ENERGY SAVINGS OPPORTUNITY SURVEY
FORT MYER, ARLINGTON, VIRGINIA

SUMMER STEAM SHUT-DOWN STUDY

A/E CONTRACT NO.
DACA 31-89-C-0198

VOLUME I

Executive Summary

Prepared for

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

By

ENGINEERING APPLICATIONS CONSULTANTS, P.C.
9004-B CROWNWOOD COURT
BURKE, VIRGINIA 22015

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1. INTRODUCTION

Fort Myer is a permanent United States Army installation located in Arlington County, Virginia, on a site backing Arlington National Cemetery and overlooking the Potomac River and Washington, D.C. The installation consists of offices, family housing, Army Band facilities, supporting facilities, and barracks buildings including those known as the "Old Guard Barracks" which house soldiers that provide services at Arlington National Cemetery.

This report consists of the Summer Steam Shut Down Study of an Energy Savings Opportunity Survey (ESOS) at Fort Myer. The purpose of this study is to improve energy efficiency at Fort Myer by analyzing the effects and benefits of closing the central steam producing boiler facility, Building 447, during the non-heating months from mid-May to mid-October. Currently, the central steam plant operates through this period to provide steam for domestic hot water, steam driven laundry presses, air conditioning system reheat, food preparation and dishwashing demands of twenty-two buildings on the base.

This project is conducted in support of the National Energy Conservation Policy Act (NECPA). ESOS projects have the prime objective of evaluating energy conservation opportunities (ECOs) in quest of meeting the goals of the NECPA, the Army Energy Plan, and the Department of Defense Energy Management Plan.

This study constitutes a final submittal and includes the project criteria and the methodology used for conducting this analysis. The study also includes an Energy Conservation Investment Program (ECIP) analysis summary for each alternative or ECO that was evaluated.

Engineering services for this project are being provided by Engineering Applications Consultants, P.C. under contract number DACA 31-89-C-0198 for the Department of the Army, Baltimore District Corps of Engineers.

Significant assistance and cooperation for this analysis has been provided by the Corps of Engineers and the operations personnel at Fort Myer. EAC wishes to extend special appreciation to Mr. James Hawk, Mr. Ralph Gibson, and Mr. Richard Rice for their cooperation and guidance which has contributed to the development of this study.

2. PROJECT SUMMARY AND RECOMMENDATIONS

This study contains the findings of the Summer Steam Shut Down Study at Fort Myer, Virginia, and is based on field survey, discussions with the users and the operating personnel, and the review of drawings and other documents whenever available. Volumes I and II of this study contain the executive summary, project criteria, study methodology, building narratives, and the results of the analysis. Volume III contains calculations and supporting data for the study. Volume IV is a compilation of the data and notes generated from field investigations.

The project criteria lists environmental conditions within the buildings and climatic data applicable to the project site. Also included under project criteria are the fuel rates, economic life of the improvements, and discount factors used in this analysis.

The methodology section of this study contains a description of energy conservation opportunities (alternatives) considered, and the procedures for calculating the energy savings. The nature of the alternatives outlined in the scope of work provides for no interaction or "overlapping" of energy saving measures, and thus no synergistic effects exist between ECO's.

This analysis investigates the economic feasibility of providing the buildings listed with an alternate source of steam during the non-heating months. The buildings considered for evaluation of summer steam requirements are 246, 247, 248, 249, 250, 251, 400, 402, 403, 404, 405, 406, 407, 410, 411, 416, 423, 450, 452, 469, 501, and 525. Of these 22 buildings covered under this study, 11 were selected to be surveyed to establish baseline criteria for each type of building. From the baseline criteria, prorated results could then be estimated for the remaining buildings. The buildings surveyed were 246, 249, 400, 402, 404, 407, 411, 423, 450, 501, and 525. Due to unique variations within some of the buildings not surveyed, additional field investigations were performed to verify and improve the "models" used to represent them.

The following alternatives for independent steam and hot water generation have been considered:

Alternative 1 — Provide one gas-fired individual boiler in each of the 22 buildings.

Alternative 2 — Provide one central gas-fired boiler to serve Enlisted Barracks buildings 246, 247, 248, 250, and 251; and provide one gas-fired individual boiler in each of the 17 other buildings. Due to the requirements of the Enlisted Barracks "central" boiler, a remote structure will be required, and thus only one location has been analyzed.

