Integrated Energy Master Plan
Executive Summary

for

Leavenworth, Kansas

Contract NO. DACA 45-78-C-0106

Prepared for

U. S. Army Engineer District, Omaha

Corps of Engineers

Omaha, Nebraska

1980

78-808-4

Burns & McDonnell

ENGINEERS - ARCHITECTS - CONSULTANTS

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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November 7, 1980

U. S. Army Engineer District, Omaha
Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha NE 68102

Fort Leavenworth
Integrated Energy Master Plan
Contract No. DACA 45-78-C-0106

Gentlemen:

We have completed the investigation, studies and analyses to determine the best opportunities for energy conservation projects.

This report contains a summary of our findings, for an energy master plan.

Sincerely,

Kenneth M. Clark, P.E.

Jay Hoglund

KMC/JH/wb

Enclosures

C1 D2
AC

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PART I – INTRODUCTION

PART I

INTRODUCTION

A. GENERAL DESCRIPTION

Fort Leavenworth is located in Northeastern Kansas on the west bank of the Missouri River and occupies approximately 6,000 acres of land and water area in Leavenworth County. Kansas City, Missouri and Topeka, Kansas are the two largest cities closest to the fort.

The Fort Leavenworth area can be generally divided into four classifications:

1. Approximately 856 acres are outgranted to various other departments, agencies, and organizations.

2. 1,984 acres are maintained as improved grounds. Improved grounds are those grounds on which intensive development and maintenance measures are effected to facilitate the military mission. This applies to buildings (such as administration, training, storage, medical, barracks, BOQ's, family quarters, etc.); grassed infield areas at Sherman Army Airfield; and the United States Disciplinary Barracks.

3. Approximately 1,580 acres are classified as unimproved grounds which include lakes, ponds, the Penetentiary Farm and wildlife management units.

4. The remaining area consists of upland and bottomland forest areas or woodlands bearing standing timber suitable for forest products and areas of young tree growth capable of eventually producing forest products.

B. PURPOSE OF REPORT

The purpose of this report is to provide a systematic approach for energy conservation and the most efficient use of energy sources available.

C. SCOPE OF STUDY

The scope of this study is to perform a complete energy analysis of Fort Leavenworth. This was accomplished in the following manner:

1. Field verification of existing conditions in all heated buildings with more than 1,000 square feet of floor area at Fort Leavenworth.

2. Computer modeling and analysis of representative buildings located at the fort.

3. Evaluation of energy saving opportunities that will reduce energy consumption and the development of Energy Conservation Investment Program (ECIP) projects.

4. Evaluation of solar energy applications.

5. Evaluation of Energy Monitoring and Control Systems (EMCS).

6. Evaluation of central plant and utility distribution systems.

D. COMPUTER PROGRAM

The computer program DOE 1.4 (formerly CAL-ERDA) was used to arrive at all individual building energy consumption figures and most Energy Conservation Investment Program projects energy savings. This program was developed jointly by the State of California and the United States Energy Research and Development Administration.

E. GENERAL OVERVIEW

All information used in the preparation of a computer model and the development of ECIP projects is from field data or post supplied documents. All buildings in the area (except similar family housing units) were surveyed and all pertinent information recorded. This included occupancy schedules, equipment operation schedules, building architecture, type and condition of heating and cooling systems and lighting systems. ECIP projects were then developed.

Computer models of buildings were developed that best represented all of the typical post buildings. The results of these computer runs provided the information to accurately assess ECIP projects and the efficient utilization of energy.

F. EXISTING PROGRAMS

Fort Leavenworth has several ongoing programs for energy conservation, including ceiling insulation in family housing, storm windows, delamping and others. As these areas are being adequately covered we did not duplicate their efforts in this report.

* * * * *

PART II – CONCLUSIONS AND RECOMMENDATIONS

PART II

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Fort Leavenworth has a considerable number of opportunties for energy savings. Table II-1 is a list of possible Energy Conservation Investment Program projects. Fort Leavenworth consists of a variety of dissimilar buildings. There are only a few "typical" buildings. This makes the generation of ECIP projects for multitudes of similar buildings difficult. For this reason many smaller Energy Conservation Opportunities (ECO) projects are presented for the facilities personnel's consideration.

