

ENERGY ENGINEERING ANALYSIS PROGRAM

FORT GEORGE G. MEADE
MARYLAND

FINAL REPORT
NOVEMBER 28, 1986

VOLUME 1

EXECUTIVE SUMMARY

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DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS

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EXECUTIVE SUMMARY

1. INTRODUCTION

Purpose

The Army Energy Plan, established in early 1978, sets both short and long term energy goals for the Army consistent with the Presidential Executive Order 12003 issued in mid-1977. It directs the Major Army commands to develop detailed implementation plans and funding documents.

The National Energy Conservation Policy Act (NECPA) of 1978, directs that all facilities owned and operated by a Federal Agency must have all energy conservation retrofits performed by 1 January 1990.

The Department of the Army, through the Corps of Engineers Baltimore, has contracted with Ewing Cole Cherry Parsky to provide the Energy Engineering Analysis Program (EEAP) at Fort George G. Meade under contract number DACA31-82-C-0307. The results of the study are indicated in detail in the MAIN REPORT, Volume 2B of the Report. Back-up calculations are provided in Volume 4B of the Report.

The purpose of this EXECUTIVE SUMMARY is to summarize the results of the EEAP.

Scope of Work

The increments of work to be provided as stated in the Contract are:

- Increment A: Energy Conservation Investigations for Buildings and Processes. The Facilities Engineering Office at Fort Meade indicated that they would rather have specific information for a selected group of buildings rather than extrapolated information which they do not believe will be useful to them because of the considerable amount of work that they have already done and are planning to do. As a consequence, with the exception of certain housing and barracks buildings which can be extrapolated, the buildings selected by Fort Meade for study are atypical, and limit the extent of the analysis.

- Increment B: Energy Conservation Investigations of Utilities and energy Distribution Systems, Energy Monitoring and Control Systems (EMCS), and Local Use of Available Waste Fuels in Existing Energy Plants. By Contract, the EMCS analysis for Increment B is limited to a general review of the problems with the existing system and an expression of Ewing Cole Cherry Parsky's opinion on what should be done with existing systems.

- Increment C: Renewable Energy Projects. By Contract, Increment C is limited to solar studies only. Solar studies are not to include space heating or cooling.

- Increment F: Facilities Engineering Conservation Measures

- Increment G: Projects Identified in Increments A & B That Do Not Qualify Under ECIP Criteria

2. EXISTING ENERGY CONSUMPTION

There are a number of factors which affect the development and presentation of historical and projected energy consumption data for the contract.

These include:

1. The energy consumption values and areas indicated in the "Installation Facility Energy Plan" do not include the consumption for the NSA buildings and the County Schools, since NSA and the schools are not considered to be part of the "Fort Meade" facilities, but do include consumption and area at Support Activities under the control of Fort Meade at other locations and at 15 U.S. Army Reserve (USAR) Centers. The utility company gas and electric bills for Fort Meade include the separately metered but not separately billed consumption of NSA and the schools.
2. The work under the contract does not include the Support Activities or the USAR Centers under the control of Fort Meade, but does include 4 NSA buildings (P-9801, P-9827, P-9828 and P-9829).
3. With the selection of atypical buildings, building group and typical building energy consumption is not available.

On the basis of discussions with the Department of the Army, Baltimore District, Corps of Engineers, the historical energy consumption shown in this report is the consumption at Fort Meade exclusive of the consumption

for the NSA buildings and the County Schools and exclusive of the consumption for the Support Activities and USAR Centers under the control of Fort Meade. As a consequence, the values indicated do not agree with the "Installation Facility Energy Plan" and also do not include consumption or cost for the individual NSA buildings in the contract, since this latter information is not available.

Additionally, on the basis of discussion with the Department of the Army, Baltimore District, Corps of Engineers, projections of energy consumption and savings resulting from implementation of the recommendations of this report are broken down into two parts. The first part includes all buildings and extrapolations exclusive of the 9800 series (NSA) buildings. The second part covers the 9800 series NSA buildings and extrapolations and provides information of projected savings only, without comparison to historical data, since the latter information is not available for these buildings.

The following tables and figures are based on the previous discussion.

Table 2.1 lists the energy conversion factors for converting fuel consumption units to BTU and MBTU for the purpose of calculating energy savings. This listing is copied from "Energy Conservation Investment Program (ECIP) Guidance", revised 6 August 1983, page 2, paragraph 3a.

Tables 2.2 through 2.9 show the consumption values in fuel units, MBTU and cost for fuels used at Fort Meade for fiscal years 1975, 1980, 1981 and 1982.

Tables 2.10 through 2.13 and their "pies" show the total base-wide facility energy values based on data from Tables 2.2 through 2.4 for fiscal years 1975, 1980, 1981 and 1982.

Table 2.14 compares the base-wide facility energy values for fiscal years 1975, 1980, 1981 and 1982 based on information obtained from Tables 2.2 through 2.4. It indicates an overall reduction of more than 18% in facility energy consumption for FY82 compared to FY75.

Figures 2-1, 2-2 and 2-3 show graphically the monthly consumption of electricity, natural gas and oil for fiscal years 1975, 1980, 1981 and 1982.

2.1 ENERGY CONVERSION FACTORS

| <u>FUEL</u> | <u>FUEL UNIT</u> | <u>CONVERSION FACTOR IN BTU</u> | <u>CONVERSION FACTOR IN MBTU</u> |
|-------------------|------------------|-------------------------------------|--------------------------------------|
| ELECTRICITY | KWH | 11,600 BTU/KWH | 0.0116 MBTU/KWH |
| NATURAL GAS | THERM | 100,000 BTU/THERM | 0.1000 MBTU/THERM |
| NATURAL GAS | CCF. | 103,100 BTU/CCF. | 0.1031 MBTU/CCF. |
| NO. 2 FUEL OIL | GAL. | 138,700 BTU/GAL. | 0.1387 MBTU/GAL. |
| PROPANE | GAL. | 95,000 BTU/GAL. | 0.0955 MBTU/GAL. |
| GASOLINE | GAL. | 149,700 BTU/GAL. | 0.1497 MBTU/GAL. |
| NO. 2 DIESEL FUEL | GAL. | 149,700 BTU/GAL. | 0.1497 MBTU/GAL. |
| AVGAS, JP-4 | | * | * |

2.2 ELECTRICITY

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION KWH</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE OF USE 1975</u> | <u>ANNUAL ELECTRIC COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|------------------------|---------------------------------------|--|---------------------------------------|--|--|
| 1975 | 75,490,399 | 875,689 | 100% | * | 100% |
| 1980 | 78,863,922 | 914,821 | 104.5 | 2,622,468 | * |
| 1981 | 79,586,097 | 923,199 | 105.4 | 2,820,639 | * |
| 1982 | 79,493,160 | 922,121 | 105.3 | 3,189,020 | * |

2.3 NATURAL GAS

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION CCF</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE OF USE 1975</u> | <u>ANNUAL GAS COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|------------------------|---------------------------------------|--|---------------------------------------|-----------------------------------|--|
| 1975 | 7,794,474 | 803,920 | 100% | * | 100% |
| 1980 | 5,798,668 | 597,843 | 74.4 | 1,808,358 | * |
| 1981 | 5,996,161 | 618,204 | 76.9 | 2,242,716 | * |
| 1982 | 6,055,612 | 624,333 | 79.0 | 2,861,319 | * |

2.4 NO. 2 FUEL OIL

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE OF USE 1975</u> | <u>ANNUAL OIL COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|------------------------|--|--|---------------------------------------|-----------------------------------|--|
| 1975 | 5,070,264 | 703,246 | 100% | * | 100% |
| 1980 | 2,842,834 | 394,301 | 53.7 | * | * |
| 1981 | 3,042,367 | 421,976 | 57.4 | 4,168,042 | * |
| 1982 | 2,889,255 | 400,739 | 54.5 | * | * |

*Information not available.

2.5 PROPANE

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE USE OF 1975</u> | <u>ANNUAL PROPANE COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|--------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|--------------------------------|
| 1975 | 21,442 | 2,037 | 100% | * | 100% |
| 1980 | 10,253 | 974 | 47.8 | * | * |
| 1981 | 26,368 | 2,505 | 123.0 | * | * |
| 1982 | 8,631 | 820 | 40.3 | * | * |

2.6 MOBILITY GASOLINE

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE USE OF 1975</u> | <u>ANNUAL GASOLINE COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|--------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|
| 1975 | 684,115 | 102,412 | 100% | * | 100% |
| 1980 | 649,519 | 97,233 | 94.9 | * | * |
| 1981 | 605,671 | 90,669 | 88.5 | * | * |
| 1982 | 565,591 | 84,669 | 82.7 | * | * |

2.7 MOBILITY DIESEL OIL

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE USE OF 1975</u> | <u>ANNUAL DIESEL COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|--------------------|--------------------------------|--------------------------------|-------------------------------|------------------------------|--------------------------------|
| 1975 | 361,910 | 54,178 | 100% | * | 100% |
| 1980 | 267,348 | 40,022 | 73.4 | * | * |
| 1981 | 250,822 | 37,548 | 69.3 | * | * |
| 1982 | 286,266 | 42,854 | 79.1 | * | * |

2.8 MOBILITY AVGAS

| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE USE OF 1975</u> | <u>ANNUAL AVGAS COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|--------------------|--------------------------------|--------------------------------|-------------------------------|-----------------------------|--------------------------------|
| 1975 | * | 7,318 | 100% | * | 100% |
| 1980 | * | 2,691 | 36.8 | * | * |
| 1981 | * | 1,783 | 24.4 | * | * |
| 1982 | * | 2,850 | 38.9 | * | * |

2.9 MOBILITY JP-4

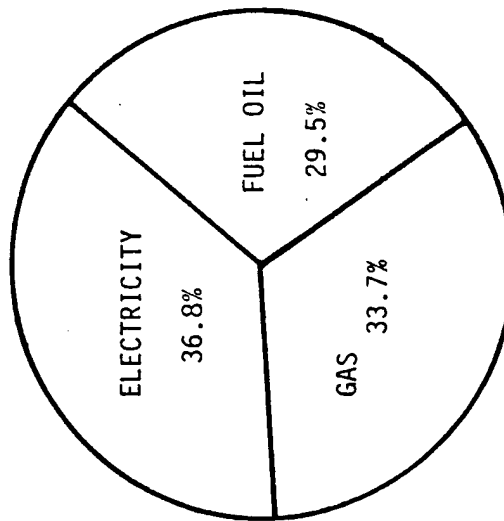
| <u>FISCAL YEAR</u> | <u>ANNUAL CONSUMPTION GAL.</u> | <u>ANNUAL CONSUMPTION MBTU</u> | <u>PERCENTAGE USE OF 1975</u> | <u>ANNUAL JP-4 COST \$</u> | <u>PERCENTAGE OF COST 1975</u> |
|--------------------|--------------------------------|--------------------------------|-------------------------------|----------------------------|--------------------------------|
| 1975 | * | 69,086 | 100% | * | 100% |
| 1980 | * | 47,808 | 69.2 | * | * |
| 1981 | * | 49,873 | 72.2 | * | * |
| 1982 | * | 41,418 | 60.0 | * | * |

*Information not available.

2.10 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE, FY1975

| FUEL TYPE | CONSUMPTION IN FUEL UNITS | CONSUMPTION IN SOURCE MBTU | % OF TOTAL CONSUMPTION | \$ ENERGY COST | % OF TOTAL COST |
|------------------|------------------------------|-------------------------------|---------------------------|-------------------|-----------------|
| Electricity | 75,450,399 KWH | 875,689 | 36.8 | * | * |
| Natural Gas | 7,794,474 CCF | 803,920 | 33.7 | * | * |
| No. 2 Fuel Oil* | 5,070,264 GAL | 703,246 | 29.5 | * | * |
| Total-Facilities | | 2,382,855 | 100.0 | | |

Total

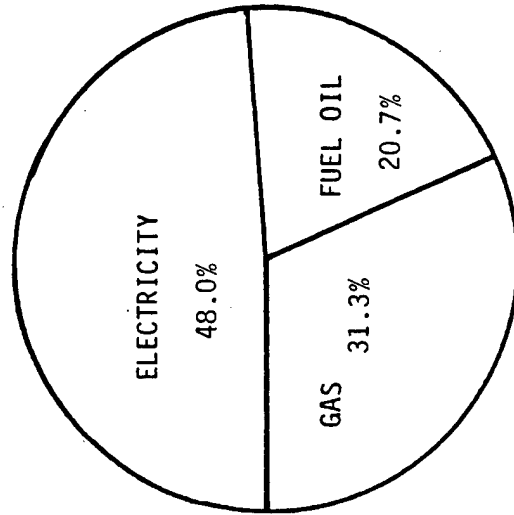


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*Information not available.

