bill to the ratepayers. The bill is overdue when not paid on or before the due date indicated on the bill. An overdue bill is subject to a Late Payment Charge of 1.25% interest per month on the full unpaid and overdue balance of the bill. The Charge shall be calculated on the overdue portions of the bill and shall not be charged against any sum that falls due during a current billing period.

SPECIAL PROVISIONS

COMBINED RESIDENTIAL AND NON-RESIDENTIAL SERVICE

Where a portion of the service supplied is used for non-residential or non-farm purposes, the appropriate General Service rate is applicable to all service; or, at the option of the customer, the wiring may be so arranged that the residential service may be separately metered and this rate is then applicable to the residential service only.

WATER HEATERS

Water heaters served under this rate must have a capacity of 30 gallons or more. The water heater may have both lower and upper heating elements, but they must be interlocked to prevent simultaneous operation. Heating elements must be rated at 240 volts (nominal) and shall not exceed 5,500 watts each.

OPTIONAL BUDGET PAYMENT PLAN

An Optional Budget Payment Plan offers the ratepayer the option of paying a budget amount each month as estimated by the Company or the actual account balance of the current bill including any arrearages.

(I) Indicates Increase

STANDARD CONTRACT RIDERS - (Cont'd)

RIDER No. 15 - ENERGY COST RATE
(Applicable to All Rates)

The amount billed for this energy cost rate shall not be subject to the State Tax Adjustment surcharge.

Minimum bills shall not be reduced by reason of this energy cost rate. This rate shall be applied to all kilowatt-hours supplied and such charge shall be an addition to any minimums applicable.

The Company shall file quarterly reports within 30 days following the conclusion of each computation year quarter. These reports will be in such form as the Commission shall have prescribed. The third quarter report shall be accompanied by an estimate of the energy cost rate of the next computation year.

The initial energy cost rate shall become effective for bills rendered on and after May 1, 1981 through December 31, 1981 unless otherwise modified or ordered by the Pennsylvania Public Utility Commission. Thereafter, the Company's proposed annual energy cost rate, effective during the billing periods of January through December, shall be submitted to the Commission by December 1 of each year and be effective for bills rendered on and after the following January 1 unless otherwise modified or ordered by the Pennsylvania Public Utility Commission and shall remain in effect for a period of one year unless revised on an interim basis subject to the approval of the Pennsylvania Public Utility Commission. The application of the energy cost rate shall be subject to continuous review and audit by the Commission at such intervals as the Commission shall determine; the Commission shall continuously review the reasonableness and lawfulness of the amounts of charges produced by the energy cost rate and the charges herein.

If from such audit it shall be determined, by final order entered after notice and hearing, that this energy cost rate has been erroneously or improperly utilized, the Company will rectify such error or impropriety, and in accordance with the terms of the order apply credits against future energy cost rates for such revenues as shall have been erroneously or improperly collected. The Commission's order shall be subject to the right of appeal.

The dollar amount remaining in the deferred fuel expense account as a result of the operation of the former energy clause will be recovered over the eight-month period beginning May, 1981 and ending December 1981 by adding a "K" factor to the existing formula. Any future adjustments to energy expense dollars, approved by the Commission, that are not covered by the operation of this energy cost rate will be handled in a similar manner.

STANDARD CONTRACT RIDERS - (Continued)

RIDER No. 10 - STATE TAX ADJUSTMENT

(Applicable to All Rates)

In addition to the charges provided in this Tariff, a surcharge of 4.74% will apply to all bills, except Rider No. 14 - NET ENERGY CLAUSE revenues, pursuant to the Pennsylvania Public Utility Commission authorization of March 10, 1970 to compensate the Company for new and increased taxes imposed by the General Assembly. (I)

The Company will recompute the surcharge using the elements prescribed by the Commission's March 10, 1970 authorization:

(1) Whenever any of the tax rates used in computing the surcharge is changed, in which case the recomputation shall take into account the changed tax rate.