Steam radiator control and residential utility metering are two of the most significant ECIP projects.

The total annual dollar savings for all the projects suggested is $474,391. Many buildings have more than one project assigned to them, so the total savings for these buildings will be somewhat less than that shown if all of the projects are implemented. Total energy savings compared to FY 78 energy consumption would be 8.1

percent. Broken down by fuels this represents a 11.0 percent savings of natural gas and a 4.7 percent savings of electricity.

We investigated several possible solar projects including various combinations of building heat and hot water heating and swimming pool heating. (See Part VIII - Solar Energy Utilization of the Energy Master Plan). Unfortunately, as attractive as solar energy is as a renewable energy source, it is still not generally cost competitive with the inexpensive natural gas available at Fort Leavenworth. The best payback on any project we examined was 35 years.

The residential utility metering project will probably present the greatest operational problems of all of the projects, but also offers some of the largest potential energy savings. In addition to the projected savings the people living in these residential units will become much more motivated toward energy conservation. (See Part IX - Utility Metering of the Energy Master Plan). Total initial capital cost for all areas recommended is $483,167. Total annual energy savings is $73,317.

An Energy Monitoring and Control System (EMCS) is being installed at Fort Leavenworth. This central control of energy systems should

have large energy saving impact. (See Part VII - Energy Monitoring and Control System of the Energy Master Plan).

The two main central plants have been studied. The main opportunity for conservation is the reduction of boiler size. The reduction in the loads on the central plants and the original sizing of boilers in a low-cost energy era have resulted in boilers which are much larger than required and operate at a lower annual efficiency than necessary. (See Part IV - Central Steam Plants and Utility Distribution Systems of the Energy Master Plan). Total cost of the EMCS will be $1,265,613 and annual savings will be $239,334.

* * * * *

PART III – TABLES AND FIGURES

TABLE II-1
E.C.I.P. SUMMARY

Project	Econ. LIFE (Years)	Nat. Gas Saved MBtu	*Elect. Saved MBtu	Annual Energy Saved $	Initial Capital Cost $	Benefit/ Cost Ratio	E/C Ratio	Payback Period (Years)
Disc.Dom. Hot Water Heaters	25	4,738	54	$14,631	$ 2,126	143.8	2,254.0	0.145
Disc. Refrig.	25	-	1,700	8,114	1,370	105.4	1,240.9	0.17
Enthalpy Ctrl. Economizers	15	-	18,751	83,346	36,454	28.1	542.1	0.4
Disc. Elec. Wtr. Coolers	25	-	482	2,409	1,687	24.5	285.7	0.7
Night Stbck.	15	1,737	-11	5,165	11,361	5.96	160.6	2.0
Flow Limit	25	19,592	267	58,969	152,960	7.8	137.2	2.4
Steam Rad. Ctrl. General	15	33,792	-	101,376	306,665	4.3	116.4	2.9
Steam Rad. Ctrl. USDB	15	11,440	-	34,320	103,912	4.3	116.3	2.9
Addition of Utility Meters	20	16,084	8,194	73,317	483,167	3.24**	53.8 **	6.72**
Enthalpy Economizers	15	453	-	1,302	10,464	1.6	42.0	8.0
Stratification Ctrl. 132/133	15	244	-	580	6,575	1.2	33.8	10.7
Replace Boilers	25	10,342	-	31,026	373,196	1.7	30.8	10.8
Stratification Ctrl. USDB	15	291	-	596	7,990	1.0	30.3	12.7
Wtr. Press. Regulator	25	923	-	59,240	236,762	3.6	4.1	3.8
		99,636	29,437	$474,391	$1,748,919			

* Based on 11,600 Btu/kWh
** Average of valid cases

TABLE I
FY1978
ENERGY CONSUMPTION

FUEL	QUANTITY	EQUIV. BTU X 10^6	% OF TOTAL
NAT. GAS	881,723 MCF	909,056.408	57%
ELECTRICITY	54,522,000 KWH	632,455.2 *	39.7% *
NO. 6 FUEL OIL	182,784 GAL	27,361.024	1.7%
NO. 2 FUEL OIL	156,912 GAL	21,762.2	1.4%
PROPANE	35,885 GAL	3,427.017	0.2%
LNG	—	—	—
COAL	—	—	—
SOLAR	—	—	—