2.11 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE, FY1980

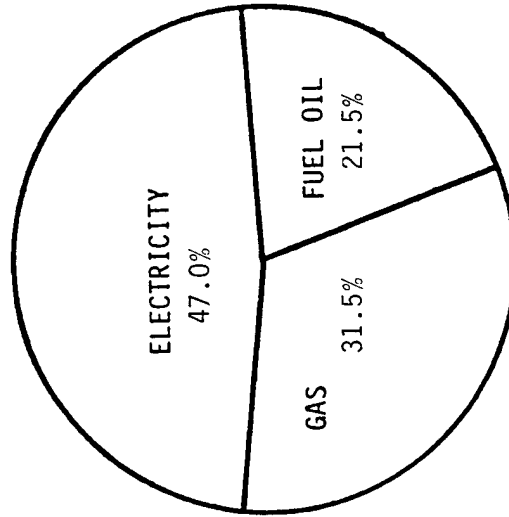
| <u>FUEL TYPE</u> | <u>CONSUMPTION IN FUEL UNITS</u> | <u>CONSUMPTION IN SOURCE MBTU</u> | <u>% OF TOTAL CONSUMPTION</u> | <u>\$ ENERGY COST</u> | <u>% OF TOTAL COST</u> |
|------------------|--------------------------------------|---------------------------------------|-----------------------------------|---------------------------|------------------------|
| Electricity | 78,803,922 KWH | 914,821 | 48.0 | 2,622,468 | * |
| Natural Gas | 5,798,668 CCF | 597,843 | 31.3 | 1,808,358 | * |
| No. 2 Fuel Oil | 2,842,834 GAL | 394,301 | 20.7 | * | * |
| Total-Facilities | | 1,906,965 | 100.0 | | |



*Information not available.

2.12 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE, FY1981

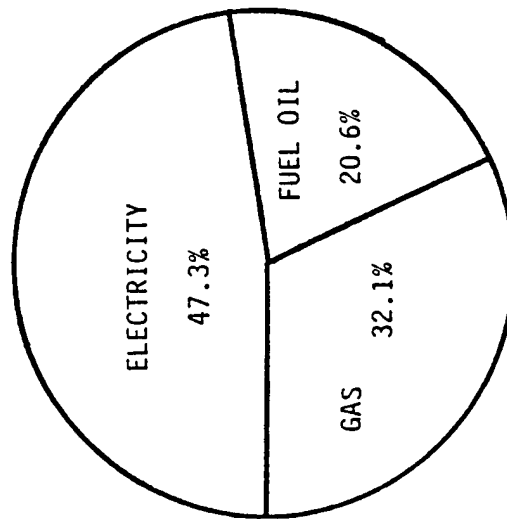
| <u>FUEL TYPE</u> | <u>CONSUMPTION IN FUEL UNITS</u> | <u>CONSUMPTION IN SOURCE MBTU</u> | <u>% OF TOTAL CONSUMPTION</u> | <u>\$ ENERGY COST</u> | <u>% OF TOTAL COST</u> |
|------------------|--------------------------------------|---------------------------------------|-----------------------------------|---------------------------|------------------------|
| Electricity | 79,586,097 KWH | 923,199 | 47.0 | 2,820,639 | * |
| Natural Gas | 5,996,161 CCF | 618,204 | 31.5 | 2,242,716 | * |
| No. 2 Fuel Oil | 3,042,367 GAL | 421,976 | 21.5 | 4,168,042 | * |
| Total-Facilities | | 1,963,379 | 100.0 | | |



*Information not available.

2.13 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE, FY1982

| FUEL TYPE | CONSUMPTION IN FUEL UNITS | CONSUMPTION IN SOURCE MBTU | % OF TOTAL CONSUMPTION | \$ ENERGY COST | % OF TOTAL COST |
|------------------|------------------------------|-------------------------------|---------------------------|-------------------|-----------------|
| Electricity | 79,493,160 KWH | 922,121 | 47.3 | 3,189,020 | * |
| Natural Gas | 6,055,612 CCF | 624,333 | 32.1 | 2,861,319 | * |
| No. 2 Fuel Oil | 2,889,255 GAL | 400,739 | 20.6 | * | * |
| Total-Facilities | | 1,947,193 | 100.0 | | |



*Information not available.

2.14 ANNUAL TOTAL COMPARISON

| <u>FISCAL YEAR</u> | <u>FACILITIES ANNUAL ENERGY MBTU/YR</u> | <u>FACILITIES USE % OF 1975</u> |
|------------------------|---|---|
| 1975 | 2,382,855 | 100.0 |
| 1980 | 1,906,965 | 80.0 |
| 1981 | 1,963,379 | 82.4 |
| 1982 | 1,947,193 | 81.7 |



KEY

- 1975
- 1980
- 1981
- 1982

FIGURE 2-1 MONTHLY ELECTRICAL ENERGY USAGE

FY75 FY80 FY81 FY82

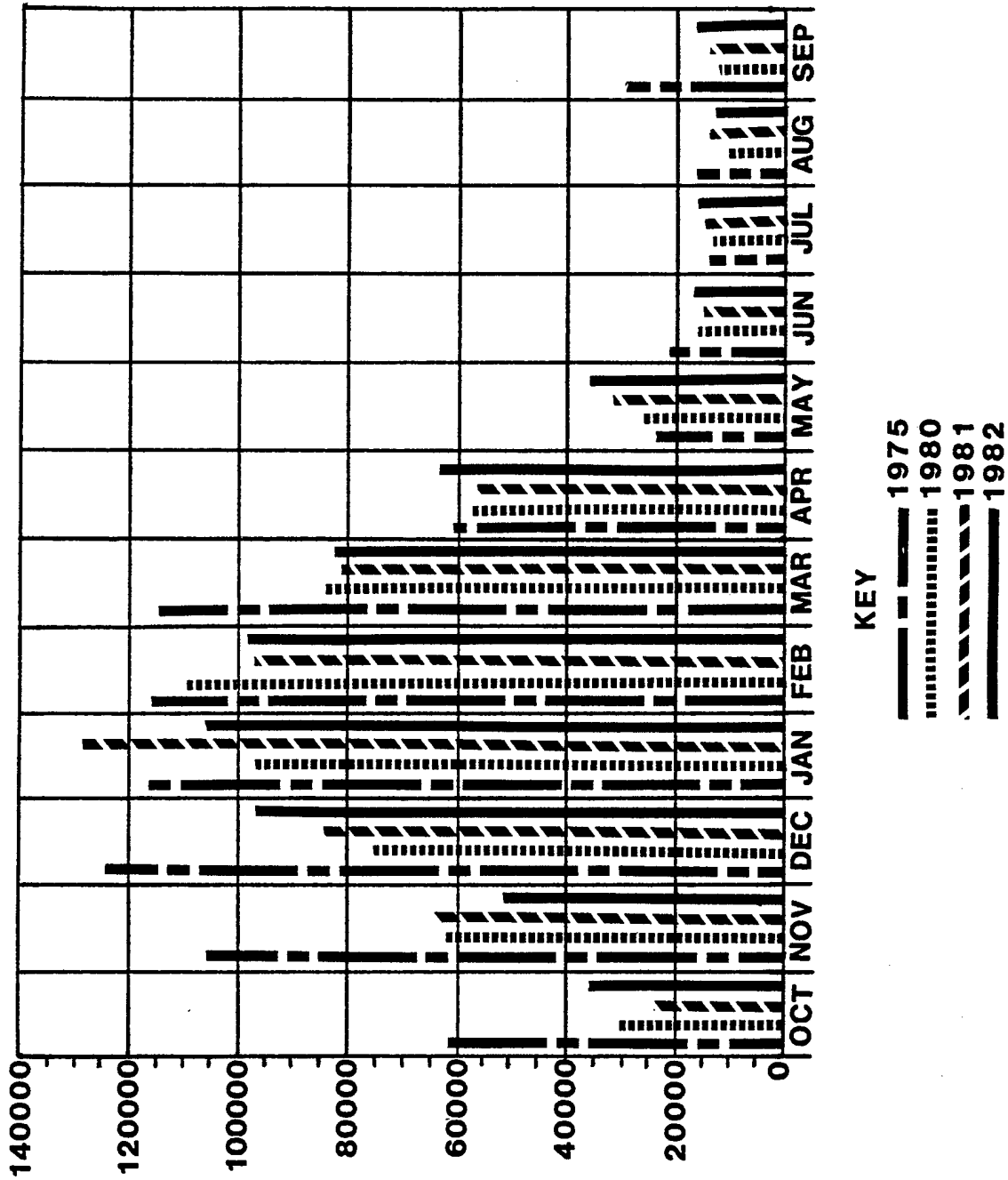


FIGURE 2-2 MONTHLY GAS ENERGY USAGE
FY75 FY80 FY81 FY82

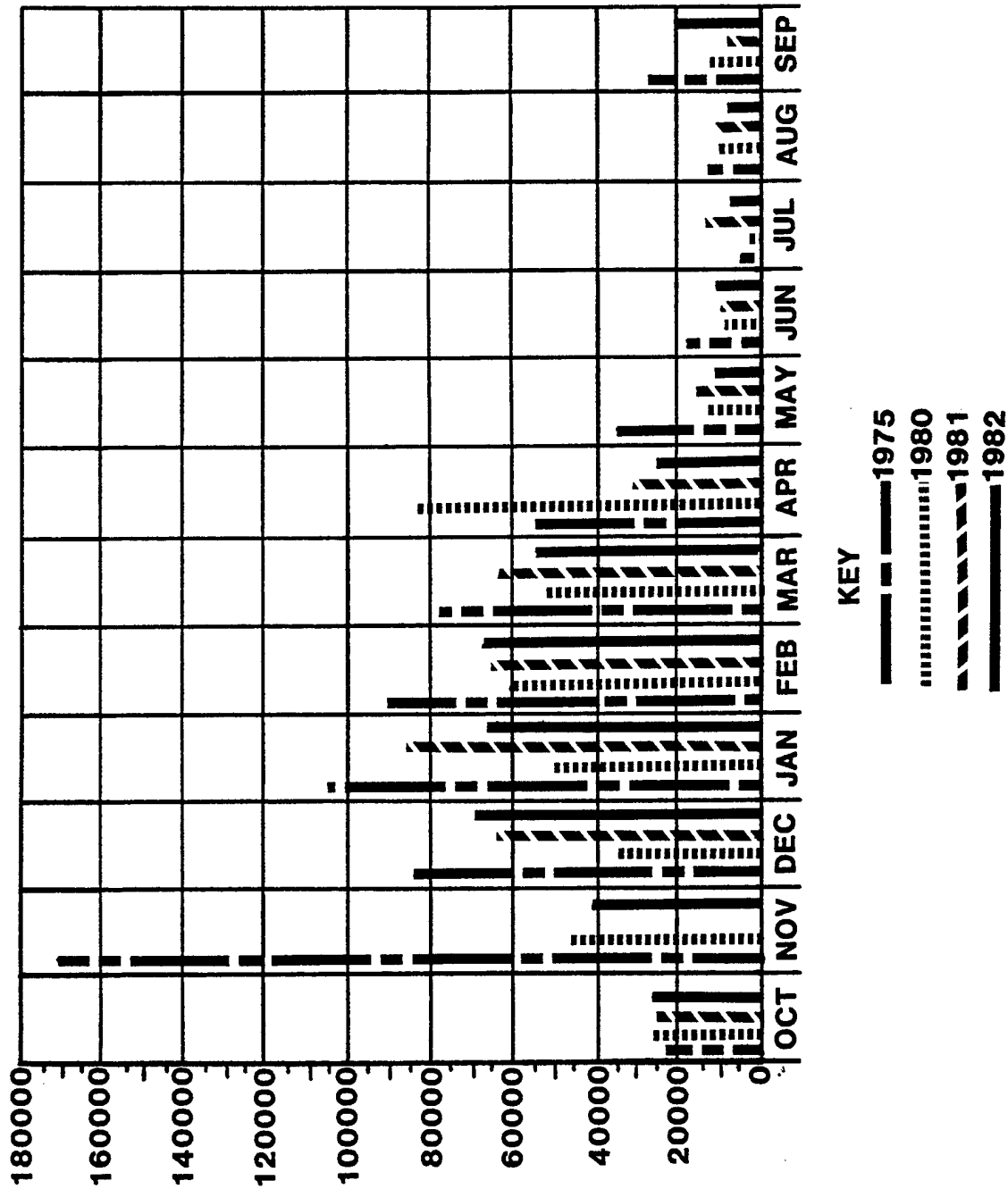


FIGURE 2-3 MONTHLY OIL ENERGY USAGE
 FY75 FY80 FY81 FY82

3. ENERGY CONSERVATION MEASURES DEVELOPED

Basis of Analysis for ECO Evaluation

Energy conservation opportunities were evaluated on the basis of letter, DAEN-MPO-U, 10 August 1982, subject: Energy Conservation Investment Program (ECIP) Guidance.

The ECIP Guidance requires that the evaluation be made as follows:

1. Life Cycle Savings to Investment Ratio (SIR)
2. Recommended simplified economic analysis summary format.
3. Present worth factors as tabulated in DAEN-MPO-U.
4. Energy costs and construction costs at the installation on the date of analysis.

Ewing Cole Cherry Parsky wrote a computer program based on the recommended simplified economic analysis summary format. This program is written in BASIC for use on an IBM/PC computer and a printout is included in Volume 2B, Chapter 5 and Volume 4B, Section 2 for future use by Fort Meade.

"Date of Analysis" energy costs used in the calculations are estimated fiscal year 1983 values, including values for Baltimore Gas & Electric scheduled rate increases, as obtained from the Chief, Environmental & Control Office, Fort George G. Meade.

