Limited Energy Study
Postwide Share Generation/Peak Shaving Generation Plant
Energy Engineering Analysis Program (EEAP)
Fort Lee, Virginia

Final Report
Volume 1 of 1

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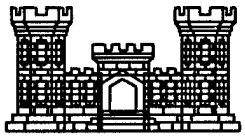

Norfolk District-
US Army Corps
of Engineers

SYSTEMS*corp*

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APPENDICES

TABLES AND FIGURES

1.1 SYNOPSIS

Systems Engineering and Management Corporation (Systems Corp) surveyed and completed energy analyses for five (5) options for a Share Generation/Peak Shaving Generation plant at Fort Lee, Virginia. The cost estimates for the study were prepared using MeansData for Windows Spreadsheets, Version 2.0a. Life cycle cost analyses were performed using the Life Cycle Cost in Design (LCCID) computer program, Version 1.0 Level 92. Project development brochures (PDBs) and DD1391 forms were prepared for the Energy Conservation Project (ECIP) developed. The project developed represents $1,074,275 in first year savings with a simple payback of 4.10 years and a savings to investment ratio (SIR) of 3.41.

1.2 INTRODUCTION

Systems Corp was contracted by the Norfolk District of the United States Army Corps of Engineers in September 1994 to perform a limited energy study for Share Generation/Peak Shaving Generation, postwide, at Fort Lee, Virginia.

1.2.1 Scope of Work

1. Identify the various Virginia Power rates available to Fort Lee for use in purchasing electric power in combination with on-site generators.

2. Identify the electrical grid where it would be most advantageous for Fort Lee to install a new electric power plant.

3. Determine the most life cycle cost effective combination of self generated and purchased electric power to meet Fort Lee's electric power requirements.

4. Perform a limited site survey of buildings and facilities to verify Fort Lee's electrical system set-up and energy consumption for analysis.

5. Calculate the energy, demand, and operating and maintenance savings for each alternative evaluated.

6. Provide complete programming and implementation documentation for all recommended projects.

7. Prepare a comprehensive report to document the work performed, the results, and the recommendations.

8. Provide an Environmental Assessment of the areas where the proposed equipment will be located.

1.2.2 Organization of the Final Report

The submitted material for this report consists of the following:

Executive Summary, Methods and Approach, Project Documentation, Scope of Work, Comments and Responses, Interim Review Presentation, and Correspondence.

1.3 PRESENT AND HISTORICAL ENERGY CONSUMPTION

1.3.1 Electricity

The electric energy consumption, demand, and costs for FY94 are shown in *Table 1.3.1.1 Fort Lee Electric*. *Figure 1.3.1.1* is a bar graph of the monthly consumption and cost. The electric costs used to calculate the electric cost savings for this project are as follows:

COST/KWH = $0.01968 (No Demand)
COST/KW = $12.62 (Monthly Demand)
COST/MWH = $43.86 (Energy & Demand)