*BASED ON 11,600 BTU

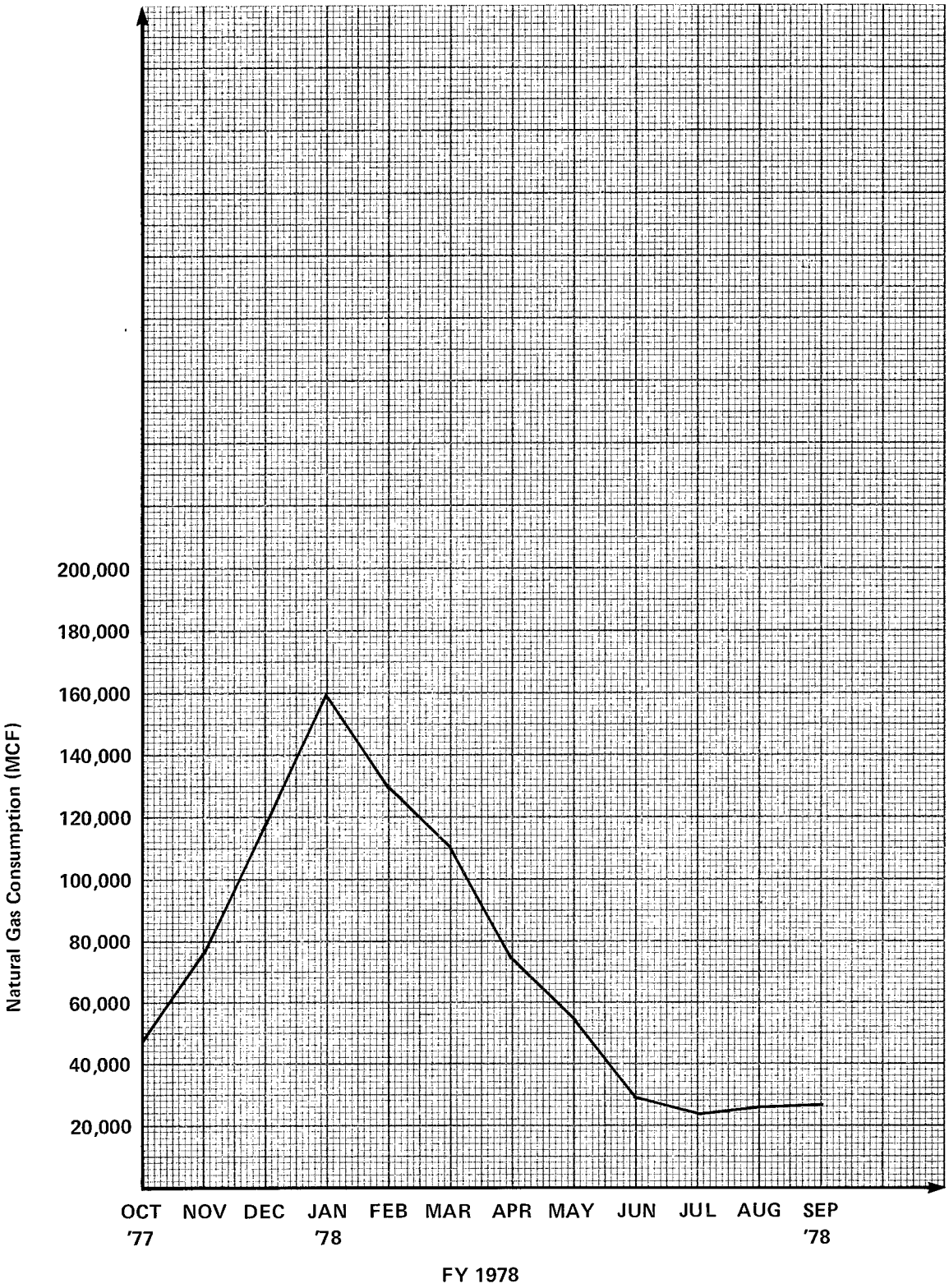

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Figure 1

TABLE III-A-FY 1978