Ewing Cole Cherry Parsky has on its staff General Construction, Mechanical and Electrical Engineers with actual contracting experience whose specialty is cost estimating and who were involved in estimating the construction costs. Cost information was obtained from vendors and the R. S. Means Construction Cost Guide where appropriate and cost estimates were established based on experience and judgment for the estimated actual installation conditions for each item. SIOH (Supervision, Inspection and Overhead) and Design Costs were established by the Army at 5% and 6%, respectively, of the construction cost and then the investment cost was calculated in accordance with the requirements of the ECIP Guidelines. (Note: The Interim Submission review comments indicate that SIOH has been revised to 5.5%. By agreement, this change is incorporated only on the 1391 Forms for the PDB's in Volume 3 of the report.)

Energy Conservation Opportunities Investigated

A general summary of Potential Energy Conservation Opportunities developed for the various buildings in the Contract during Phase I is attached as Table 3.1, starting on Page ES-3.9.

Energy savings, energy cost savings, installation costs and savings to investment ratio for the various Energy Conservation Opportunities determined during Phase I, as well as additional items developed during the Phase II work, were calculated using the preceding procedure. More detailed information on the ECO's is also included in Volume 2B, Main Report and in Volume 4B, Section 3.

The ECO's were analyzed for funding in accordance with Funding Diagram 3.2 on Page ES-3.16.

The various Energy Conservation Opportunities were originally grouped by "construction trade" for the purposes of determining potential ECIP projects. Fort Meade and the Army requested, however, that all items in any building be included in one project and that all applicable items be included in projects. The items were then organized into groups as follows:

- E1 Buildings With Major Boiler Work
- E2 Housing Units
- E3 Buildings With Major Insulation Work
- E4 Buildings With Miscellaneous Heating, Ventilating and Air Conditioning and Automatic Temperature Control Work
- E5 Solar Energy
- 6 Increment F Items
- 7 Items Which Do Not Qualify Under EEAP Program - Increment G

ECIP Projects

Table 3.3 starting on page ES-3.17 summarizes the recommended ECIP projects, including extrapolated buildings and Increment C.

Other Projects

The dollar value of the category 7 items is not sufficient to warrant separate Increment G projects and these are, therefore, included in Increment F. Table 6.1 starting on Page ES-6.9 of this Executive Summary summarizes the recommended Increment F and G projects.

Energy Management and Control System

The Honeywell CPU installed in 1977 is a back plane wired system using random access memory for the files and operating system. The latest revision is Honeywell REV 1175. This is an all electronic unit and revisions have been made to clean up the software and include all changes or "patches" made over the 1977-1983 period of time.

The following options are available for the new Delta 1000 CPU:

1. Colorographic CRT - This provides interactive graphic displays with normal command and data retrieval functions for an optimum operator interface. The operator has a pictorial representation of the system plus dynamic information on the graphic picture such as fan status, supply air temperature, alarm conditions, return air temperature, pump status, etc.
2. Data Manager System - This is a microprocessor-based historical storage system that enhances the Delta reporting functions. The software is made up of submodules which provide historical storage (trend logs, energy reports or any logging function may be put on the disk for future retrieval) and maintenance management (preventative maintenance work orders based on calendar days, operating time of the equipment and event occurrences).

The Delta 1000 System can be expanded to a Delta 5200 System which is quite similar to the Tri-Service Specification.

The following new technologies can be applied to the existing system as well as current state of the art systems: Direct Digital Control, Fiber Optics and FM Radio Control.

The Honeywell Delta 1000 EMCS is a viable system and can provide significant energy savings. It requires, as does any large, sophisticated EMCS, periodic updating, and constant preventative and corrective maintenance, and this should be provided. It can be expanded and it is recommended that this be done, as appropriate, to improve its usefulness.

The existing CPU should be retrofitted or replaced to include current electronics and software changes and patches made over the 1977 - 1983 period of time. Budget \$35,000 to \$40,000.

When new buildings are constructed, or existing buildings are altered, consideration should be given to the use of DDC rather than conventional automatic temperature controls. For sophisticated control systems, DDC may be less costly than conventional systems. For any event, DDC reduces the cost of connection to the EMCS and provides local management - distributive processing - functions.

Recommendations for improved utilization are as follows:

1. Optimum Start/Stop was not included in the original implementation but Fort Meade has begun the process of using this system capability. This process should be expedited so that all heating and air conditioning systems under control of the EMCS utilize this feature of the system.
2. Load reset and reheat reduction were not included in the original implementation. There are no reheat systems under the control of the EMCS. Load reset for water chillers, boilers and heating systems should be implemented through the EMCS for the buildings which are under the control of the EMCS if appropriate.
3. Enthalpy control was not included in the original implementation and is not recommended by the Corps of Engineers because their experience is that maintenance costs are too high.
4. Electrical demand control was included in the original implementation. For fiscal year 1982, electrical demand charges were \$2,636,173 or 24.4% of the total electrical costs for Fort Meade and NSA. Implementation of additional demand control through the EMCS should be cost effective.

The EMCS is monolithic and any failure of the CPU affects the entire system. Special expertise is required to maintain the CPU and it should be updated as newer versions become available. It is recommended, therefore, that Fort Meade arrange for maintenance of the CPU through a maintenance contract with the manufacturer's (Honeywell) service organization and that the contract include updating of the CPU.

The balance of the system also requires periodic preventative and corrective maintenance. This maintenance can be accomplished by any one, or a combination, of the following three methods.

1. Fort Meade personnel
2. Contract with an independent service organization
3. Contract with the manufacturers' (Honeywell) service organization

Method No. 1 is dependent upon Fort Meade's capability of hiring and keeping qualified personnel. If this can be accomplished, this method will have the lowest cost to Fort Meade.

Method No. 2 is dependent upon being able to find a capable independent service organization and, if so, would probably be more expensive than Method No. 1 and less expensive than Method No. 3.

Method No. 3 is probably the most costly method. It is recommended, however, that Fort Meade consider using Method No. 3, in conjunction with retrofitting of the CPU, for a period of one year for the purpose of modernizing the system and placing it in an operating condition that will provide reliable monitoring and energy management. After this initial year, the contract with Honeywell should be renewed for the CPU and maintenance Method No. 1, No. 2, or No. 3 should be implemented for the balance of the system as Fort Meade deems appropriate.

The Data Manager System and Colorographic CRT have the potential for saving labor and improving maintenance but may not be cost effective.

Fort Meade should consider expanding the EMCS to all buildings which have energy cost avoidances that will justify the installation cost.

Reliance on manual energy management functions is risky because of the potential for human error or negligence. Time clocks can be effective, but they require resetting after every power failure and sometimes require seasonal resetting, both of which are manual functions. Installation of time clocks with energy management functions other than on/off approaches or exceeds the cost of connecting to the EMCS.

The budget price for installing a data gathering panel to control one point is approximately \$2000. This type of expansion is justifiable when the energy cost avoidance is \$400 or more per year. The budget price for each additional control point on the panel is \$400 and is justifiable for each additional control point that has an annual energy cost avoidance of \$80.

Radio frequency control can be used for expansion to serve smaller buildings and systems. The initial installation would be justifiable if sufficient control points can be found that will provide an annual energy cost avoidance of \$1000. Additional control points can then be added if their cost avoidance is \$65 or more per year.

Expansion to the Delta 5200 configuration does not appear to be appropriate at the present time.

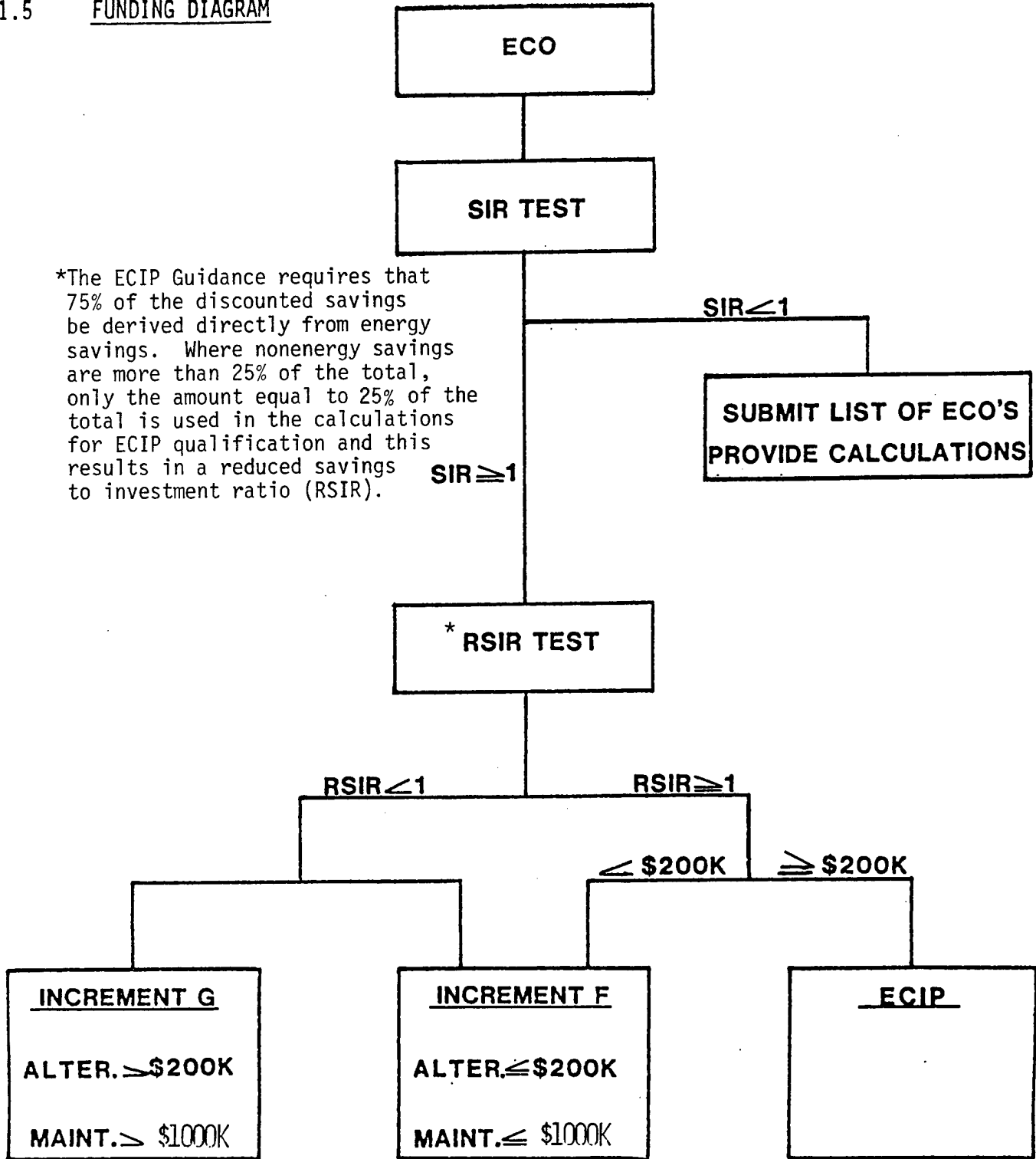
3.1.6 DOMESTIC HOT WATER SYSTEM

C Implemented, Planned or Studied by Fort Meade
 X Potential ECO applicable to building

| BUILDING NO. | P-90 | P-90 BH | P-370 | T-504 | T-618 | P-726 | P-1644 | P-1837 | P-1978 | P-2239 | P-2246 | T-2250 | P-2251 | P-2257 | T-2276 | P-2480 | P-2482 | P-2490 | P-2692 | P-2793 | P-3073 | P-4215 | P-4216 | P-4217 | P-4247 | P-4272 | P-4411 | P-4415 | P-4431 | P-4432 | P-4523 | P-4550 | P-4551 | P-4552 | P-4553 | P-4554 | P-4700 | P-4705 | P-6330 | P-7100 | P-7338 | P-7638 | P-8452 | P-8472 | P-8481 | P-8484 | P-8605 | P-8688 | P-9801 | P-9827 | P-9828 | P-9829 | | | |
|--------------------------------------|------|---------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|--|--|
| FLOW RESTRICTORS | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BOOSTER HEATER DISHWASHER | | | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODIFY CONTROLS | | | | X | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REPLACE D.H. HEATERS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODIFICATION- PLUMBING SYSTEMS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEAT PUMP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Blank spaces indicate that ECO was investigated but found to be not applicable for the building.

5.1.5 FUNDING DIAGRAM



*The ECIP Guidance requires that 75% of the discounted savings be derived directly from energy savings. Where nonenergy savings are more than 25% of the total, only the amount equal to 25% of the total is used in the calculations for ECIP qualification and this results in a reduced savings to investment ratio (RSIR).