(2) Whenever the Company makes effective increased or decreased rates (other than net energy clause), in which case the recomputation shall take into account the adjustments prescribed by the Commission's March 10, 1970 authorization.

(3) On March 31, 1971, and each year thereafter.

Every recomputation made pursuant to the above paragraph shall be submitted to the Commission within ten days after the occurrence of the event or date which occasions such recomputation; and if the recomputed surcharge is less than the one then in effect the Company will, and if the recomputed surcharge is more than the one then in effect the Company may, accompany such recomputation with a tariff or supplement to reflect such recomputed surcharge, the effective data of which, shall be ten days after filing.

(I) Indicates Increase

STANDARD CONTRACT RIDERS - (Continued)

RIDER No. 9 - SCHOOL AND GOVERNMENTAL SERVICE

(Applicable to Rates GS, GM, GHR, GMH, GLH, and GL only)

(Applicable only to customers served hereunder as of 12/19/72
or any definite commitments made to customers as of that date)

Where public or parochial schools, or local, state, or federal governments or public agencies thereof, use the Company's standard service under Rates GS, GM, GHR, GMH, GLH, and GL, bills shall be computed in accordance with the terms of the applicable rate except as modified by the following provisions:

(1) Where Rate GS, GM or GL is applicable, the bill will be reduced by two percent of the total of the Capacity and Energy Charges computed thereunder without reference to the Minimum Charge. The net average charge after such reduction shall not exceed 11.78 cents per kilowatt-hour except by reason of the Minimum Monthly Charge which shall be one and one-half per cent of the average estimated cost, in place, of equipment installed exclusively for the customer's service, but not less than $5.73. (I) (I)

(2) Where Rate "GHR" or the "GH" portion of "GMH and "GLH" is applicable, the bill will be reduced by two per cent of the total charge computed thereunder but shall not be reduced below the Minimum Charge therein.

(3) A Late Payment Charge specified in the applicable rates GS, GM, GHR, GMH, GLH, or GL will be added to the net amount for failure to make payment of the bill within thirty days from the mailing date.

(I) Indicates Increase

STANDARD CONTRACT RIDERS - (Continued)

RIDER No. 5 - OFF-PEAK SERVICE

(Applicable to Rates "GM", "GL", "I" and "L" - and to Rates "GMH" and "GLH" during months of June, July, August and September only)

Where a customer has a Demand in excess of 100 kilowatts and is supplied by any standard service voltage or where a municipality has a Demand in excess of 50 kilowatts and is supplied from the Company's lines of 2,400 volts or higher for the operation of water pumps for public water supply systems, and where such customer so operates that the maximum Demand created during any billing period occurs during Off-Peak hours, the bill will be calculated using the Billing Demand defined below on the applicable Rate and any other applicable Riders.

DEMANDS AND ENERGIES

The On-Peak Demand is the Demand during On-Peak hours.

The Off-Peak Demand is the Demand during Off-Peak hours.

The Billing Demand is the On-Peak Demand except where the Off-Peak Demand is more than two times the On-Peak Demand. Then the Billing Demand will be 50% of the Off-Peak Demand. In no case will the Billing Demand be lower than the Billing Demand as determined on the applicable Rate.

Demands and Energies will be determined on an Individual Demand basis and corresponding quantities will be combined to obtain Demands and Energies for billing purposes.

ON-PEAK AND OFF-PEAK HOURS

The On-Peak hours shall be between 8:00 A.M. and 10:00 P.M. of each day throughout the year except Saturdays, Sundays, and generally observed holidays. The remaining hours shall be designated as Off-Peak. The Company may, upon written notice to customers taking service under this rider and upon filing same with the Pennsylvania Public Utility Commission, make such changes in the On-Peak hours as it may from time to time deem necessary. (C)

METER CHARGE

(C)

For customers with contracted demands less than 1,000 KW which apply for service on Rider 5, the following meter charges will be added to the customer's monthly bill for each metered service voltage supplied to the customer:

For service applied for prior to	January 1, 1982	$17.00 per month
For service applied for after	January 1, 1982	$33.00 per month

(C) Indicates Change

RATE GM - GENERAL SERVICE MEDIUM

AVAILABILITY

Available for all the standard electric service taken on a customer's premises for which a residential rate is not available where the demand exceeds five kilowatts.