NATURAL GAS CONSUMPTION

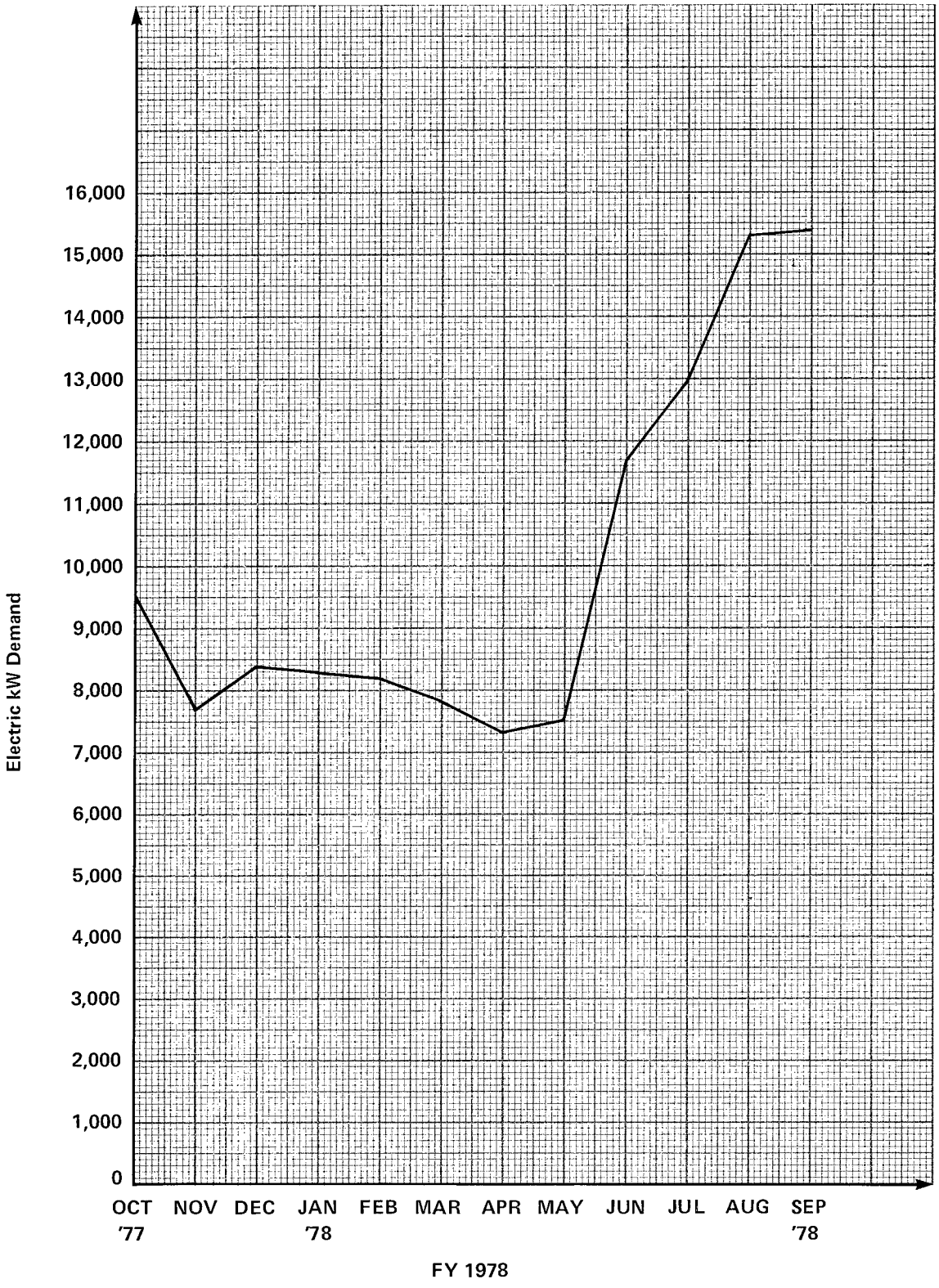

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Figure 2

TABLE III-B-FY 1978