3.3 ECIP PROJECTS SUMMARY TABLE

| BUILDING NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | FIRST YEAR COST SAVINGS (\$) | TOTAL DISCOUNTED SAVINGS (\$) | NON-ENERGY DISCOUNTED SAVINGS (\$) | SIR | REDUCED SIR |
|--------------|--|-------------------------|----------------------|---------------------------------|------------------------------|-------------------------------|------------------------------------|------|-------------|
| E-1 | Buildings With Major Boiler Work | 858,692 | 772,824 | 26,535 | 253,212 | 3,780,289 | -21,663 | 4.89 | - |
| E-2 | Housing Units | 786,450 | 708,298 | 19,588 | 120,510 | 2,242,874 | -80,596 | 3.17 | - |
| E-3 | Buildings With Major Insulation Work | 1,026,884 | 924,193 | 8,035 | 60,206 | 1,031,900 | 8,470 | 1.12 | - |
| E-4 | Buildings With Miscellaneous HVAC and ATC Work | 617,624 | 555,856 | 28,118 | 135,780 | 1,817,109 | 32,161 | 3.27 | - |
| E-5 | Solar Energy | 541,830 | 487,647 | 5,920 | 32,862 | 702,546 | - | 1.44 | - |

3.4
6.5
17.1
4.5
16.5

3.3 ECIP PROJECT SUMMARY TABLE (CONTINUED)

DETAILED DESCRIPTION OF ECIP PROJECTS

| <u>ECIP PROJECT</u> | <u>DESCRIPTION</u> | <u>BUILDINGS</u> |
|---------------------|---|----------------------------|
| E-1 | <u>Buildings With Major Boiler Work</u> | |
| | Boiler Oxygen Controls | P90BH, P2251, P2482 |
| | Preheat Combustion Air | P90BH, P2251, P2482, P8481 |
| | Boiler Turbulators | P90BH, P2251 |
| | High Efficiency Motor Replacement | P90BH |
| | Night Setback/Setup | P90 |
| | Economizer Cycle | P90 |
| | Limit Infiltration Hanger Doors | P90 |
| | Zero Energy Band Thermostat | P90 |
| | Thermostatic Control of Fans | P90 |
| | Repair Stack Dampers | P2251, P8481 |
| | Blow Down Heat Recovery | P2251, P2482, P8481 |
| | Stack Economizers | P2482 |
| | Replace Burners | P2482, P8481 |
| | Replace Incandescent Lighting | P2482, P8481 |
| | Decentralized Summer Domestic Hot Water | P8481 |
| E-2 | <u>Housing Units</u> | |
| | Boiler Oxygen Controls | P1644, P1643 Extrapolated |
| | Preheat Combustion Air | P1644, P1643 Extrapolated |
| | Boiler Turbulators | P1644, P1643 Extrapolated |
| | Night Setback/Setup | P1644, P1643 Extrapolated |

3.3 ECIP PROJECT SUMMARY TABLE (CONTINUED)

| <u>ECIP PROJECT</u> | <u>DESCRIPTION</u> | <u>BUILDINGS</u> |
|---------------------|---|---|
| E-2 | <u>Housing Units (CONTINUED)</u> | |
| | Night Setback/Setup | *P3073C + 199 Extrapolated Apartments |
| | Vent Dampers - Boiler or Furnace and Water Heater | *P3073C + 199 Extrapolated Apartments *P4247 + 29 Extrapolated Buildings *P4523 + 27 Extrapolated Buildings |
| | Storm Windows | *P4247 + 29 Extrapolated Buildings *P7638B + 75 Extrapolated Apartments |
| | Weatherstripping and Caulking | *P4247 + 29 Extrapolated Buildings *P7338F + 209 Extrapolated Apartments *P7638B + 75 Extrapolated Apartments |
| | Boiler Replacement | *P4247 + 29 Extrapolated Buildings *P4523 + 27 Extrapolated Buildings |
| | Insulation - Garage Ceiling | *P4523 + 27 Extrapolated Buildings |
| | Insulation - Garage Wall | *P4523 + 27 Extrapolated Buildings |
| | Replace Kitchen Exhaust Damper | *P7338F + 30 Extrapolated Apartments |
| | Replace Attic Fan Louvers | *P7338F + 30 Extrapolated Apartments |

*EXTRAPOLATIONS

P3073C: 61 buildings - P3010 through P3076
P4247: 29 buildings - P4231 through P4260
P4523: 27 buildings - P4501, P4511, P4519, P4521, P4522, P4524, P4526 through P4529, P4531 through P4539, P4541 through P4544, P4546 through P4549
P7338F: 37 buildings - P7301 through P7315, P7318 through P7332, P7334, P7336, P7339 through P7343
P7638B: 37 buildings - P7604, P7606 through P7642

E-3 Buildings With Major Insulation Work

| | |
|--|--|
| Insulation - Outside Wall Exterior Surface | P8472 |
| Insulation - Outside Wall Interior Surface | P9801 + P9802, P9803, P9804 Extrapolated |

3.3 ECIP PROJECT SUMMARY TABLE (CONTINUED)

| <u>ECIP PROJECT</u> | <u>DESCRIPTION</u> | <u>BUILDINGS</u> |
|---------------------|--|--|
| E-3 | <u>Buildings With Major Insulation Work</u> Continued... | |
| | Modify Controls - Shut Off OA On Warmup | P8472 |
| | High Efficiency Motor Replacement | P9801 + P9802, P9803, P9804 Extrapolated |
| | Chiller Reset Controls | P9801 + P9802, P9803, P9804 Extrapolated |
| E-4 | <u>Buildings With Miscellaneous HVAC and ATC Work</u> | |
| | Economizer Cycle | T504, P4551, P4700 |
| | Night Setback/Setup | T608, T726 +*20 Extrapolated Buildings P2490, P4272, P4705 |
| | Insulation - Piping | T726 +*20 Extrapolated Buildings |
| | Insulation - Ductwork | T726 +*20 Extrapolated Buildings |
| | Revise Controls - 48-hr. Timer | T726 +*20 Extrapolated Buildings |
| | Modify Controls - Shut off OA on Warmup | P2239, P4552, P4554 P8452, P9829 |
| | Summer Steam Boiler | P2239 |
| | Boiler Turbulators | P2239, P2257, P4554, P7100 |
| | Solar Film | P2257 (Barracks), P4705, P7100, P8452 |
| | Radiator Controls | P2257, P4553, P4554 |
| | Chiller Reset Controls | P2257, P2480, P2490, P4215, P4411, P4550, P4705, P7100, P8605 +*10 Extrapolated Buildings, P9827, P9828 |

*EXTRAPOLATIONS

T726: 20 buildings - T702 through T708, T722 through T727, T728, T732 through
T738

P8605: 10 buildings - P8478, P8479, P8543, P8544, P8545, P8606, P8607, P8609, P8611

3.3 ECIP PROJECT SUMMARY TABLE (CONTINUED)

| <u>ECIP PROJECT</u> | <u>DESCRIPTION</u> | <u>BUILDINGS</u> |
|---------------------|---|--|
| E-4 | <u>Buildings With Miscellaneous HVAC and ATC Work (CONTINUED)</u> | |
| | High Efficiency Motor Replacement | P2480, P2490, P4205, P4272, P4550, P6330, P7100, P8605 +*10 Extrapolated Buildings, P9827, P9828, P9829 |
| | Control Domestic Hot Water Pump | P6330, P9829 |
| | Reduce CFM/Shutoff on Unoccupied | P2480 |
| | Chiller Heat Recovery | P2480 |
| | Reduce OA, Unoccupied & Warmup | P6330 |
| | Zone Dampers to Separate Emergency and Pharmacy | P2480 |
| | Exhaust to Make Up Air Heat Recovery | P6330 |
| | Decentralize Hot Water | P7100 |
| | Weatherstripping and Caulking | P8452 |
| | Exhaust Fan Time Clocks | P8452 |
| | Zero Energy Band Thermostats | P8452, P9827 |
| E-5 | <u>Solar Energy - Domestic Hot Water</u> | |
| | Barracks Building | P8605 + Extrapolated Buildings: (P8478, P8479, P8543, P8544, P8545, P8606, P8607, P8609, P8610, P8611, P9801, P9802, P9803, P9804, P9827, P9828) |
| | Other Buildings | T2250, P2480, P6330 |

*EXTRAPOLATIONS

P8605: 10 buildings - P8478, P8479, P8543, P8544, P8545, P8606, P8607, P8609, P8611

EXECUTIVE SUMMARY

ES-3.21

4. ENERGY AND COST SAVINGS

Summary

The following Tables 4.1 through 4.4 summarize the potential energy savings. These indicate that for the Fort Meade facilities there is a potential savings of 76,838 MBTU per year if all of the ECIP projects are implemented and 30,384 MBTU per year if all of the Increment F projects are implemented, with a grand total potential savings of 107,222 MBTU per year. These savings, coupled with the savings that were previously established as noted by comparing FY82 data with base year FY75 data, together with projected savings of 94,770 MBTU per year for ECIP projects under construction, indicate on Table 4.4 that the goal savings of 20% will be exceeded by 6.8% if all of the projects are implemented.

The Tables also indicate that for the NSA Buildings surveyed, and their extrapolations, there is a potential savings of 11,358 MBTU per year if the ECIP projects are implemented and 6,518 MBTU per year if the Increment F projects are implemented, with a grand total potential savings of 17,876 MBTU per year.

4.1 ECIP & INCREMENT F PROJECTS FUEL SAVINGS SUMMARY-MBTY/Y FOR EACH FUEL

| <u>ECIP PROJECTS</u> | <u>ELECTRIC</u> | <u>GAS</u> | <u>OIL</u> | <u>TOTAL</u> |
|--|-----------------|------------|---------------|---------------|
| E-1 Buildings with Major Boiler Work | F 2,916 | F(-)15,212 | F 38,831 | F 26,535 |
| E-2 Housing Units | F 0 | F 15,916 | F 3,672 | F 19,588 |
| E-3 Buildings With Major Insulation Work | | | | |
| Buildings Other Than 9800 Buildings | F 14 | F 0 | F 228 | F 242 |
| 9800 Buildings | N 1,689 | N 0 | N 6,104 | N 7,793 |
| E-4 Buildings With Miscellaneous HVAC and ATC Work | | | | |
| Buildings Other Than 9800 | F 14,305 | F 6,309 | F 5,944 | F 26,558 |
| 9800 Buildings | N 990 | N 0 | N 570 | N 1,560 |
| E-5 Solar Energy | | | | |
| Buildings Other Than 9800 Buildings | F 0 | F 1,393 | F 2,522 | F 3,915 |
| 9800 Buildings | N 0 | N 0 | N 2,005 | N 2,005 |
| Sub Totals Fort Meade | 17,235 | 8,406 | 51,197 | 76,838 |
| Sub Totals NSA Buildings | <u>2,679</u> | <u>0</u> | <u>8,679</u> | <u>11,358</u> |
| Totals ECIP Projects | 19,914 | 8,406 | 59,876 | 88,196 |
| <u>Increment F and G Projects</u> | | | | |
| Totals Fort Meade | 13,681 | 5,983 | 10,720 | 30,384 |
| Totals NSA Buildings | <u>4,235</u> | <u>0</u> | <u>2,283</u> | <u>6,518</u> |
| Totals Increment F and G | 17,916 | 5,983 | 13,003 | 36,902 |
| <u>Grand Totals</u> | | | | |
| Sub Totals Fort Meade | 30,916 | 14,389 | 61,917 | 107,222 |
| Sub Totals NSA Buildings | <u>6,914</u> | <u>0</u> | <u>10,962</u> | <u>17,876</u> |
| Grand Totals | 37,830 | 14,389 | 72,879 | 125,098 |

F = Totals Fort Meade N = Totals NSA Buildings

4.2 INCREMENT F AND G PROJECTS FUEL SAVINGS
 MBTU/YR FOR EACH FUEL

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | ELECTRIC | | GAS | | OIL | | TOTAL | |
|-------------|--|-------------------------|----------------------|---------------------------------|----------|-------|-------|---|-------|-------|-------|-------|
| | | | | | F | N | F | N | F | N | F | N |
| F-1 | Reduce Domestic Hot Water Setpoint Buildings 370 and 8605 + 10 Extrapolated Buildings | 192 | 168 | 1,881 | - | - | - | - | 1,881 | - | 1,881 | - |
| F-2 | Piping Insulation Building 8472 | 47 | 42 | 79 | - | - | - | - | 79 | - | 79 | - |
| F-3 | Adjust Controls To Reduce Overheating Buildings 2239, 2246, 4411 (not accurately quantifiable) | 199 | 178 | 443 | - | - | 103 | - | 340 | - | 443 | - |
| F-4 | Repair Burners Building 908H | 832 | 749 | 1,144 | - | - | - | - | 1,144 | - | 1,144 | - |
| F-5 | Repair Leaks, Condensate Pump Building 8605 | 555 | 500 | 357 | - | - | - | - | 357 | - | 357 | - |
| F-6 | Seal Kitchen Exhaust Damper Apartment 1837F + 100 Extrapolated Apartments | 2,626 | 2,424 | 3,376 | - | - | 3,376 | - | - | - | 3,376 | - |
| F-7 | Reduce Outside Air, Rebalance, Building 8605 + 10 Extrapolated Buildings | 6,720 | 6,039 | 4,610 | 2,104 | - | - | - | 2,506 | - | 4,610 | - |
| F-8 | Reduce Lighting Levels Building 1978 | 306 | 275 | 182 | 182 | - | - | - | - | - | 182 | - |
| F-9 | Night Setback/Setup Barracks Building 8605 + 10 Extrapolated Buildings | 11,605 | 10,439 | 2,423 | - | - | - | - | 2,423 | - | 2,423 | - |
| F-10 | Weatherstripping and Caulking, Doors and Windows, Buildings 2250, 4451 | 18,284 | 16,456 | 1,842 | - | - | 17 | - | 1,825 | - | 1,842 | - |
| F-11 | Clean Radiators, Building 4431 (Note: Not Accurately Quantifiable) | 333 | 300 | 52 | - | - | 52 | - | - | - | 52 | - |
| F-12 | Zero Energy Band Thermostats Building 370 | 1,110 | 999 | 222 | 96 | - | 126 | - | - | - | 222 | - |
| F-13 | Reduce CFM, Day/Night Time Clocks, Buildings 9801 + 3 Extrapolated Buildings, 9828 | 29,304 | 26,254 | 5,370 | - | 3,087 | - | - | - | 2,283 | - | 5,370 |
| F-14 | Photo Cell Exterior Lighting Building 2793 | 84 | 75 | 4 | 4 | - | - | - | - | - | 4 | - |