Alternative 3 — Provide electric boilers in lieu of gas-fired boilers where applicable.

Alternative 4 — a. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 1.

b. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 2.

The results of this analysis are that all of the alternatives examined meet the qualifications for the ECIP criteria (refer to section Energy Plan below).

Table 1. ECIP Analysis Results

Alt.	Total Investment	Annual Energy Savings (MBTU) Elec.	Oil	Gas	Total	Annual Savings ($) Energy	Non-Energy	SIR	Simple Payback
1	$ 954,240	249	14,909	23,641	38,799	119,468	341,567	7.45	2.07 yrs
2	$ 956,480	206	14,909	23,830	38,946	120,163	341,567	7.45	2.07 yrs
3	$1,002,400	-537	14,909	24,627	38,999	102,160	340,630	6.86	2.26 yrs
4a	$1,013,600	251	14,909	23,797	38,957	120,502	341,567	7.03	2.19 yrs
4b	$1,015,840	208	14,909	23,987	39,104	121,209	341,567	7.04	2.20 yrs

Though various alternatives provide slightly different approaches to meeting summer period steam demands, there are two key factors common to all alternatives that dictated the close results, leaving only small differences between the alternatives. Energy savings range from 38,799 MBTU in Alternative 1 to 38,957 MBTU in Alternative 4, and total monetary savings range from $442,790 in Alternative 3 to $462,776 in Alternative 4.

One reason for the similar results among the alternatives is that for many of the buildings studied, the steam demand was large enough and did not allow the use of higher efficiency equipment. Thus a major portion of each alternative consists of the same large gas-fired boilers. As seen with Alternatives 3, 4a and 4b, when the use of the electric or high-efficiency gas equipment is extended to some of the buildings which are borderline cases, the increased investment costs are not recovered through improved fuel economy. Moreover, the total natural gas consumption in Alternatives 3, 4a and 4b does not decrease more than 6.3% from the gas consumed in the baseline option, Alternative 1.

In Alternative 3, there is an additional penalty with the cost of electricity being nearly 3.5 times the cost of natural gas, not including the extra demand charge. It is this demand charge, however, that significantly limits the use of electric powered equipment. In the summer, it is certain that any increase in load will result in an increase in the peak load because the air conditioning chillers will also be in use. This higher peak load will then be used to determine the demand charge for the month. In the Army Corps of Engineers Technical Manual 5-810-5, paragraph 4-4.c.2 acknowledges this cost of electricity and states that "because of the high operating cost of electrical equipment, electricity is not used for large-volume water heating when natural gas is available." This study has used electric equipment to satisfy only the smaller hot water demands among the buildings to analyze Alternative 3. Extending the use of electric equipment to buildings with larger demands yields even less desirable results.

The second, and perhaps most significant reason for the small variance in the results, is that a considerable portion of the savings in each of the alternatives resulted from a reduction in the operations and maintenance costs associated with the Central Boiler Plant, Building 447. The costs used to determine these savings were based on fiscal year 1991, and amount to approximately 80% of the $461,035 of anticipated (first year) total annual savings. It should be recognized that the change over from fuel oil to natural gas took place in October 1990, and that part of the year may have non-routine service and maintenance costs included. While the calculations have included central plant operations costs as an item of savings, maintenance and repair costs of the central boiler plant and the extensive distribution system, including any of the "non-routine" services, are not considered as savings under any of the proposed alternatives. The maintenance and repair work will still be required on an annual basis in order to provide an operational central heating system for the following winter.

The direct energy savings shown in Table 1 for each alternative are the combined results of three factors. First, all of the alternatives benefit from a direct energy savings of over 50% at the points-of-use in the buildings. As verified during the field investigations, most of the higher energy using buildings have, within the past 15 years, switched to instantaneous type domestic water heating equipment and have been provided with little or no hot water storage capacity. This approach to satisfying a hot water demand does not consider that a duration of peak use will be followed by an extended period of low use, and consequently, an opportunity for balanced recovery. Thus, instantaneous equipment allows for a peak condition to be satisfied indefinitely and does not encourage users to be energy efficient. Current Army Technical manual 5-810-5 provides for sizing equipment using storage capacity and takes durations of peak use into consideration. This practice leads to equipment of significantly smaller capacities and will not allow for misuse of hot water.