ELECTRIC DEMAND

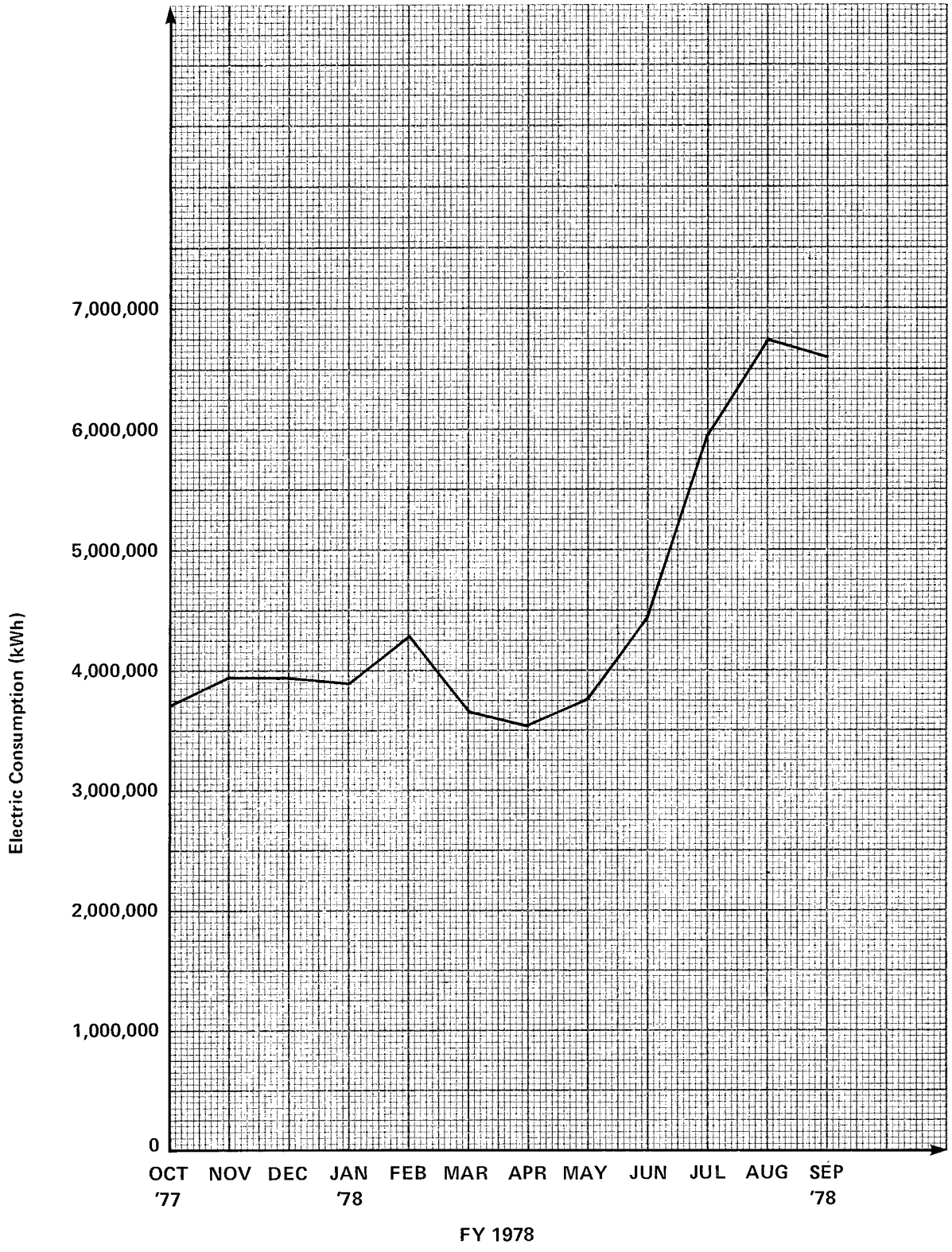

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Figure 3

TABLE III-C-FY 1978
ELECTRIC CONSUMPTION