Table 1.3.1.1

Fort Lee Electric

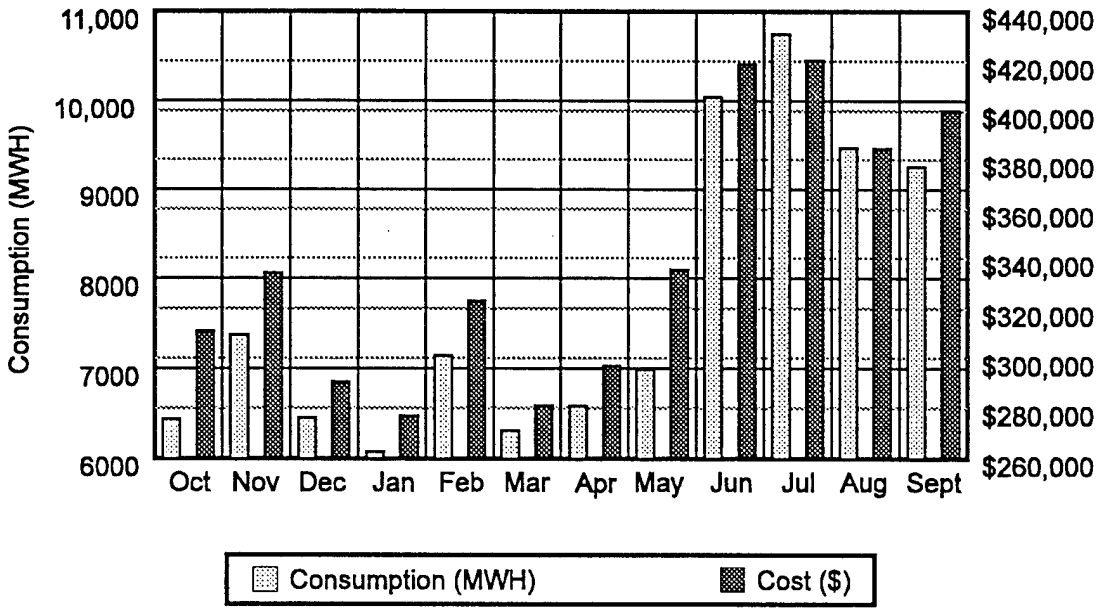
FY 94

Month	Actual Demand (KW)	Consumption (KWH)	Total Cost	Cost/MWH
Oct '93	13,409	6,437	$311,008	$48.32
Nov	12,441	7,373	334,045	45.31
Dec	11,888	6,451	290,528	45.04
Jan '94	12,399	6,077	277,021	45.59
Feb	12,735	7,142	323,045	45.23
Mar	12,372	6,307	281,174	44.58
Apr	13,703	6,581	296,996	45.13
May	16,917	6,984	335,382	48.02
Jun	16,848	10,045	418,857	41.70
Jul	16,968	10,749	420,407	39.11
Aug	16,450	9,469	384,644	40.62
Sep	17,000	9,255	400,243	43.25
TOTAL	—	*92,870*	*$4,073,350*	*$43.86*
Min	11,888	6,077	$277,021	$39.11
Max	17,000	10,749	420,407	48.02
Avg	14,458	7,739	339,446	43.86

Figure 1.3.1.1

Fort Lee Electric

FY 94



1.3.2 Fuel Oil #2

The fuel oil #2 consumption and costs for Fort Lee for FY94 are shown in *Table 1.3.2.1 Fort Lee Fuel Oil #2*. *Figure 1.3.2.1* is a bar graph of the monthly consumption and costs. The fuel oil cost used to calculate fuel oil costs and savings for this project was:

COST/MWH = $19.19 (Annual Average)

1.3.3 Natural Gas

The natural gas energy consumption and costs for Fort Lee for FY94 are shown in *Table 1.3.3.1 Fort Lee Natural Gas*. *Figure 1.3.3.1* is a bar graph of the monthly consumption and costs. The natural gas cost used to calculate savings and costs for the project was:

COST/MWH = $11.23 (Annual Average)

1.4 ENERGY CONSERVATION OPPORTUNITIES

Systems Corp analyzed one energy conservation opportunity at Fort Lee, Virginia. The analysis was performed utilizing energy models developed by Systems Corp and data collected during the field survey of the plants and facilities at Fort Lee. Five options were evaluated under the ECO to determine potential energy savings, dollar savings, implementation costs, simple payback, life cycle cost, and savings to investment ratio (SIR). The ECO evaluated was for a shared generation/peak shaving plant for Fort Lee, postwide. The five options that were evaluated are as follows:

Option 1 Use existing facilities in combination with three (3) 1.5 MW leased diesel engine generators and breakdowns.

Option 2 Construct new plant with four (4) 1.5 MW diesel engine generators to shave 4 MW of demand with 0.5 MW for additional capacity and 1.5 MW in reserve for maintenance and breakdowns.

Table 1.3.2.1

Fort Lee Fuel Oil #2

FY 94

Month	Consumption (BBL)	Consumption (KWH)	Cost	Cost/MWH
Oct '93	125	213	$4,095	$19.23
Nov	383	654	12,547	19.19
Dec	450	768	14,742	19.20
Jan '94	801	1,367	26,241	19.20
Feb	538	918	17,625	19.20
Mar	532	908	17,428	19.19
Apr	272	464	8,911	19.20
May	37	63	1,212	19.24
Jun	587	1,002	19,230	19.19
Jul	8	14	262	18.71
Aug	—	—	—	—
Sep	—	—	—	—
TOTAL	*3,733*	*6,372*	*$122,293*	*$19.19*
Min	0	0	$0	$18.71
Max	801	1,367	26,241	19.24
Avg	311	531	10,191	19.19