F = Totals Fort Meade Buildings N = Totals NSA Buildings

4.2 INCREMENT F AND G PROJECTS FUEL SAVINGS
MBTU/YR FOR EACH FUEL (Continued)

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | ELECTRIC | | GAS | | OIL | | TOTAL | |
|-------------|--|-------------------------|----------------------|---------------------------------|----------|-------|-----|----|-----|---|-------|-------|
| | | | | | F | N | F | N | F | N | F | N |
| F-15 | Weatherstripping, Garage Doors - Wing C, Building 2246 | 777 | 699 | 105 | - | - | - | - | 105 | - | 105 | - |
| F-16 | Night Setback/Setup 1837F (Boiler for Buildings 1836, 1837, 1938) + 34 Extrapolated Boilers | 36,890 | 33,215 | 2,196 | - | 2,196 | - | - | - | - | 2,196 | - |
| F-17 | Reduce Air Flow To Design CFM, Rebalance Building 4432 | 611 | 549 | 92 | 92 | - | - | - | - | - | 92 | - |
| F-18 | Reduce Outside Air, Rebalance Building 90, 4550 | 1,220 | 1,098 | 69 | 29 | 10 | - | 30 | - | - | 69 | - |
| F-19 | Energy Conserving Fluorescent Lamps, Various Buildings | 43,216 | 38,904 | 9,534 | 8,386 | 1,148 | - | - | - | - | 8,386 | 1,148 |
| F-20 | Economizer Cycles, CP0 Area and Redwood Cafe, Building 4432 | 5,772 | 5,195 | 763 | 763 | - | - | - | - | - | 763 | - |
| F-21 | Maintenance - Unit Heater Building 2276 | 166 | 150 | 6 | - | - | - | 6 | - | - | 6 | - |
| F-22 | Heat Pump for Domestic Hot Water, Building 8688 | 1,388 | 1,249 | 15 | 15 | - | - | - | - | - | 15 | - |
| F-23 | Remove Vestibule Radiators Building 4551 | 244 | 210 | 5 | - | 5 | - | - | - | - | 5 | - |
| F-24 | Weatherstrip Window Air Conditioning Unit Building 504 | 30 | 27 | 1 | - | 1 | - | - | - | - | 1 | - |
| F-25 | Modify Controls, Shut Off Outside Air on Warmup, 100%, Outside Air on Cool Down Buildings 4431, 4432 | 3,996 | 3,597 | 97 | - | 97 | - | - | - | - | 97 | - |
| F-26 | Demand Control, Building 4272 | 555 | 500 | 0 | 0 | - | - | - | - | - | 0 | - |
| F-27 | Replace Incandescent Lamps with Fluorescent Lamps, Various Buildings | 24,843 | 21,707 | 1,864 | - | - | - | - | - | - | 1,864 | - |
| F-28 | High Efficiency Motor Replacement Building 4217 | 1,354 | 1,219 | 39 | 39 | - | - | - | - | - | 39 | - |

F = Totals Fort Meade Buildings N = Totals NSA Buildings

4.2 INCREMENT F AND G PROJECTS FUEL SAVINGS
 MBTU/YR FOR EACH FUEL (Continued)

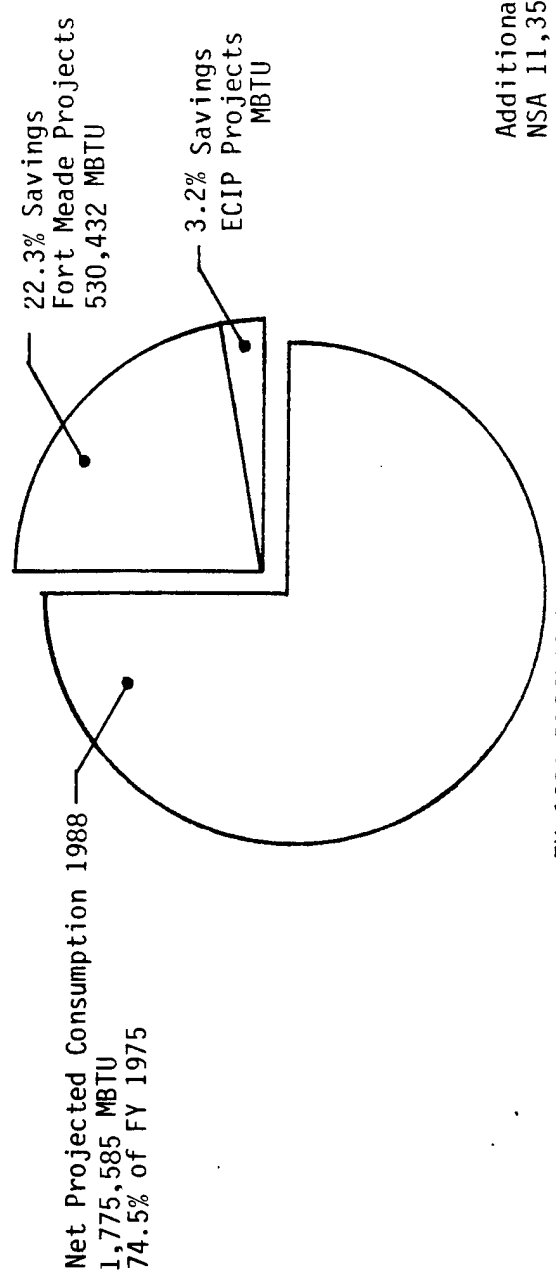
| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | ELECTRIC | | GAS | | OIL | | TOTAL | |
|-------------|--|-------------------------|----------------------|---------------------------------|----------|-------|-------|----|--------|-------|--------|-------|
| | | | | | F | N | F | N | F | N | F | N |
| F-29 | Ductwork Insulation Building 4551 | 72 | 64 | 3 | 3 | - | - | - | - | - | 3 | - |
| F-30 | Control Domestic Hot Water Pump Buildings 370, 4411 | 444 | 400 | 4 | 4 | - | - | - | - | - | 4 | - |
| F-31 | Solar Film Buildings 4415, 4432 | 3,362 | 3,027 | 100 | 100 | - | - | - | - | - | 100 | - |
| F-32 | Insulation, Interior Ceiling and Wall, Building 2246 Arms Room | 3,885 | 3,497 | 24 | - | - | - | 24 | - | - | 24 | - |
| F-33 | Modify Outside Air Vent Building 4432 | 910 | 89 | * | - | - | * | - | - | - | * | - |
| F-34 | Seal Manhole Cover Building 4551 | 145 | 131 | * | - | - | * | - | - | - | * | - |
| F-35 | Modify Intake Ductwork Building 4554 | 722 | 650 | * | - | - | * | - | - | - | * | - |
| F-36 | Repair Barometric Damper Building 726 | 84 | 75 | * | - | - | * | - | - | - | * | - |
| F-37 | Electric Outlet and Switch Energy Seals | * | * | * | * | * | * | * | * | * | * | * |
| | Quantifiable Grand Total | 202,883 | 181,866 | 36,902 | 13,681 | 4,235 | 5,983 | 0 | 10,720 | 2,283 | 30,384 | 6,518 |

* Not Quantifiable
 F = Totals Fort Meade Buildings N = Totals NSA Buildings

4.3 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE
 FY 1988 VS 1975 WITH ECIP PROJECTS ACCOMPLISHED (NOT INCLUDING NSA BUILDINGS)

| FUEL TYPE | FY 1975 | | | *** PROJECTED FY 1988 | | | |
|----------------|---------------------|-----------------------|----------------------|----------------------------------|-----------------------|------------------------|------------|
| | CONSUMPTION MBTU | % TOTAL CONSUM. | ENERGY COST \$ | PROJECTED CONSUMPTION MBTU | % TOTAL CONSUM. | ENERGY COST \$** | % TOTAL |
| Electricity | 875,689 | 36.8 | * | 904,886 | 48.4 | 4,117,231 | 33.8 |
| Natural Gas | 803,920 | 33.7 | * | 615,927 | 32.9 | 4,502,426 | 37.0 |
| No. 2 Fuel Oil | 703,246 | 29.5 | * | 349,542 | 18.7 | 3,554,842 | 29.2 |
| | 2,382,855 | 100.0 | | 1,870,355 | 100.0 | 12,174,499 | 100.0 |

*** Projected 1988 1,870,355 MBTU; Projected Savings Projects Under Construction = 94,770 MBTU
 Net Projected 1988 1,775,585 MBTU; Net Projected 1988 = 74.5% of 1975



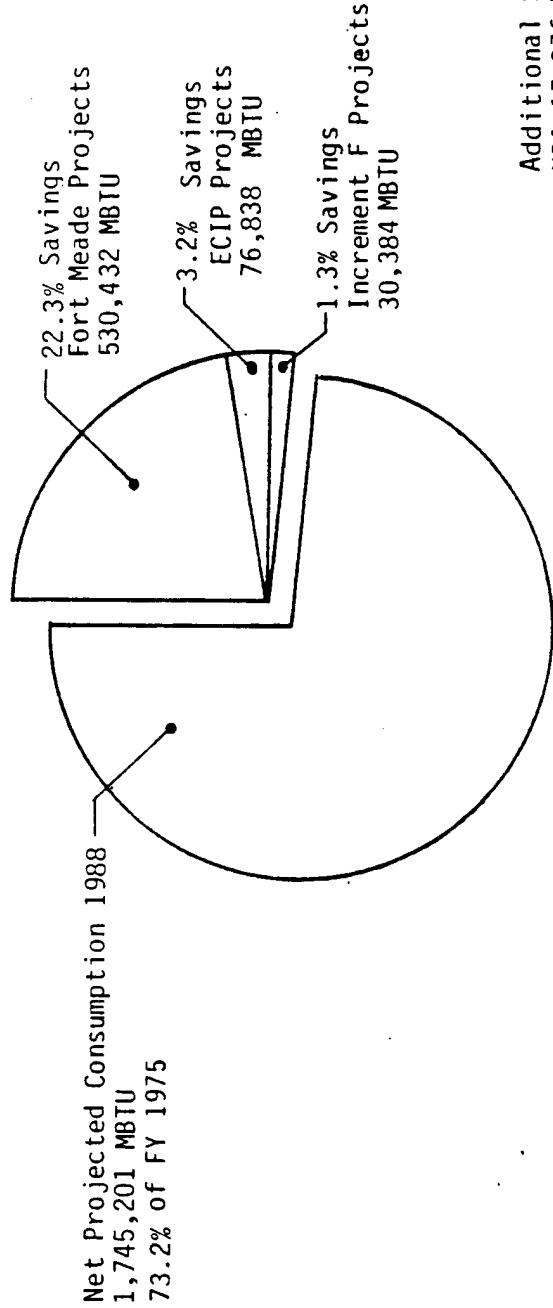
FY 1988 PROJECTED VS 1975 CONSUMPTION

* Information Not Available
 ** Fuel Costs Escalated from 1982 Costs
 *** Not Including Savings For Projects Under Construction

4.4 ENERGY CONSUMPTION, COST AND PERCENTAGES BY FUEL TYPE
 FY 1988 VS 1975 WITH ECIP & INCREMENT F PROJECTS ACCOMPLISHED (NOT INCLUDING NSA BUILDINGS)

| FUEL TYPE | FY 1975 | | | *** PROJECTED FY 1988 | | | |
|----------------|---------------------|-----------------------|----------------------|--------------------------|------------|----------------|------------|
| | CONSUMPTION MBTU | % TOTAL CONSUM. | ENERGY COST \$ | PROJECTED CONSUMPTION | % TOTAL | ENERGY COST | % TOTAL |
| Electricity | 875,689 | 36.8 | * | 891,205 | 48.4 | 4,054,983 | 33.9 |
| Natural Gas | 803,920 | 33.7 | * | 609,944 | 33.2 | 4,458,690 | 37.3 |
| No. 2 Fuel Oil | 703,246 | 29.5 | * | 338,822 | 18.4 | 3,445,819 | 28.8 |
| | 2,382,855 | 100.0 | | 1,839,971 | 100.0 | 11,959,492 | 100.0 |

*** Projected 1988 1,839,971 MBTU; Projected Savings Projects Under Construction = 94,770 MBTU
 Net Projected 1988 1,745,201 MBTU; Net Projected 1988 = 73.2% of 1975



FY 1988 PROJECTED VS 1975 CONSUMPTION

Additional Savings
 NSA 17,876 MBTU

* Information Not Available
 ** Fuel Costs Escalated from 1982 Costs
 *** Not Including Savings For Projects Under Construction

5. INCREMENT C - SOLAR

Scope

This chapter presents Increment C, renewable energy studies, of the Energy Engineering Analysis Program (EEAP) and identifies solar energy opportunities at Fort George G. Meade.