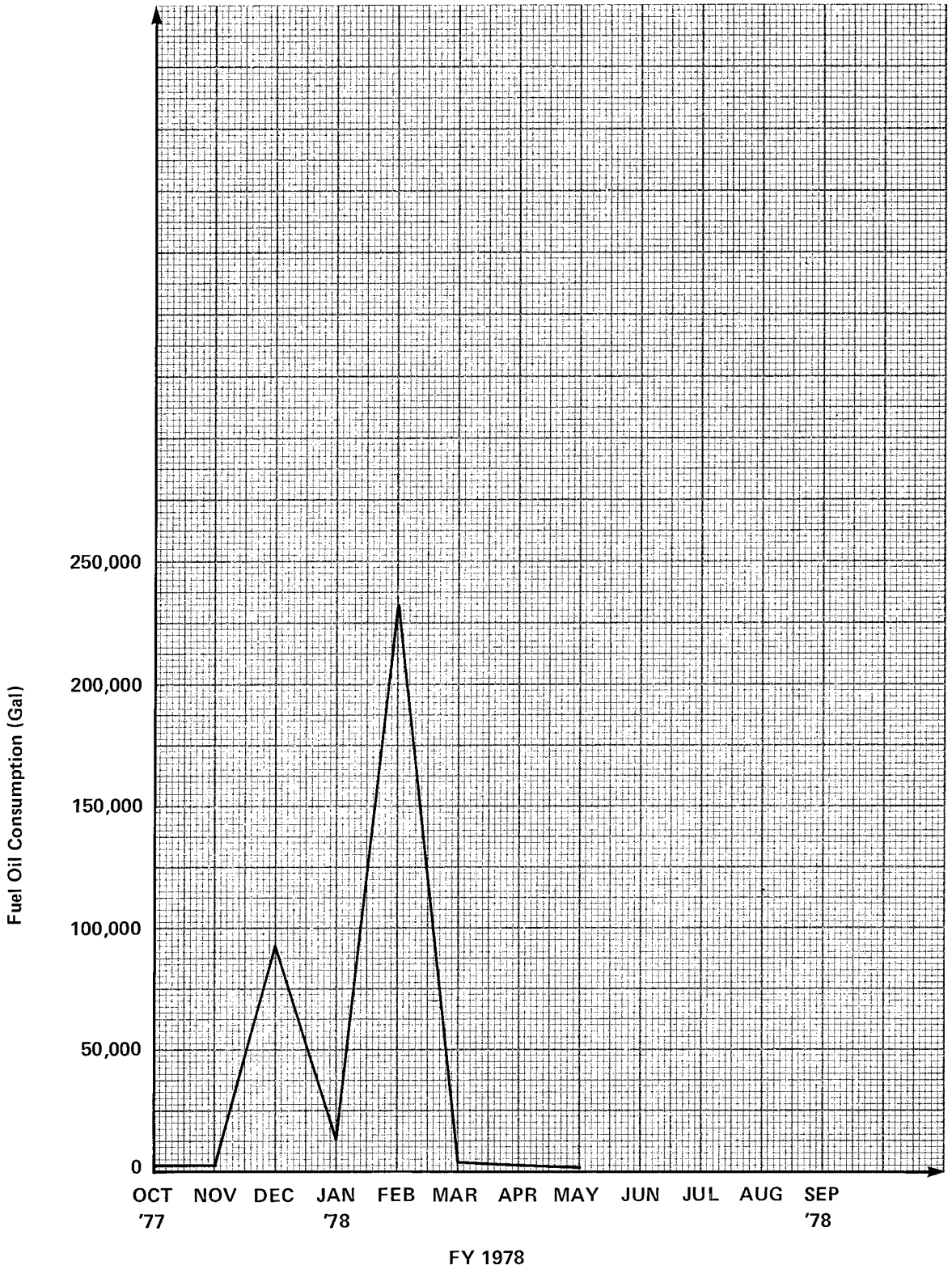

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Figure 4

TABLE III-D-FY 1978
FUEL OIL CONSUMPTION