Figure 1.3.2.1

Fort Lee Fuel Oil #2

FY 94

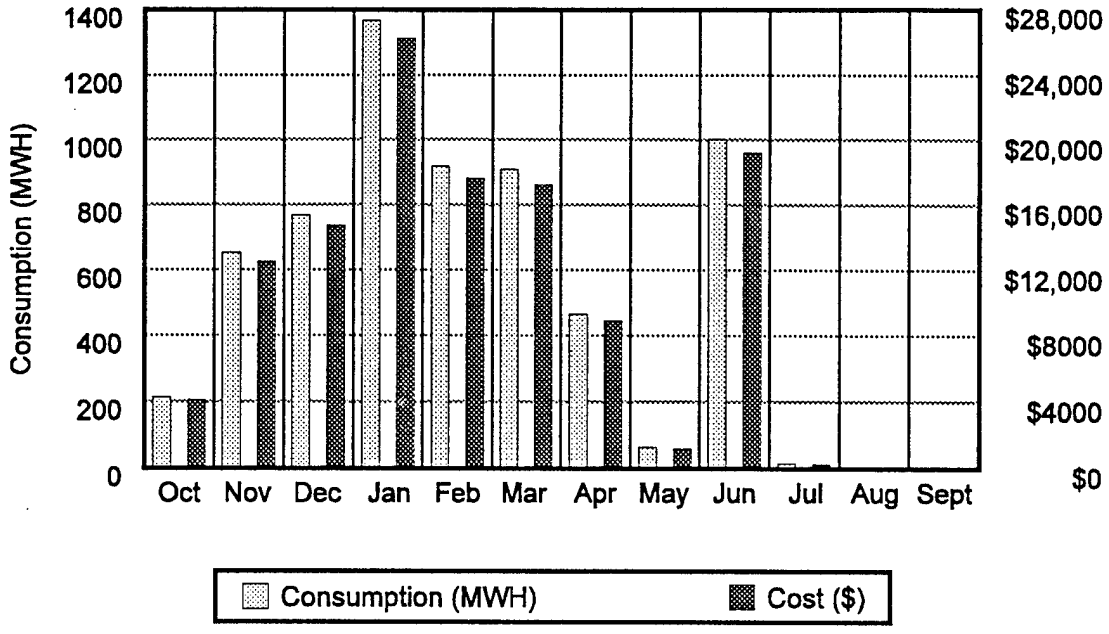


Table 1.3.3.1

Fort Lee Natural Gas

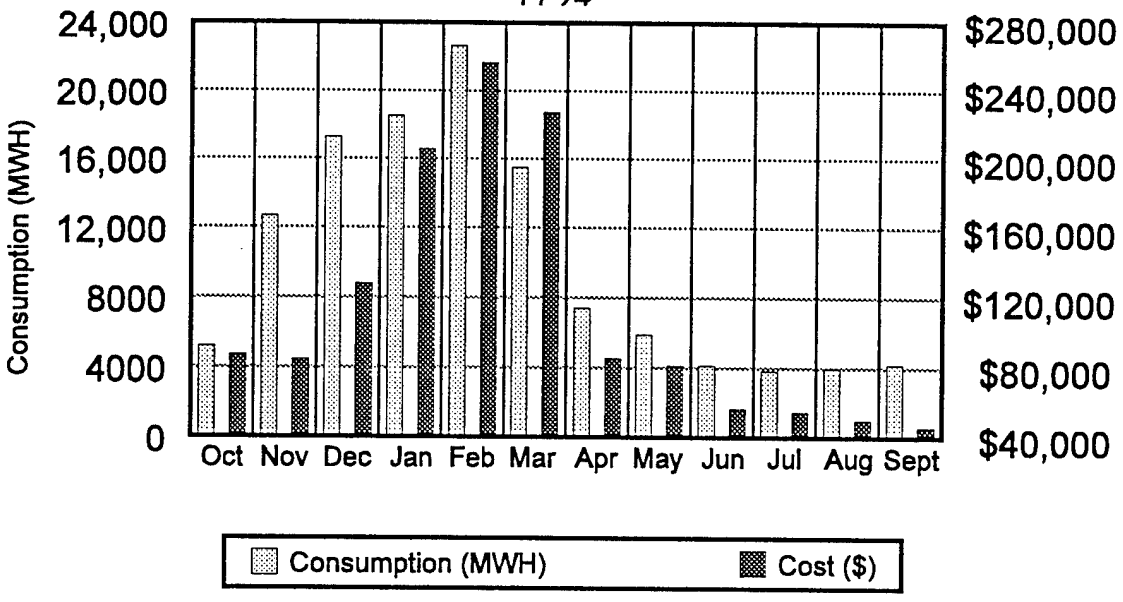
FY 94

Month	Consumption (KSCF)	Consumption (MWH)	Cost	Cost/MWH
Oct '93	17,125	5,174	$86,854	$16.79
Nov	42,067	12,711	84,408	6.64
Dec	57,201	17,284	127,928	7.40
Jan '94	61,325	18,530	205,498	11.09
Feb	74,995	22,660	256,695	11.33
Mar	51,329	15,510	227,506	14.67
Apr	24,448	7,387	85,187	11.53
May	19,460	5,880	80,972	13.77
Jun	13,564	4,098	56,535	13.80
Jul	12,684	3,832	54,581	14.24
Aug	13,146	3,972	49,834	12.55
Sep	13,894	4,198	45,685	10.88
TOTAL	*401,238*	*121,236*	*$1,361,683*	*$11.23*
Min	12,684	3,832	$45,685	$6.64
Max	74,995	22,660	256,695	16.79
Avg	33,437	10,103	113,474	11.23

Figure 1.3.3.1

Fort Lee Natural Gas

FY 94



Option 3 Construct new plant with four (4) 1.5 MW natural gas engine generators to shave 4 MW of demand with 0.5 MW for additional capacity and 1.5 MW in reserve for maintenance and breakdowns.

Option 4 Construct new plant with 8-1.5 MW diesel engine generators to shave 8 MW with 1 MW for additional capacity and 3 MW in reserve for maintenance and breakdowns.

Option 5 Construct new plant with 4-1.5 MW diesel engine generators and 4-1.5 MW natural gas engine generators to shave 8 MW of demand with 1 MW for additional capacity and 3 MW in reserve for maintenance and breakdowns.

Systems Corp's energy analysis models were used to determine the savings achieved by implementing each of the above options. MeansData for Windows Spreadsheets, Version 2.0a, cost estimating software was used to estimate the implementation cost of each option. The U.S. Army Corps of Engineers' Life Cycle Cost in Design, Version 1.0 Level 92, software was used to perform life cycle cost analyses and determine the SIR of each option.

1.4.2 Economic Results

Systems Corp recommends that the option with the highest SIR be implemented which is *Option 4*. *Table 1.4.2.1* illustrates the economic results for all options evaluated.

TABLE 1.4.2.1
ALL OPTIONS FROM HIGHEST TO LOWEST SIR