MONTHLY RATE

Customer Charge - $5.85 (I)

CAPACITY CHARGE

First 5 kilowatts or less of Demand---------- No Charge
Additional kilowatts of Demand at---------- $9.95 per kilowatt

ENERGY CHARGE (I)

First 550 kilowatt-hours at---------- 10.53¢ per kilowatt-hour
Next 750 kilowatt-hours at---------- 5.51¢ per kilowatt-hour
Additional kilowatt-hours at---------- 2.27¢ per kilowatt-hour

MAXIMUM AVERAGE CHARGE

The average charge under the above rate shall not exceed 17.75 cents per kilowatt-hour (I) except by reason of the Minimum Charge hereinafter provided.

MINIMUM CHARGE

$5.85 for the first five kilowatts or less of Demand; and $4.31 for each additional (I) kilowatt for either the current month billing Demand or 50% of the highest Demand during the preceding eleven months, whichever is the greater, but not less than $5.85.

RIDERS

Bills rendered under this schedule are subject to the charges stated in any applicable rider.

LATE PAYMENT CHARGE

Bills will be calculated on the rates stated herein, and are due and payable on or before fifteen days from the date of mailing of the bill to the ratepayers. The bill is overdue when not paid on or before the due date indicated on the bill. An overdue bill is subject to a Late Payment Charge of 1.25% interest per month on the full unpaid and overdue balance of the bill. The Charge shall be calculated on the overdue portions of the bill and shall not be charged against any sum that falls due during a current billing period.

DETERMINATION OF DEMAND

The Demand will be measured where a customer's monthly use exceeds 1,000 kilowatt-hours or where the Demand is known to exceed 5 kilowatts. The Demand will be the sum of Individual Demands of each metered standard service. Individual Demand, except in unusual cases, will be determined by measurement of the average kilowatts during the fifteen-minute period of greatest kilowatt-hour use during the billing period. Individual Demands which may exceed 30 kilowatts will be adjusted for power factor by multiplying by

$$\left\{0.8 + \left(0.6 \quad \frac{\text{Reactive kilovolt-ampere hours}}{\text{Kilowatt-hours}}\right)\right\}$$

, where such multiplier will be not less than 1.00 nor more than 2.00.

CONTRACT

Contracts will be written for a period of not less than one year.

STANDARD CONTRACT RIDERS

For modifications of the above rate under special conditions, see "Standard Contract Riders".

(I) Indicates Increase

RATE GL - GENERAL SERVICE LARGE

Former RATE "N"

AVAILABILITY

Available for all the standard electric service taken on a customer's premises where the Demand is not less than 300 kilowatts.

MONTHLY RATE (I)

CAPACITY CHARGE

First 300 kilowatts or less of Demand	$3,010.00
Additional kilowatts of Demand at	$ 7.28 per kilowatt

ENERGY CHARGE (I)

All kilowatt-hours at	2.27¢ per kilowatt-hour

MINIMUM CHARGE (I)

The Minimum Charge shall be $4.31 per kilowatt for the highest Demand previously established during the life of the contract but not less than $3,010.00

RIDERS

Bills rendered under this schedule are subject to the charges stated in any applicable rider.

LATE PAYMENT CHARGE

Bills will be calculated on the rates stated herein, and are due and payable on or before fifteen days from the date of mailing of the bill to the ratepayers. The bill is overdue when not paid on or before the due date indicated on the bill. An overdue bill is subject to a Late Payment Charge of 1.25% interest per month on the full unpaid and overdue balance of the bill. The Charge shall be calculated on the overdue portions of the bill and shall not be charged against any sum that falls due during a current billing period.