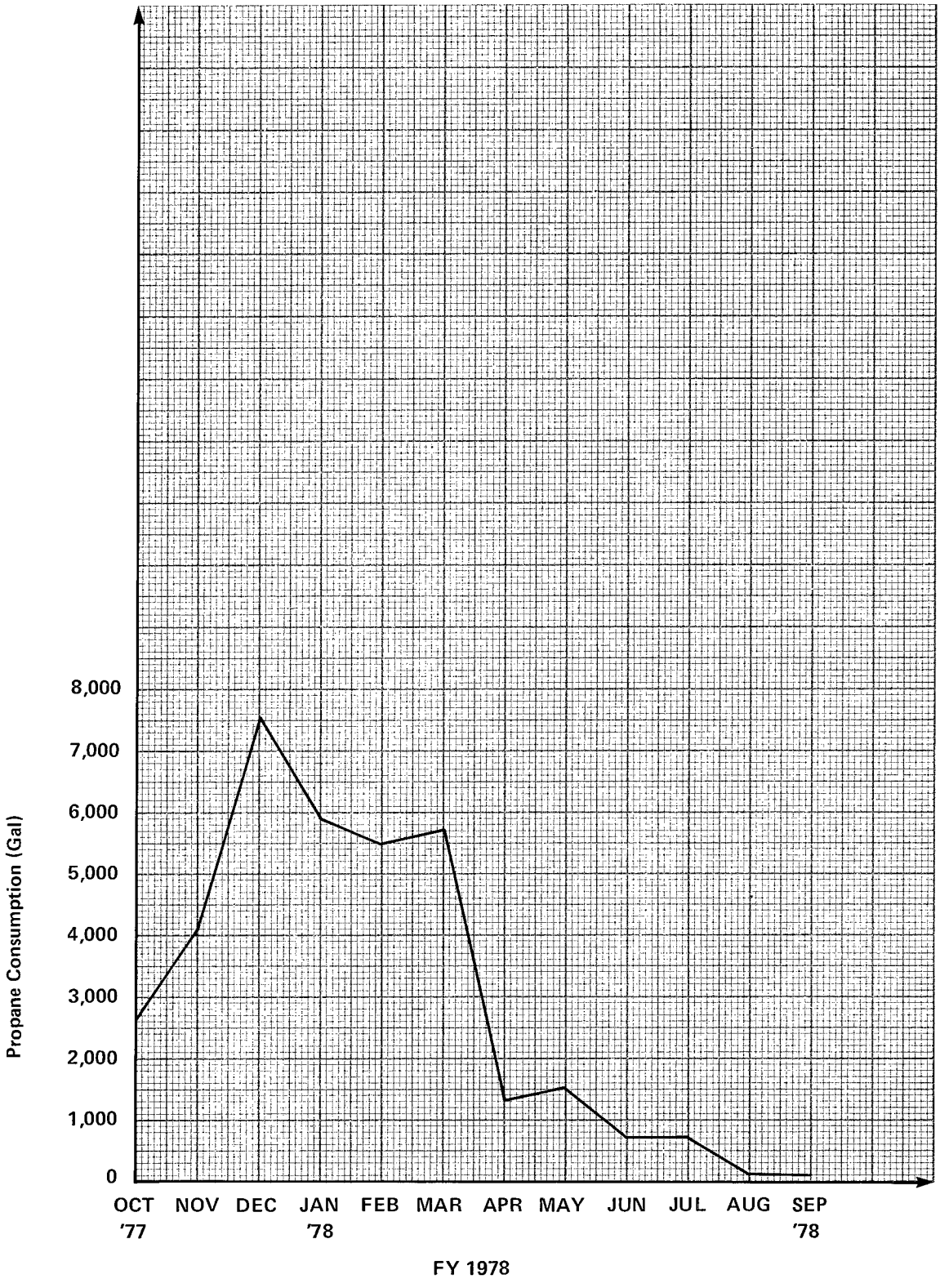

Figure 5

TABLE III-E-FY-1978
PROPANE CONSUMPTION

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