The second factor leading to direct energy savings is that most of the buildings are using hot water at 120°F to 140°F. Presently, Army regulations provide for a temperature of 95°F at the point of use for general domestic washing applications. The calculations for this study use storage tank temperatures of 100°F to 110°F. Applications that require elevated temperatures, such as dishwashing, use local temperature boosting equipment which is generally steam fired.

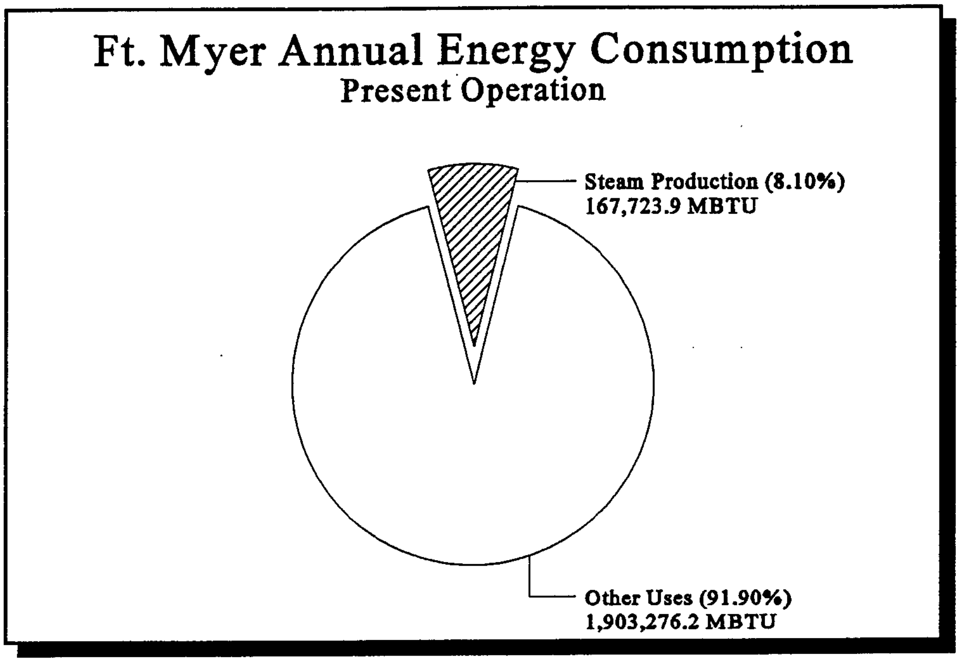
The third factor is the difference in the cost of natural gas for standard and interruptible services. The central boiler plant qualifies for the lower interruptible rate (approximately 60% of the normal service rate) because the equipment can be fired with fuel oil as well, according to the utility company Washington Gas, regardless of any on-site oil reserves. It is an assumption of this study that the local boilers and water heaters would not be provided with the capability of burning fuel oil and thus will not be able to benefit from the much lower interruptible service gas rate. Though environmental regulations may, in the future, provide clean burning gas suppliers an arm to leverage higher interruptible service rates to users who could burn heavier fuel oils, Washington Gas is not forecasting this increase. This study assumes only standard trends, as stipulated in the recent ECIP criteria, will affect fuel prices. The remaining price difference between the services is accounted for by using an adjusted or "penalized" rate in calculating the cost savings resulting from lower natural gas usage of the various alternatives.