The Energy Engineering Analysis Program (EEAP) for Increment C covers the following items:

1. Determine the feasibility of using solar and other renewable energy to supply space heating, cooling, domestic hot water or process heat. Refuse incineration is considered to be a renewable energy source, but is not included in this increment.
2. Perform a life cycle cost analysis using the Engineering Technical Letter (ETL) 1110-3-332 dated March 22, 1982.

During contract negotiations these requirements were limited to solar studies only. The solar studies are not to include space heating or cooling.

The "SOLFEAS" computer simulation program developed by the Construction Engineering Research Laboratory (CERL), COE, Champaign, Illinois was selected to perform the studies for this Contract, since it meets all

requirements and provides all components of the economic analysis. This program has recently been developed by CERL in conjunction with personnel from the Fort Worth district and contains integral weather data for 248 weather service stations known as SOLMET stations.

Results

The buildings surveyed under the Contract were categorized into groups on the basis of type of usage as follows:

- Group 1 - Family Housing
- Group 2 - Shops and Hangars
- Group 3 - Mess Hall
- Group 4 - Administration
- Group 5 - Quarters
- Group 6 - Laundry
- Group 7 - Swimming Pool
- Group 8 - Hospital
- Group 9 - Other Usage

A typical building was selected for Groups 1 through 8 and monthly load profile calculated by proportioning annual load on the basis of number of days per month. The results are shown in Table 5.1, Page ES-5.4.

The SOLFEAS program was then run for each building and the optimum selections from the program are summarized in Table 5.2, Page ES-5.5.

As can be seen from Table 5.2, the use of solar energy for summer water heating is feasible for small contributions - 10% to 20% - of relatively large year round loads in excess of approximately 1400 MBTU/Y for gas fired systems and approximately 600 MBTU/Y for oil-fired systems. There is a potential conflict between the SOLFEAS runs showing paybacks for 10% to 20%

solar contributions versus ETL 1110-3-302 requirements for a minimum 35% sizing for domestic hot water solar systems.

Supplementary Information

Subsequent to the original SOLFEAS calculations, it was determined that it is feasible to shut down Boiler Plant P-8481 in the summer and install local gas-fired boilers/heaters in the equipment rooms of the various buildings served by it to provide summer domestic hot water and steam as may be required. This includes Buildings P8478, P-8479, P-8543, P-8544, P-8545, P-8605, P-8606, P-8607, P-8609 and P-8611.

SOLFEAS, however, allows only use of one fuel to determine life cycle cost. The SOLFEAS data was, therefore, extrapolated for combination gas/oil for these buildings.

Recommendations

It is recommended that such solar energy systems be provided for Buildings P-8605 (and by extrapolation from P-8605 for Buildings P-8478, P-8479, P-8543, P-8544, P-8545, P-8606, P-8607, P-8609, P-8610, P-8611, P-9801, P-9802, P-9803, P-9804, P-9827 and P-9828 - see Table 5.2, Page ES-5.4 for extrapolation values), T-2250, P-6330 and P-2480 as an ECIP project.

5.1 MONTHLY MBTU LOAD PROFILE FOR TYPICAL BUILDINGS

| MONTH | BUILDING | | | | | | | |
|-------|--------------------|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | GROUP 1 P-3073C | GROUP 2 P-90 | GROUP 3 P-2239 | GROUP 4 P-1978 | GROUP 5 P-8605 | GROUP 6 T-2250 | GROUP 7 P-6330 | GROUP 8 P-2480 |
| JAN | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| FEB | 1.61 | 1.26 | 75.54 | 2.96 | 47.76 | 788.34 | 94.38 | 195.93 |
| MAR | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| APR | 1.75 | 1.37 | 80.97 | 3.15 | 51.17 | 844.66 | 101.11 | 209.92 |
| MAY | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| JUN | 1.75 | 1.37 | 80.97 | 3.15 | 51.17 | 844.66 | 101.11 | 209.92 |
| JUL | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| AUG | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| SEP | 1.75 | 1.37 | 80.97 | 3.15 | 51.17 | 844.66 | 101.11 | 209.92 |
| OCT | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| NOV | 1.75 | 1.37 | 80.97 | 3.15 | 51.17 | 844.66 | 101.11 | 209.92 |
| DEC | 1.81 | 1.42 | 83.67 | 3.25 | 52.87 | 872.82 | 104.48 | 216.91 |
| TOTAL | 21.28 | 16.68 | 985.11 | 38.31 | 622.53 | 10276.72 | 1230.18 | 2553.98 |

5.2 SOLFEAS PROGRAM SUMMARY

| GROUP NO. | BUILDING | COLLECTOR AREA SQ. FT. | BASE ENERGY MBTU/Y | CONVENTIONAL FUEL | % BASE SAVED | MBTU/Y SAVED | CONSTR. COST \$ | MAXIMUM SIR |
|-----------|--|------------------------|--------------------|-------------------|--------------|--------------|-----------------|-------------|
| 1 | P-3073C | 20 | 28.4 | GAS | 33.0 | 6.6 | 2990 | *0 |
| 2 | P-90 | 20 | 16.7 | ELECT | 39.5 | 6.6 | 2990 | *0 |
| 3 | P-2239 | 500 | 1313.5 | GAS | 20.2 | 265.3 | 12930 | .962 |
| 4 | P-1978 | 120 | 51.1 | GAS | 70.7 | 36.1 | 7500 | * .066 |
| 5 | P-8605 | 320 | 830.0 | OIL/GAS** | 20.4 | 169.6 | 16540 | 1.10 |
| | Extrapolation | 3200 | 8300.0 | OIL/GAS** | 20.4 | 1696.0 | 165400 | |
| 6 | T-2250 | 2300 | 13627.2 | OIL | 10.1 | 1376.3 | 106000 | 2.078 |
| 7 | P-6330 | 620 | 1640.2 | GAS | 20.1 | 329.7 | 30100 | 1.019 |
| 8 | P-2480 | 580 | 3405.3 | OIL | 10.1 | 343.9 | 28290 | 1.824 |
| 5 | P-9800 Bldgs. Extrapolated (11.82) | 3780 | 9810.6 | OIL | 20.4 | 2004.7 | 195500 | 1.417 |

* Discounted Payback in Excess of 100 Years.

** See Supplementary Information

6. INCREMENT "F" - FACILITY ENGINEER CONSERVATION MEASURES

Energy Actions by Fort George G. Meade

Fort George G. Meade is to be complimented on the considerable amount of successful effort it has expended on energy conservation, as demonstrated by the results shown in the "Installation Facility Energy Plan" for fiscal years 1981 and 1983 summarized herein. The FY82 consumption represented an 18.3% reduction in energy use from the FY75 base line.

Most of the commonly known, easy to implement energy conservation opportunities - items such as storm windows, weatherstripping and caulking, insulation, etc. - have been or are in the process of being implemented at Fort Meade.

Some not so common but excellent energy conservation items have been or will be installed. This includes items such as boiler stack economizer and oxygen trim control on the two large boilers in Building P-8481, a waste water heat recovery system in Laundry Building T-2250, planned installation of a refrigerant compressor heat recovery system in Cold Storage Building P-4272, and an exhaust to make up air heat recovery system in NSA Consolidated Mess Building P-9829. A central Energy Management Control System was installed in 1977. A demonstration solar house is located on the Post and tests have been performed to determine energy savings available from solar energy. (The house used solar energy for heating as well as domestic hot water. The technical report does not provide information relevant to large domestic hot water only systems

analyzed as part of this report.) Additional information is shown in the charts included in Section 3 under the heading "3.1 General Summary of Potential Energy Conservation Opportunities", starting on Page ES-3.9.

Projects accomplished under OMA funds include elimination of water heaters, replacement of incandescent lighting with fluorescent lighting, improvements to combustion controls, replacement of boilers and burners, replacement of transformers and switchgear, replacement of inefficient furnaces, replacement of inefficient water heaters, reduction of interior and exterior lighting, consolidation of building space, installation of energy conserving shower inserts, and miscellaneous other energy conservation improvements.

The Fort Meade energy program also includes the following items:

- o Publicity to encourage energy conservation
- o Technical assistance visits to note energy deficiencies and initiate corrective action
- o Energy hot line and heat line for building occupants to report energy conservation problems or to find out the current policy
- o Special utility equipment permits issued to building occupants as one means to control and account for energy consumption of electrical appliances
- o New construction projects review to determine if adequate provisions have been made for conserving energy
- o Controlled air conditioning/heating seasons
- o Controlled air conditioning/heating/ventilation operating procedures
- o Domestic hot water discontinued wherever possible and controls lowered to minimum temperature setting elsewhere

o Lighting reduction

In addition, prior to the recommendations in the Interim Phase II submission, Fort Meade combined the heating and air conditioning shops and established a separate team within the combined shop for automatic control system service and maintenance.

The tables and charts on the following five pages are reproduced from the FY83 Installation Facilities Energy Plan to summarize energy data pertinent to Fort Meade. The data shown does not include NSA facilities.

Increment A, B, C and G Projects

Table 3.3, ECIP Projects Summary Table, starting on Page ES-3.17 in Section 3, summarizes the Increment A, B, and C ECIP projects, including extrapolated buildings.

The dollar value of the Increment G items is not sufficient to warrant separate Increment G projects and these are, therefore, included in Increment F.

Increment F and G Projects

Table 6.1, Increment F and G Projects Summary Table, starting on Page ES-6.9, summarizes the recommended Increment F and G projects and Table 6.2, Increment F and G Projects Labor and Material Summary, starting on Page ES-6.12, provides breakdown information on labor and material for each project.

INSTALLATION Fort George G. Meade

DATE 1 March 1983

ENERGY DATA

| | MBTU FY75 | | MBTU FY82 | | PERCENT CHANGE | |
|-------------------------|------------------------|-----------|--------------|-----------|-------------------|--------|
| | OWNED | LEASED | OWNED | LEASED | OWNED | LEASED |
| | DEIS Facilities Energy | 2,492,277 | -- | 2,020,083 | -- | -18.9 |
| Non-DEIS Facilities | -- | -- | -- | -- | -- | -- |
| Energy | -- | -- | -- | -- | -- | -- |
| Solar | -- | -- | -- | -- | -- | -- |
| Hydro | -- | -- | -- | -- | -- | -- |
| Refuse Derived Fuel | -- | -- | -- | -- | -- | -- |
| Wood | -- | -- | -- | -- | -- | -- |
| Other | -- | -- | -- | -- | -- | -- |
| Total Facilities Energy | 2,492,277 | -- | 2,020,083 | -- | -18.9 | -- |
| Total Mobility Energy | 232,994 | -- | 171,791 | -- | -26.3 | -- |

| INVESTMENT | #PROJECT | COST \$ | ANNUAL SAVINGS | | YEAR SAVINGS BEGIN |
|------------------|----------|---------|----------------------|---------------------|-----------------------|
| | | | (\$000) ¹ | MBTU | |
| CMA ² | N/A | -- | -- | -- | -- |
| ECIP (MCA) | 1 | 152.0 | 20.2 | 8,009 | 77 |
| " | 1 | 727.0 | 124.5 ³ | 36,743 ³ | -- |
| " | 2 | 1,643.1 | 519.7 | 128,892 | 79 |
| " | 1 | 991.0 | 450.6 | 81,010 | 80 |
| " | 2 | 185.4 | 159.4 | 19,760 | 82 |
| " | 2 | 3,500.0 | 582.3 | 78,600 | 84 |
| " | 1 | 6,343.1 | 1,450.8 | 117,505 | 87 |
| ECIP (FHMA) | 2 | 2,357.0 | 190.0 | 65,075 | 82 |
| " | 1 | 608.0 | 72.4 | 16,170 | 84 |
| " | 2 | 7,947.3 | 809.6 | 118,698 | 87 |
| PAA | 0 | -- | -- | -- | -- |
| ECAM | 0 | -- | -- | -- | -- |
| OTHER | 0 | -- | -- | -- | -- |