POWER PLANT OPTIONS	TOTAL INVESTMENT	FIRST YEAR SAVINGS	SIR	SIMPLE PAYBACK (YEARS)	AIRR
OPTION 4	$4,400,644	$1,074,275	3.41	4.10	9.52%
OPTION 2	$2,243,848	$357,346	2.58	6.28	N/A
OPTION 5	$7,785,577	$999,384	1.87	7.79	6.28%
OPTION 1	$1,889,888	$269,603	1.45	7.01	4.94%
OPTION 3	$5,768,209	$394,740	1.12	14.61	N/A

* Note: Economic results are slightly different from interim results. LCCA were rerun using an updated version of LCCID.

1.4.3 ECIP Project Developed

Systems Corp developed one ECIP project as a result of this study. The project is for the implementation of *Option 4*.

This section details the methodology and approach used in this study from the site survey through the final economic results. The methods and approach utilized were formulated around the requirements detailed in the Scope of Work included in *Appendix A*.

2.1 Data Collection and Site Survey

The first phase of the project included collecting general information on the overall facilities at Fort Lee and how energy is being used. The field survey and data collection was performed by a team of three Systems Corp engineers from 06 September to 09 September 1994. Detailed data concerning the existing power generating plants was collected including the condition of the existing power plant facilities, mode of operation, energy consumption, maintenance and repair history of equipment, engineering drawings, utility system diagrams, and concerns expressed by operators and managers. Energy data and price schedules were collected from Fort Lee engineering personnel, the Virginia Electric and Power Company, and the Army Defense Energy Information System (DEIS).

The site survey of the existing power generating plants was performed to examine the system layout and determine the condition of the existing equipment. A general survey of overall post facilities and utilities was performed to determine current electrical load characteristics as well as anticipated additional loads from new construction projects, available utility service tie-in points, and possible sites for a new power generating plant.