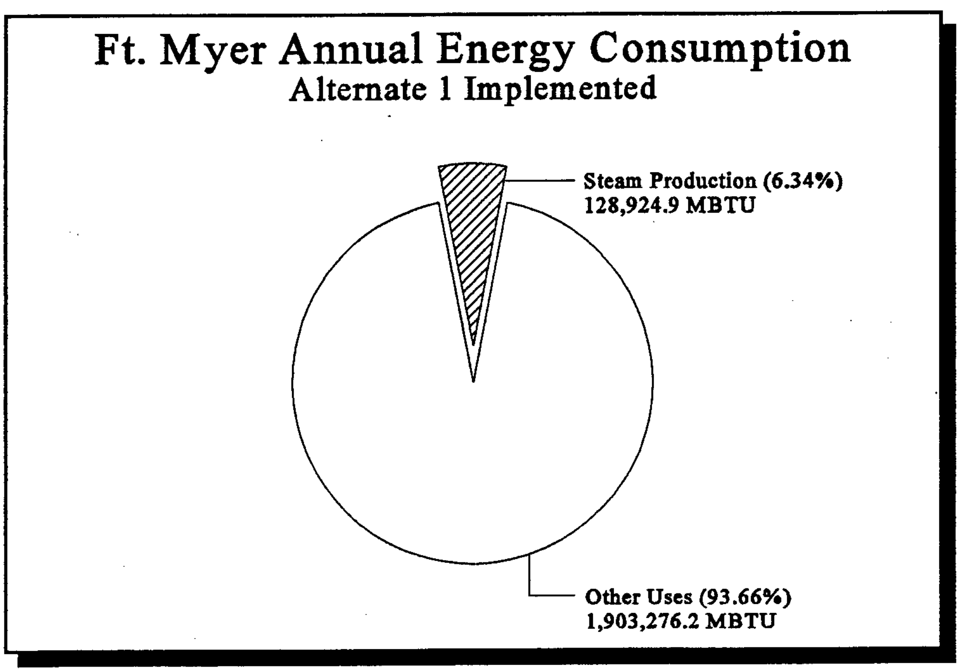
A final consideration in analyzing the energy savings is that the central steam distribution system is aging as indicated by leaks, malfunctioning valves, and deteriorating insulation and bare pipes. Using local steam equipment avoids these energy losses, and also provides a period to address maintenance needs on a scheduled basis to prepare the system for use during the winter months. The steam distribution systems within the buildings surveyed appears to be in good condition and do not contribute significantly to the loss of steam from the central system. However, the steam presses in the barracks buildings would remain as a point-of-use steam loss for all of the alternatives considered.

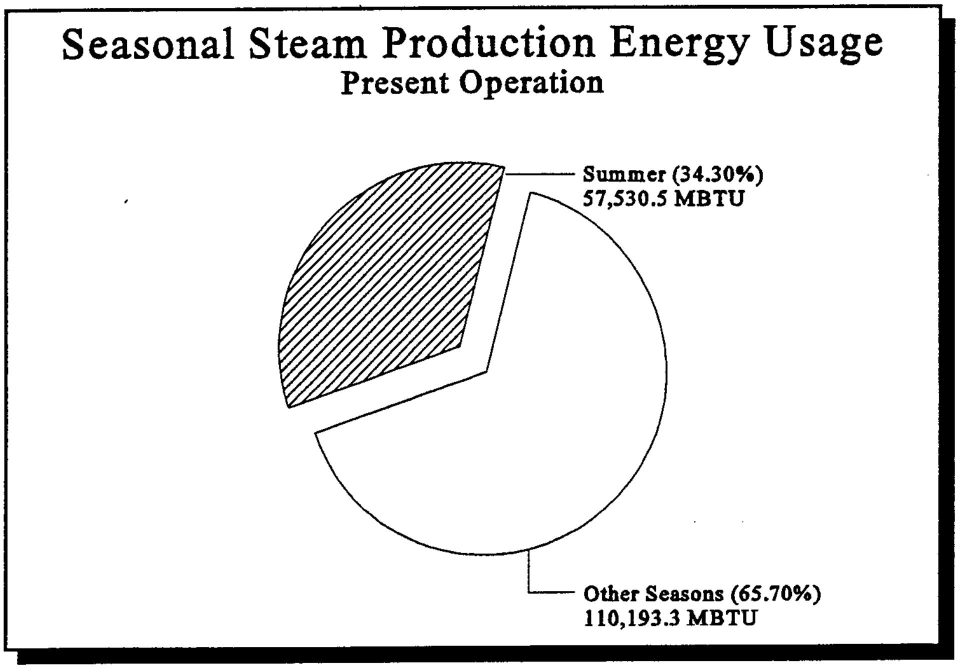
This analysis has shown that Alternatives 1 and 2 are the most favorable in meeting the ECIP criteria and would have economic benefits if implemented. Because there is little or no economic difference between Alternatives 1 and 2, Alternative 1 is recommended as a more flexible and more aesthetically pleasing alternative. In Alternative 2, the semi-central boiler system serving the "Old Guard" barracks was analyzed with the provision of two boilers to be operated in a back-up or redundant fashion. If the barracks were to depend on one boiler for their entire needs, there would be a greater chance of a breakdown affecting all of these barracks than with an independent boiler for each building as provided in Alternative 1. Therefore, to yield an accurate comparison, only viable installations could be considered. In addition, Alternative 2 provides for a separate structure which would be located behind the "Old Guard" buildings. This could detract from the appearance of the installation from the outside (Arlington Boulevard exposure), and would limit any future use of this space. The areas under consideration are presently used for parking, access to the buildings, and various training exercises by the "Old Guard" companies.