DETERMINATION OF DEMAND

The Demand will be the sum of Individual Demands of each metered standard service, but not less than 300 kilowatts.

Individual Demand, except in unusual cases, will be the average kilowatts during the fifteen-minute period of greatest kilowatt-hour use during the month. Individual demands which may exceed 30 kilowatts will be adjusted for power factor by multiplying by $\left\{ 0.8 + \left(0.6 \frac{\text{Reactive Kilovolt-ampere hours}}{\text{Kilowatt-hours}} \right) \right\}$, where such multiplier will be not less than 1.00 nor more than 2.00.

CONTRACT PROVISIONS

Contracts will be written for a period of not less than one year.

Where the customer has established an energy management and conservation program and has demonstrated to the satisfaction of the Company that such program has resulted in a reduced Demand, the Company will, upon the customer's request, amend the contract to reflect such reduced Demand for the purpose of calculating the Minimum Charge, but in no case shall the Demand be reduced to less than 300 kilowatts if the customer remains on this rate.

STANDARD CONTRACT RIDERS

For modifications of the above rate under special conditions, see "Standard Contract Riders".

(I) Indicates Increase

STANDARD CONTRACT RIDERS

GENERAL

In addition to the standard service as set forth under the rates filed with this tariff the Company, where practicable, will render certain special classes of service where desired by the customer and provided that the customer meets the necessary requirements for such special service. A special agreement, additional and supplemental to the regular contract under which standard service is rendered, will be made with a customer for any of the special classes of service hereinafter indicated. The terms, conditions and other considerations for such special classes of service are set forth in the following Standard Contract Riders. Notwithstanding anything to the contrary in the said contract contained, the terms of a rider shall continue in force as long as the said contract remains valid. All terms in said contract, except as modified in the rider or riders applicable to it, shall be and remain in full force and effect.

RIDER No. 1 - DIRECT CURRENT SERVICE

(Applicable to Rates GM and GL only)

Where customers have received direct current service continuously since February 1, 1928 the Company will render such service on this rider and bills will be computed in accordance with the following provisions:

Each customer receiving direct current service will be billed monthly for (1) a charge of $17.83 plus (2) a charge computed on the applicable rate schedule (either Rate GM or GL), applying to the direct current system's metered kilowatt demand and kilowatt-hour consumption a kilowatt demand and a kilowatt-hour consumption based on the ratios of the customer's connected load and estimated consumption to the total of the connected loads and estimated consumptions of all direct current customers. (I)

RIDER No. 2 - UNTRANSFORMED SERVICE

(Applicable to Rates GM, GHR, GMH, GLH and GL only)

Where customers take all or part of their electric service directly from the Company's available primary distribution or transmission systems, and furnish all necessary equipment to take untransformed service, in strict accordance with the Company's standards and specifications, a monthly reduction based upon the Individual Demand of such circuit shall be allowed as follows:

First 50 kilowatts at 20 cents per kilowatt
Next 550 kilowatts at 13 cents per kilowatt
Excess over 600 kilowatts at 7 cents per kilowatt

RIDER No. 3 - SCHOOL AND GOVERNMENTAL SERVICE DISCOUNT PERIOD

(Applicable to Rates GS, GM, GHR, GMH, GLH, GL and L only)

For public or parochial schools, or local, state or federal governments or public agencies thereof, a Late Payment Charge specified in the applicable rates GS, GM, GHR, GMH, GLH, GL or L will be added to the net amount for failure to make payment of the bill within thirty days from the mailing date.

(I) Indicates Increase

NUS CORPORATION

Page____ of _____

DATE _____

CLIENT_____ FILE NO._____ BY_____

SUBJECT_____ Checked By_____