2.2 Analysis

This section details the steps taken in the analysis phase of this project from the determination of baseline savings and costs to various options for a new power plant.

2.2.1 Baseline Calculations

The baseline calculations for this project involved the determination of electrical energy and demand savings achieved through the operation of the existing plant as well as the determination of fuel costs and operation and maintenance costs for the plants.

2.2.1.1 Electrical Savings

The electrical energy and demand savings were determined by evaluating power plant logs obtained during the field survey. The logs detail the number of kilowatt-hours (KWH) produced in a given month as well as the number of generators in operation. This data was used to determine demand (KW) savings for the existing plants located in building 1109 and 1336. Data involving energy and demand savings was input into Lotus 123 Release 4.0 spreadsheets for evaluation.

2.2.1.2 Fuel Costs

Fuel costs incurred in the operation of the existing plants were obtained by using the power plant logs. These logs specify the monthly diesel consumption for each engine. For Engine 1 in Building 1109, natural gas consumption was estimated by determining an equivalent fuel input rate as compared to the other engines. This estimate was necessary since there is no operable gas meter at the plant. The estimates were calculated using a Lotus 123 Version 4.0 spreadsheet.

2.2.1.3 Operation and Maintenance Costs

Operation costs were estimated based on the costs of manning the existing plants. The dedication of two (2) full-time operators were assigned along with indirect costs for supervision, tracking, and logging since the main plant at 1109 is not automated. Maintenance costs were estimated by utilizing a printout of the K-Account obtained during the field survey. This printout allowed for an estimate to be made of the repair parts and maintenance required at both 1109 and 1336. Also, routine maintenance costs were estimated on a $/KWH basis.

2.2.2 ECO Calculations

The energy conservation opportunity (ECO) evaluated was for a share generation/peak shaving generation plant at Fort Lee. Five options were evaluated under this ECO and are described as follows:

> Option 1: Utilize existing plants with the addition of 4.5 MW of leased generation equipment.

Option 2: Construct new plant and utilize four (4) 1.5 MW diesel engine generators to shave four (4) MW of demand.

Option 3: Construct new plant and utilize four (4) 1.5 MW natural gas engine generators to shave four (4) MW of demand.

Option 4: Construct new plant and utilize eight (8) 1.5 MW diesel engine generators to shave eight (8) MW of demand.

Option 5: Construct new plant and utilize four (4) 1.5 MW natural gas engine generators for base loading and four (4) 1.5 MW diesel engine generators for peaking so that, when combined, eight (8) MW of demand will be shaved.

This section of the report will further explain how the options were determined and how the electrical savings, fuel costs, and operation and maintenance costs were calculated.

2.2.2.1 Determination of Options

To determine the options which would be evaluated for implementation of the ECO, Fort Lee's daily demand profiles were closely evaluated. Daily demand data was obtained from Fort Lee and Virginia Power. This data, covering a time period from October 1992 to July 1994, was input into a Lotus 123 Version 4.0 spreadsheet for evaluation.

Load profile charts provide a basis for the selection of power generating equipment as well as data for feasibility and economic studies. A family of load profile charts showing a representative 24-hour period, monthly demand, and seasonal demand variation were developed to formulate new power generating plant alternatives including capacity and mode of operation.

Key observations used to formulate options for the new power generating plant were:

- The peak demand is relatively flat due to demand management by Fort Lee's energy management control system (EMCS) and summer peak shaving by the existing power plants. The summer demand levels out at 17 megawatts (MW) which is the maximum contract billing demand.

- The existing power plants' mode of operation is to provide standby capacity for the utility company to earn standby generator (MSSG) credit and to shave summer demand peak by approximately 4 MW.

- The existing power plants have no reserve capacity to maintain electrical demand below the 17 MW level if one of the engine generators fails.

- The summer demand will peak at approximately 21 MW if the existing power plants are not in operation.

- There is approximately a 9 MW demand variation between the summer peak demand and the winter/fall/spring peak demand.

- A new power generating plant could be installed to replace the existing plants to earn MSSG standby credit and shave 4 MW of summer peak, or a new power plant could be installed which would have the capacity to further reduce the summer demand to the level set by winter/fall/spring peak demand. To be conservative, this option would save eight (8) MW of demand charges during summer months and 90% of eight (8) MW during the remainder of the year. A more aggressive approach could be taken to save the entire nine (9) MW; however, for the evaluation, the more conservative selection of eight (8) MW was taken.