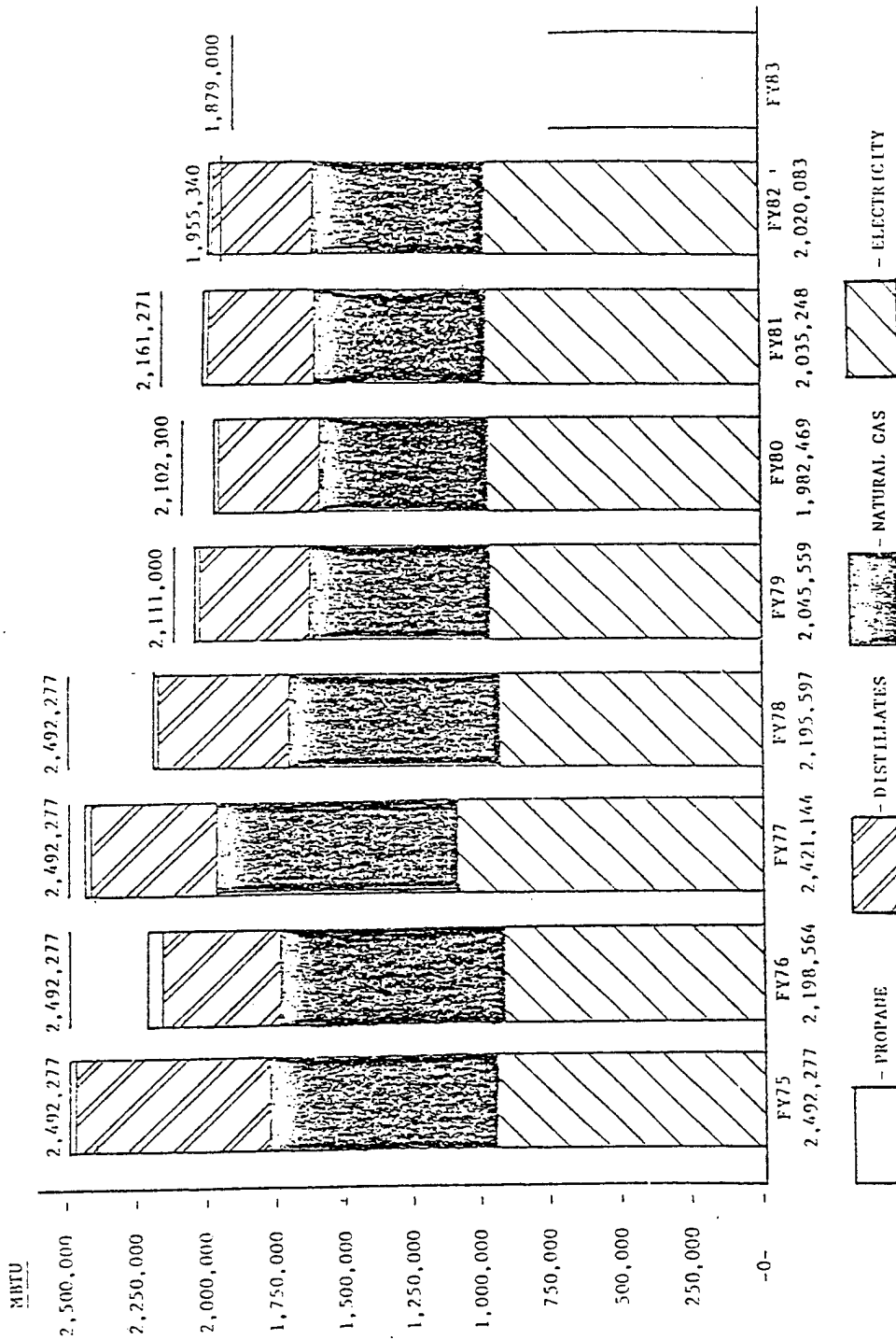
1/ Annual cost savings are shown in terms of projected first year savings. Values are not escalated to reflect current fuel cost.

2/ Energy improvements are being made under CMA funded projects. However, records are not kept to separate improvement costs or savings.

3/ Data represents savings anticipated by installation of EMCS. System has been non-operational for most of the period since installation. Recent efforts to revitalize the system have restored 50% of its capacity to conserve energy.

Figure B - 1
ENERGY CO. CONSERVATION PROGRAM

FACILITY ENERGY CONSUMPTION/OBJECTIVE - FY75 thru FY83



ENERGY DATA
HISTORIC/GOALS

| | H I S T O R I C | | | | | | | | G O A L S | | |
|---|------------------------------|-------|-------|-------|-------|-------|-------|-------|--------------------|-------------------|-------------------|
| | FY75 | FY76 | FY77 | FY78 | FY79 | FY80 | FY81 | FY82 | FY83 | FY84 | FY85 |
| ENERGY CONSUMPTION (DTU x 10 ⁹) | 2492 | 2274 | 2373 | 2197 | 2046 | 1982 | 2035 | 2020 | 1879 ¹ | 2018 ² | 2013 ² |
| BTU x 10 ³ /SF | (216.6 ⁴ 197.8 | 206.7 | 215.7 | 207.3 | 190.9 | 183.6 | 181.7 | 182.0 | 167.8 ³ | 1772 | 1752 |
| FACILITIES (SF x 10 ⁶) | 12.6 | 11.0 | 11.0 | 10.6 | 10.8 | 10.0 | 11.2 | 11.1 | 11.2 | 11.4 | 11.5 |
| SAVINGS OVER FY75 (DTU x 10 ⁹) | - | 218 | 119 | 295 | 446 | 509 | 457 | 472 | 613 | 474 | 479 |

1/ Reflects FY83 Facility Energy Goal set by FORSCOM.

2/ Reflects BTU/SF Goals for Fort Meade, published in March 1981 FORSCOM Facilities Energy Plan Summary.

3/ Note that Fort Meade's FY83 goal is 4.1~~8~~ less than previously projected goal for FY85.

4/ FY75 SF adjusted by FORSCOM.

ECIP PROJECTS COMPLETED

| <u>DESCRIPTION</u> | <u>PN</u> | <u>FY</u> | <u>INVESTMENT COST (\$000)</u> | <u>ANNUAL SAVINGS (\$000)</u> | <u>ANNUAL SAVINGS MBTU</u> | <u>SAVINGS BEGIN</u> |
|---|---------------------|-----------|--------------------------------|-------------------------------|----------------------------|----------------------|
| Building insulation and Weatherstripping | 997.300/ 997.302 | 76 | 152.0 | 20.0 | 8,009 | 77 |
| Centralized Control System (EMCS) | 997.304 | 76 | 727.0 | 124.5* | 36,743 | * |
| Install Floor and Ceiling Insulation | 997.306 (219) | 77 | 633.1 | 85.9 | 34,820 | 79 |
| Storm windows and Building Insulation | 220.20 | 78 | 1,010.0 | 433.8 | 94,072 | 79 |
| Storm windows, weatherstrip, Building Insulation | 220.22 (221) | 77 | 991.0 | 450.6 | 81,010 | 80 |
| Family Housing Improvements (Areas 3 and 11) | 882.050 | 80 | 157.0 | 16.2 | 4,122 | 82 |
| Boiler Economizer | 224 | 80 | 149.0 | 19.6 | 4,860 | 82 |
| Laundry Improvements | 228 | 81 | 368.4 | 139.8 | 14,900 | 82 |
| Family Housing Improvements (Areas 1, 2, 4 thru 10) | 882.070 | 81 | 2,200.0 | 173.8 | 60,953 | 82 |

TOTAL INVESTMENT TO DATE: \$ 6,387,500.

TOTAL ANNUAL SAVINGS TO DATE: \$ 1,464,200.; 339,489 MBTU

* EHCIS has been non-operational for most of the period since installation. Recently efforts have been successful in revitalizing the system. Current savings are probably 50% of original projected savings.

E C I P P R O J E C T S T A T U S 15 MAR 83

ECIP PROJECTS UNDER CONSTRUCTION

| <u>DESCRIPTION</u> | <u>PN</u> | <u>FY</u> | <u>INVESTMENT COST (\$000)</u> | <u>ANNUAL SAVINGS (\$000)</u> | <u>ANNUAL SAVINGS MBTU</u> | <u>SAVINGS BEGIN</u> |
|---------------------------------------|-----------|-----------|--------------------------------|-------------------------------|----------------------------|----------------------|
| Building Energy Retrofit Phase I | 226 | 82 | 3,500.0 | 582.3 | 78,600 | 84 |
| Family Housing Automatic Vent Dampers | 882.080 | 82 | 608.0 | 72.4 | 16,170 | 83 |

TOTAL INVESTMENT: \$ 4,108,000.

TOTAL ANNUAL SAVINGS: \$ 654,700., 94,770 MBTU

ECIP PROJECTS SUBMITTED FOR FUNDING

| <u>DESCRIPTION</u> | <u>PN</u> | <u>FY</u> | <u>INVESTMENT COST (\$000)</u> | <u>ANNUAL SAVINGS (\$000)</u> | <u>ANNUAL SAVINGS MBTU</u> | <u>SAVINGS BEGIN</u> |
|---|-----------|-----------|--------------------------------|-------------------------------|----------------------------|----------------------|
| Building Energy Retrofit Phase II (& Phase III) | 237 | 85 | 6,343.1 | 1,405.8 | 117,505 | 87 |
| Family Housing -- Storm Windows and Insulation | T-454 | 85 | 2,841.4 | 637.7 | 56,012 | 87 |
| Family Housing -- Insulated Siding | T-458 | 85 | 5,106.2 | 442.1 | 62,686 | 87 |

TOTAL INVESTMENT: \$ 14,290,700.

TOTAL ANNUAL SAVINGS: \$ 2,485,600., 118,698 MBTU

6.1 INCREMENT F AND G SUMMARY TABLE

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | FIRST YEAR COST SAVINGS (\$) | TOTAL DISCOUNTED SAVINGS (\$) | NON-ENERGY DISCOUNTED SAVINGS(\$) | SIR | REDUCED SIR |
|-------------|--|-------------------------|----------------------|---------------------------------|------------------------------|-------------------------------|-----------------------------------|---------|-------------|
| F-1 | Reduce Domestic Hot Water Setpoint Buildings 370 and 8605 + 10 Extrapolated Buildings | 192 | 168 | 1,881 | 16,435 | 186,136 | 0 | 1,108.0 | - |
| F-2 | Piping Insulation Building 8472 | 47 | 42 | 79 | 687 | 12,217 | 0 | 289.0 | - |
| F-3 | Adjust Controls To Reduce Overheating Buildings 2239, 2246, 4411 (not accurately quantifiable) | 199 | 178 | 443 | 3,581 | 42,011 | 0 | 236.0 | - |
| F-4 | Repair Burners Building 90BH | 832 | 749 | 1,144 | 9,978 | 176,017 | 0 | 234.9 | - |
| F-5 | Repair Leaks, Condensate Pump Building 8605 | 555 | 500 | 357 | 3,114 | 54,936 | 0 | 110.0 | - |
| F-6 | Seal Kitchen Exhaust Damper Apartment 1837F + 100 Extrapolated Apartments | 2,626 | 2,424 | 3,376 | 20,301 | 199,778 | 0 | 82.5 | - |
| F-7 | Reduce Outside Air, Rebalance, Building 8605 + 10 Extrapolated Buildings | 6,720 | 6,039 | 4,610 | 29,106 | 324,071 | 18,172 | 53.6 | - |
| F-8 | Reduce Lighting Levels Building 1978 | 306 | 275 | 182 | 811 | 10,728 | 4,152 | 39.0 | 31.8 |
| F-9 | Night Setback/Setup Barracks Building 8605 + 10 Extrapolated Buildings | 11,605 | 10,439 | 2,423 | 21,131 | 239,217 | 0 | 22.9 | - |
| F-10 | Weatherstripping and Caulking, Doors and Windows, Buildings 2250, 4451 | 18,284 | 16,456 | 1,842 | 15,779 | 280,216 | -2,477 | 17.0 | - |
| F-11 | Clean Radiators, Building 4431 (Note: Not Accurately Quantifiable) | 333 | 300 | 52 | 312 | 4,278 | 0 | 14.3 | - |
| F-12 | Zero Energy Band Thermostats Building 370 | 1,110 | 999 | 222 | 1,088 | 13,881 | 829 | 13.9 | - |
| F-13 | Reduce CFM, Day/Night Time Clocks, Buildings 9801 + 3 Extrapolated Buildings, 9828 | 29,304 | 26,254 | 5,370 | 27,623 | 311,232 | 0 | 11.8 | - |
| F-14 | Photo Cell Exterior Lighting Building 2793 | 84 | 75 | 4 | 73 | 877 | 725 | 11.7 | 2.7 |