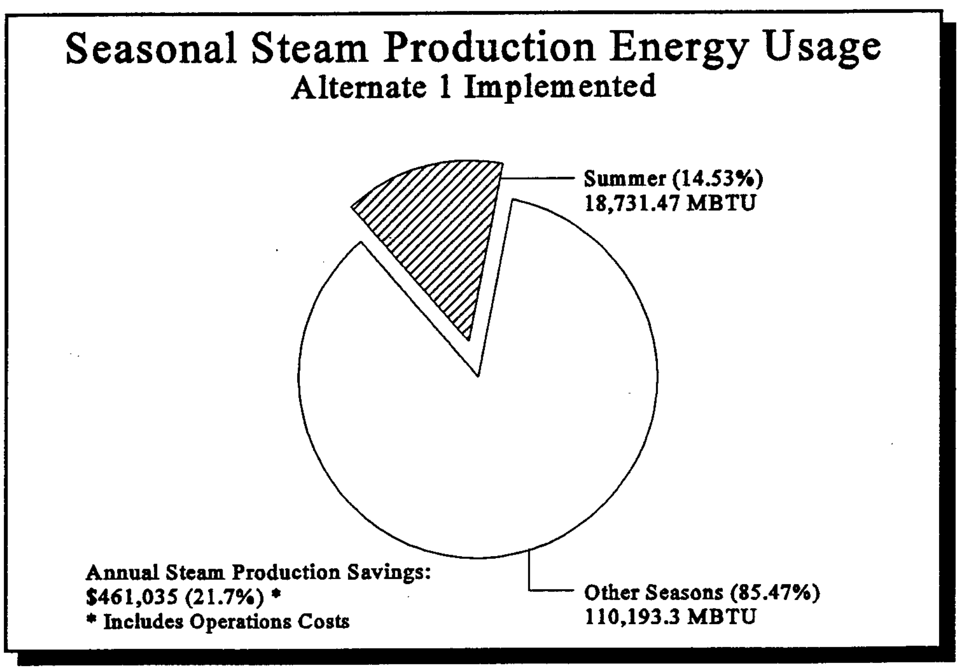
3. ENERGY CONSUMPTIONS AND SAVINGS

The following figures present the estimated basewide energy usage patterns before and after the implementation of Alternative 1; providing an individual gas fired boiler or domestic water heater, as applicable, in each building currently served by the central steam plant during the summer period.






Seasonal Steam Production Energy Usage
Present Operation
Summer (34.30%)
57,530.5 MBTU
Other Seasons (65.70%)
110,193.3 MBTU


Seasonal Steam Production Energy Usage
Alternate 1 Implemented
Summer (14.53%)
18,731.47 MBTU
Annual Steam Production Savings:
$461,035 (21.7%) *
* Includes Operations Costs
Other Seasons (85.47%)
110,193.3 MBTU

4. ENERGY PLAN

The Energy Conservation Investment Program (ECIP) is available for the energy conservation opportunity (ECO) analyzed in this report. ECIP funding can apply to projects which have a construction cost estimate greater than $300,000, a savings to investment ratio (SIR) greater than 1.25 and a simple payback period of ten years or less. ECIP projects are also assessed a level of risk associated with continuity of the base mission and stability of the baseline energy consumption used in the analysis calculations.

The services provided by Fort Myer are expected to be required throughout the foreseeable long term. Accordingly, it is also expected that the energy baseline used in the preparation of this analysis will remain stable for the period of the savings calculation.

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