2.2.2.1.1 Option 1

Option 1 evaluates the use of leased generators, a total of 4.5 MW, to be obtained by Fort Lee. The use of these generators for peak shaving was not included in the baseline evaluation since the data collected did not include the generators and they were not present at Fort Lee at the time of the survey. The leased generators were considered to be an option which adds capacity to the existing plants since Fort Lee is incurring a cost to obtain them ($72,000 per year plus $35 per hour of run-time).

2.2.2.1.2 Options 2 and 3

Options 2 and 3 both evaluate the construction of a new power generating plant to contain four (4) 1.5 MW engine generators. The options are the same with the exception of the fuel source utilized for the engines; Option 2 utilizes diesel fuel while Option 3 utilizes natural gas. For the purpose of this study, the peak shaving capacity of both plants was set at four (4) MW which matches the

capacity of the existing plants. The plant was slightly oversized to prevent a loss of demand savings due to a generator being out of service unexpectedly. These two options allow Fort Lee to remain at the negotiated demand level of seventeen (17) MW. An additional 0.5 MW is available with one generator out of service to account for additional loads to be added at Fort Lee.

2.2.2.1.3 Options 4 and 5

Options 4 and 5 both evaluate the construction of a new power generating plant to contain eight (8) 1.5 MW engine generators. This plant configuration allows for eight (8) MW of demand to be shaved. These two options were arrived at by evaluating demand data for Fort Lee. By examining the demand data, it appears that the average differential between the summer demand and the winter/fall/spring demand is approximately eight (8) MW. By examining the actual peak demands, the differential is nine (9) MW. To be more conservative in the estimates, the average of eight (8) MW difference in demand was utilized to calculate costs and savings. By shaving the summer peak (21 MW) down to the winter/fall/spring peak (13 MW), the ratchet charge that effects Fort Lee would be eliminated. A new negotiated demand of thirteen (13) MW could be set with Virginia Power.

The difference between Options 4 and 5 is the fuel source used for the base load generators. (Please refer to *Section 2.3* for more information on base loading.) For Option 4, all generators are diesel. For Option 5, the four (4) base load generators are natural gas with four (4) diesel generators for peaking.

2.2.2.2 Electrical Savings

Electrical energy and demand savings were determined by estimating the required operating time for each option. The operating time was determined by evaluating the area under a summer average demand curve for the given peak shaving level. Demand savings for each option are the operating KW of the option for the four (4) summer months plus 90% of the operating KW for the remaining eight (8) months.

2.2.2.3 Fuel Costs

The fuel costs for each option were calculated by taking the previously determined KWH for the option and dividing by the KW shaved to determine full load operating hours. The operating hours

are utilized with vendor supplied engine data of fuel input rates to determine fuel costs. Additional hours of operation are included to account for participation in the standby generation rate during the winter months (rate MSSG).

2.2.2.4 Operation and Maintenance Costs

Costs for operation and manning each option were calculated in a manner similar to the baseline calculations. Operating costs will be lower since each option utilizes Fort Lee's EMCS to operate the plant. Manning costs will only be required for monitoring the plant. Maintenance costs for each option were estimated using contract maintenance prices supplied via a vendor quote.

2.3 Engine Selection

The choice of engine size for this project involved several factors including price, management strategies, and peak shaving level. For price, the goal was to minimize the price per KW. The remainder of this section discusses the other criteria considered.

2.3.1 Electrical Power Management Strategies

Based on the load analysis performed, the following demand management strategies were formulated:

Strategy 1: Continue to utilize existing on-site generators to limit the electrical demand to the current negotiated maximum demand level of seventeen (17) MW and attempt to avoid paying penalties issued by Virginia Power when the demand level is exceeded. Utilize leased generators to possibly lower negotiated demand level.

Strategy 2: Continue to limit summer demand at the negotiated demand level of seventeen (17) MW by utilizing a new power generating plant, thereby providing reserve capacity to improve reliability for maintaining generation capacity levels required during peak shaving periods.

Strategy 3: A large difference in peak demand between the summer and the winter/spring/fall months along with a 90% utility company ratchet charge provides an opportunity for significant savings on demand charges by limiting the summer demand peak to the

winter/spring/fall demand level. This allows Fort Lee to lower the negotiated demand level closer to the winter/spring/fall peak demand and avoid paying for the high summer demand capacity year round.