6.1 INCREMENT F AND G SUMMARY TABLE (Continued)

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | FIRST YEAR COST SAVINGS (\$) | TOTAL DISCOUNTED SAVINGS (\$) | NON-ENERGY DISCOUNTED SAVINGS (\$) | SIR | REDUCED SIR |
|-------------|--|-------------------------|----------------------|---------------------------------|------------------------------|-------------------------------|------------------------------------|------|-------------|
| F-15 | Weatherstripping, Garage Doors - Wing C, Building 2246 | 777 | 699 | 105 | 916 | 6,702 | 0 | 9.58 | - |
| F-16 | Night Setback/Setup 1837F (Boiler for Buildings 1836, 1837, 1938) + 34 Extrapolated Boilers | 36,890 | 33,215 | 2,196 | 13,172 | 18,063 | 0 | 5.44 | - |
| F-17 | Reduce Air Flow To Design CFM, Rebalance Building 4432 | 611 | 549 | 92 | 231 | 2,568 | 0 | 4.67 | - |
| F-18 | Reduce Outside Air, Rebalance Building 90, 4550 | 1,220 | 1,098 | 69 | 421 | 4,839 | 182 | 4.41 | - |
| F-19 | Energy Conserving Fluorescent Lamps, Various Buildings | 43,216 | 38,904 | 9,534 | 41,589 | 160,778 | 73,112 | 4.13 | 3.0 |
| F-20 | Economizer Cycles, CP0 Area and Redwood Cafe, Building 4432 | 5,772 | 5,195 | 763 | 1,907 | 21,221 | 0 | 4.09 | - |
| F-21 | Maintenance - Unit Heater Building 2276 | 166 | 150 | 6 | 53 | 602 | 0 | 4.02 | - |
| F-22 | Heat Pump for Domestic Hot Water, Building 8688 | 1,388 | 1,249 | 15 | 303 | 3,636 | 3,097 | 2.91 | 0.57 |
| F-23 | Remove Vestibule Radiators Building 4551 | 244 | 210 | 5 | 32 | 634 | 0 | 2.88 | - |
| F-24 | Weatherstrip Window Air Conditioning Unit Building 504 | 30 | 27 | 1 | 7 | 65 | 0 | 2.40 | - |
| F-25 | Modify Controls, Shut Off Outside Air on Warmup, 100%, Outside Air on Cool Down Buildings 4431, 4432 | 3,996 | 3,579 | 97 | 584 | 8,004 | 0 | 2.23 | - |
| F-26 | Demand Control, Building 4272 | 555 | 500 | 0 | 120 | 1,090 | 1,090 | 2.18 | 0 |
| F-27 | Replace Incandescent Lamps with Fluorescent Lamps, Various Buildings | 24,843 | 21,707 | 1,864 | 13,546 | 42,533 | 20,708 | 1.96 | 1.34 |
| F-28 | High Efficiency Motor Replacement Building 4217 | 1,354 | 1,219 | 39 | 139 | 1,896 | 499 | 1.56 | 1.52 |

6.1 INCREMENT F AND G SUMMARY TABLE (Continued)

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | INVESTMENT COST (\$) | ANNUAL ENERGY SAVINGS (MBTU/YR) | FIRST YEAR COST SAVINGS (\$) | TOTAL DISCOUNTED SAVINGS (\$) | NON-ENERGY DISCOUNTED SAVINGS (\$) | SIR | REDUCED SIR |
|-------------|--|-------------------------|----------------------|---------------------------------|------------------------------|-------------------------------|------------------------------------|-------|-------------|
| F-29 | Ductwork Insulation Building 4551 | 72 | 64 | 3 | 8 | 91 | 0 | 1.41 | - |
| F-30 | Control Domestic Hot Water Pump Buildings 370, 4411 | 444 | 400 | 4 | 51 | 482 | 376 | 1.21 | .35 |
| F-31 | Solar Film Buildings 4415, 4432 | 3,362 | 3,027 | 100 | 344 | 3,642 | 863 | 1.20 | - |
| F-32 | Insulation, Interior Ceiling and Wall, Building 2246 Arms Room | 3,885 | 3,497 | 24 | 211 | 3,722 | 0 | 1.06 | - |
| F-33 | Modify Outside Air Vent Building 4432 | 910 | 819 | * | * | * | * | * | * |
| F-34 | Seal Manhole Cover Building 4551 | 145 | 131 | * | * | * | * | * | * |
| F-35 | Modify Intake Ductwork Building 4554 | 722 | 650 | * | * | * | * | * | * |
| F-36 | Repair Barometric Damper Building 726 | 84 | 75 | * | * | * | * | * | * |
| F-37 | Electric Outlet and Switch Energy Seals | * | * | * | * | * | * | * | * |
| | Quantifiable Grand Total | 202,883 | 181,862 | 36,902 | 223,653 | 2,136,343 | 121,328 | 11.74 | - |

* Not Quantifiable.

6.2 INCREMENT F AND G LABOR AND MATERIAL SUMMARY

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | CONSTRUCTION COST (\$) | MATERIAL COST (\$) | LABOR COST (\$) | LABOR HOURS | SIQH (\$) | DESIGN (\$) | LABOR RATE |
|-------------|--|-------------------------|------------------------|--------------------|-----------------|-------------|-----------|-------------|------------|
| F-1 | Reduce Domestic Hot Water Setpoint Buildings 370 and 8605 + 10 Extrapolated Buildings | 192 | 168 | 0 | 168 | 12 | 12 | 12 | 14 |
| F-2 | Piping Insulation Building 8472 | 47 | 42 | 13 | 26 | 34 | 2 | 3 | 35 |
| F-3 | Adjust Controls To Reduce Overheating Buildings 2239, 2246, 4411 (not accurately quantifiable) | 199 | 178 | 0 | 178 | 13 | 9 | 12 | 14 |
| F-4 | Repair Burners Building 908H | 832 | 749 | 260 | 420 | 12 | 37 | 45 | 35 |
| F-5 | Repair Leaks, Condensate Pump Building 8605 | 555 | 500 | 150 | 315 | 9 | 25 | 30 | 35 |
| F-6 | Seal Kitchen Exhaust Damper Apartment 1837F + 100 Extrapolated Apartments | 2,626 | 2,424 | 1,010 | 1,414 | 101 | 92 | 110 | 14 |
| F-7 | Reduce Outside Air, Rebalance, Building 8605 + 10 Extrapolated Buildings | 6,710 | 6,050 | 3,960 | 1,100 | 22 | 297 | 363 | 50 |
| F-8 | Reduce Lighting Levels Building 1978 | 306 | 275 | 0 | 275 | 20 | 14 | 17 | 14 |
| F-9 | Night Setback/Setup Barracks Building 8605 + 10 Extrapolated Buildings | 11,605 | 10,450 | 4,180 | 5,250 | 150 | 528 | 627 | 35 |
| F-10 | Weatherstripping and Caulking, Doors and Windows, Buildings 2250, 4451 | 18,284 | 16,473 | 5,766 | 9,266 | 265 | 823 | 988 | 35 |
| F-11 | Clean Radiators, Building 4431 (Note: Not Accurately Quantifiable) | 333 | 300 | 0 | 300 | 21 | 15 | 18 | 14 |
| F-12 | Zero Energy Band Thermostats Building 370 | 1,110 | 1,000 | 400 | 500 | 14 | 50 | 60 | 35 |
| F-13 | Reduce CFM, Day/Night Time Clocks, Buildings 9801 + 3 Extrapolated Buildings, 9828 | 29,304 | 26,400 | 10,320 | 13,500 | 386 | 1,320 | 1,584 | 35 |
| F-14 | Photo Cell Exterior Lighting Building 2793 | 84 | 75 | 30 | 38 | 3 | 4 | 5 | 14 |

6.2 INCREMENT F AND G LABOR AND MATERIAL SUMMARY (Continued)

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | CONSTRUCTION COST (\$) | MATERIAL COST (\$) | LABOR COST (\$) | LABOR HOURS | SIQH (\$) | DESIGN (\$) | LABOR RATE |
|-------------|--|-------------------------|------------------------|--------------------|-----------------|-------------|-----------|-------------|------------|
| F-15 | Weatherstripping, Garage Doors - Wing C, Building 2246 | 777 | 700 | 245 | 394 | 11 | 35 | 42 | 35 |
| F-16 | Night Setback/Setup 1837F (Boiler for Buildings 1836, 1837, 1938) + 34 Extrapolated Boilers | 36,890 | 33,250 | 13,300 | 16,625 | 475 | 1,645 | 1,995 | 35 |
| F-17 | Reduce Air Flow To Design CFM, Rebalance Building 4432 | 611 | 550 | 0 | 550 | 11 | 28 | 33 | 50 |
| F-18 | Reduce Outside Air, Rebalance Building 90, 4550 | 1,220 | 1,110 | 0 | 1,110 | 22 | 55 | 65 | 50 |
| F-19 | Energy Conserving Fluorescent Lamps, Various Buildings | 43,216 | 38,979 | 38,979 | 0 | 0 | 1,944 | 2,333 | - |
| F-20 | Economizer Cycles, CP0 Area and Redwood Cafe, Building 4432 | 5,772 | 5,200 | 2,080 | 2,600 | 74 | 260 | 312 | 35 |
| F-21 | Maintenance - Unit Heater Building 2276 | 166 | 150 | 45 | 94 | 7 | 7 | 9 | 14 |
| F-22 | Heat Pump for Domestic Hot Water, Building 8688 | 1,388 | 1,250 | 375 | 780 | 22 | 63 | 75 | 35 |
| F-23 | Remove Vestibule Radiators Building 4551 | 244 | 220 | 10 | 210 | 6 | 10 | 14 | 35 |
| F-24 | Weatherstrip Window Air Conditioning Unit Building 504 | 30 | 27 | 12 | 15 | 1 | 1 | 2 | 14 |
| F-25 | Modify Controls, Shut Off Outside Air on Warmup, 100%, Outside Air on Cool Down Buildings 4431, 4432 | 3,996 | 3,600 | 1,440 | 1,800 | 52 | 180 | 216 | 35 |
| F-26 | Demand Control, Building 4272 | 555 | 500 | 200 | 250 | 7 | 25 | 30 | 35 |
| F-27 | Replace Incandescent Lamps with Fluorescent Lamps, Various Buildings | 24,843 | 21,710 | 21,710 | 0 | 0 | 1,424 | 1,709 | - |
| F-28 | High Efficiency Motor Replacement Building 4217 | 1,354 | 1,220 | 744 | 320 | 9 | 61 | 73 | 35 |

6.2 INCREMENT F AND G LABOR AND MATERIAL SUMMARY (Continued)

| PROJECT NO. | ENERGY CONSERVATION MEASURE | TOTAL PROJECT COST (\$) | CONSTRUCTION COST (\$) | MATERIAL COST (\$) | LABOR COST (\$) | LABOR HOURS | SIQH (\$) | DESIGN (\$) | LABOR RATE |
|-------------|--|-------------------------|------------------------|--------------------|-----------------|-------------|-----------|-------------|------------|
| F-29 | Ductwork Insulation Building 4551 | 72 | 65 | 20 | 40 | 1 | 3 | 4 | 35 |
| F-30 | Control Domestic Hot Water Pump Buildings 370, 4411 | 444 | 400 | 160 | 200 | 6 | 20 | 24 | 35 |
| F-31 | Solar Film Buildings 4415, 4432 | 3,362 | 3,030 | 1,061 | 1,705 | 49 | 151 | 181 | 35 |
| F-32 | Insulation, Interior Ceiling and Wall, Building 2246 Arms Room | 3,885 | 3,500 | 1,225 | 1,969 | 56 | 175 | 210 | 35 |
| F-33 | Modify Outside Air Vent Building 4432 | 910 | 820 | 340 | 385 | 11 | 41 | 49 | 35 |
| F-34 | Seal Manhole Cover Building 4551 | 145 | 130 | 20 | 105 | 3 | 7 | 8 | 35 |
| F-35 | Modify Intake Ductwork Building 4554 | 726 | 650 | 290 | 310 | 9 | 33 | 39 | 35 |
| F-36 | Repair Barometric Damper Building 726 | 84 | 75 | 33 | 42 | 3 | 4 | 5 | 14 |
| F-37 | Electric Outlet and Switch Energy Seals | NOT QUANTIFIABLE | | | | | | | |

7. ENERGY PLAN

Recommendations

Table 3.3, starting on Page ES-3.17, of this Executive Summary summarizes the costs, savings, and economics of the ECIP projects and Tables 6.1, Page ES-6.9, and Table 6.2, Page ES-6.12, of this Executive Summary summarize Increment F and G projects. Programming documents for the ECIP projects are contained in Volume 3 of the report.

It is recommended that all projects be implemented, and done so as soon as possible, in order to maximize energy savings. Priority for implementation can be established in order of decreasing SIR, with highest SIR being accomplished first. Ultimately, however, implementation should be left to the discretion of the facility, as other implementation criteria may be involved.

For the Energy Management and Control System it is recommended that: the existing CPU should be retrofit or replaced, including a manufacturer's maintenance contract; the use of Direct Digital Control be considered when constructing new buildings or altering existing buildings; the various buildings and systems served by the EMCS be analyzed for implementation of the optimum start/stop and load reset features of the system; demand control for additional buildings and systems be considered; and consideration be given to expanding the system to serve other buildings.

Projected energy savings are listed in the Summary on Page ES-4.1 of this report.

Projected Energy Savings

Tables 4.1 through 4.4 of this Executive Summary summarize the potential energy savings. These indicate that for the Fort Meade facility there is a potential savings of 78,543 MBTU per year if all of the ECIP projects are implemented and 30,384 MBTU per year if all of the Increment F projects are implemented, with a grand total potential savings of 108,927 MBTU per year. These savings, coupled with the savings that were previously established as noted by comparing FY82 data with base year FY75 data, together with projected savings of 94,770 MBTU per year for ECIP projects under construction, indicate that the goal savings of 20% will be exceeded by 6.8% if all of the projects are implemented.

The Tables also indicate that for the NSA Buildings surveyed, and their extrapolations, there is a potential savings of 11,358 MBTU per year if the ECIP projects are implemented and 6,518 MBTU per year if the Increment F projects are implemented, with a grand total potential savings of 17,876 MBTU per year.

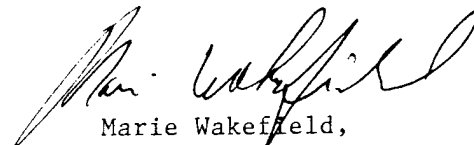


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