2.3.2 Engine Selection Considerations

The power management scheme to be used in strategies 1 and 2 is called peak shaving. Strategy 3 will use a peak shaving scheme in combination with a power management scheme called base loading.

Peak shaving eliminates sharp peaks, generally of short duration, from the demand profile, thus lowering the billing demand which may allow Fort Lee to take advantage of a discount rate if the demand is maintained below the negotiated level. This type of power management can be very demanding on an engine. The engine must be capable of carrying the difference between the maximum utility supply and the maximum power demand. For Strategies 1 and 2, this capacity is four (4) MW with two (2) MW in reserve capacity to maintain reliability. The engines must also be able to start quickly and automatically in parallel with the utility.

Base loading is the operation of a generator set at a constant load. When the power demand exceeds the generator output, electricity must be imported from other sources. For Strategy 3, there is a total of nine (9) MW load peak variation between summer demand and winter/spring/fall demand that needs to be generated by the new power plant. A good portion, approximately 3 to 4.5 MW, of generating capacity can run at constant load for a good duration of the day during the summer months. The remainder of the generating capacity will operate in a peak shaving mode. Base loading is the power management scheme that is the least demanding on the generators. Since the generator set is operated at a constant load, engine response is not as critical as in a peak shaving case. For Strategy 3, the new power plant will be sized to provide generation for a nine (9) MW load with three (3) MW in reserve capacity.

The engine type selected for peak shaving application is a turbo-charged diesel, low emission model engine. Diesel engine generator sets have a low first cost, good engine response, and good application for short engine operating hours. Spark ignited, natural gas engine-generator sets were selected for base loading applications. These engines have very low emissions as compared to diesel engines. With longer operating hours and stringent environmental requirements, low emission factors will be a key issue. In addition, using a natural gas engine instead of a diesel engine for the base loading application will provide a lower long term operating cost. For Strategies 1 and 2, a power plant option will be evaluated using only diesel engines and an option using only natural gas

engines. For Strategy 3, an option will be evaluated using only diesel engines and an option using a combination of diesel and natural gas engines.

Reliability is critical in peak shaving applications. If the plant is unable to peak shave on only one summer day, it could cost Fort Lee significant demand charges for the remainder of the year. For this reason, the power plant should be designed with a reserve capacity to deal with unscheduled maintenance or breakdowns as well as unexpected load increases. In addition, the plant should not rely on one or two large engines to meet the load. If one of the engines goes out of service, the power plant will be unable to meet the required load. By sizing the engines in logical capacity increments that fit the demand profile and mode of operation, not only will the power plant be more reliable but it will also operate more efficiently. The engines will be able to operate at near full load for maximum efficiency which will minimize operating costs.

2.4 Cost Estimates

The cost estimates for the different options were obtained using a variety of sources. This section explains how each part of the cost estimate was determined.

The initial cost for each option is the sum of the construction costs for the project and the project costs. The construction cost includes all costs in materials, labor, and contractor's overhead and profit. The project costs include supervision, inspection, and overhead (SIOH) for the project and the project design costs.

2.4.1 Construction Costs

The construction cost for each option was estimated using MeansData for Windows Spreadsheets version 2.0a cost estimating software. Prices not available in the accompanying database were obtained using a combination of sources. These sources include the following:

Local supplier and vendors
Systems Corp Estimating Data

All pricing has been adjusted where applicable to represent the labor costs in the Fort Lee labor market. The construction cost estimates have been prepared to include a reasonable level of detail for each option calculated.

2.4.2 Project Costs

The project costs for each option include the cost of supervision, inspection, and overhead required to complete the project. A value of 5.0% of the construction cost has been used for the SIOH. Also included in the project costs is the cost to design each option. The design cost has been included at a fixed value of 5.0% of the construction cost. This approach assures consistent values have been used for the project costs for each option.

2.5 Life Cycle Costs

The life cycle cost analysis for the options are a combination of energy costs, investment costs, maintenance costs, and replacement costs. Each of these components may or may not be significant factors in determining the life cycle cost of the project. Each of these cost components have been evaluated for each option calculated in order to determine their contribution, if any, to the life cycle cost of the project.

The life cycle costs were calculated using the computer program Life Cycle Costing in Design (LCCID), Version 1.0, Level 92, as required in the Scope of Work.

2.5.1 Energy Costs

Energy costs for each type of fuel used in the facilities included in the Scope of Work were obtained from the installation and through the Defense Energy Information System (DEIS). The costs were obtained along with the amount of energy used for FY94. Average energy costs per unit of fuel were calculated.

2.5.1.1 Electricity

The electric energy consumption, demand, and costs for FY94 are shown in *Table 2.5.1.1.1 Fort Lee Electric*. *Figure 2.5.1.1.1* is a bar graph of the monthly consumption and cost. The electric costs used to calculate the electric cost savings for this project are as follows:

COST/KWH	=	$ 0.01968/KWH (No Demand)
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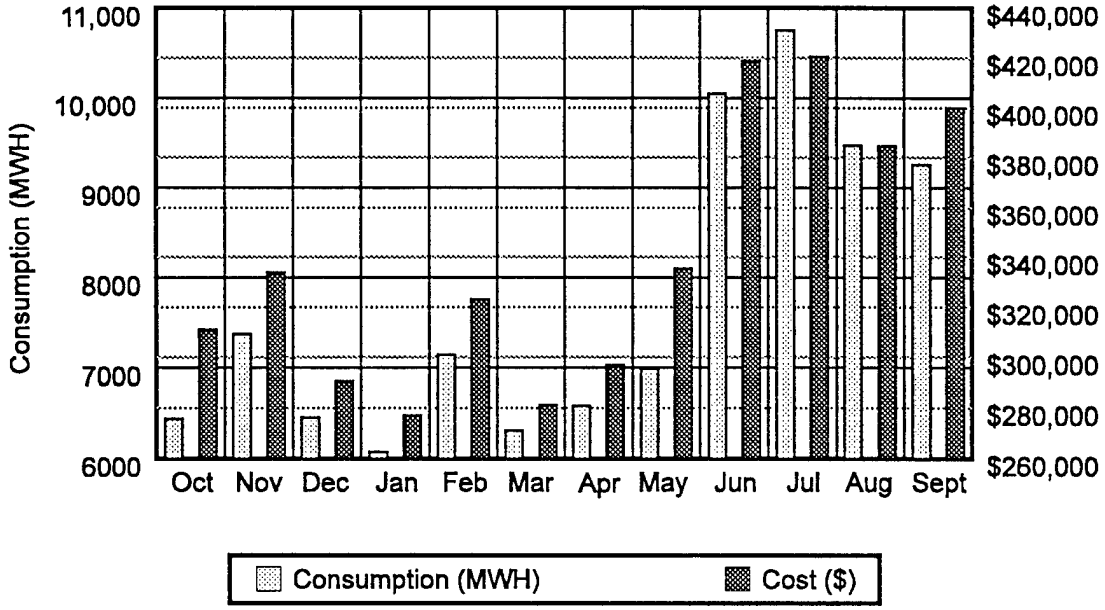
Figure 2.5.1.1.1

Fort Lee Electric

FY 94



2.5.1.2 Fuel Oil #2

The fuel oil #2 energy consumption and costs for Fort Lee for FY94 are shown in *Table 2.5.1.2.1 Fort Lee Fuel Oil #2*. *Figure 2.5.1.2.1* is a bar graph of the monthly consumption and costs. The fuel oil cost used to calculate fuel oil costs/savings for this project was:

COST/MWH = $19.19/MWH (Annual Average)

2.5.1.3 Natural Gas

The natural gas energy consumption and costs for Fort Lee for FY94 are shown in *Table 2.5.1.3.1 Fort Lee Natural Gas*. *Figure 2.5.1.3.1* is a bar graph of the monthly consumption and costs. The natural gas cost used to calculate savings/costs for this project was:

COST/MWH = $11.23/MWH (Annual Average)

2.5.2 Maintenance and Replacement Costs

The maintenance and operating costs/savings for each option were calculated where applicable. We first considered whether the annual recurring (maintenance and operation) non-energy costs would significantly change as a result of each option. It is the policy of Systems Corp to be conservative when estimating these more subjective cost components--which, if improperly evaluated, could result in inappropriate project qualification and funding decisions. These costs are shown on each life cycle cost summary sheet included in *Sections 5* and *6* of this report and are explained in further detail in those sections.

The replacement costs (non-energy, non-annual recurring cost) for each option have been evaluated in the same manner as non-energy, annual recurring cost. A replacement cost was used for the existing plants since they are operating past their economic lives.

Table 2.5.1.2.1

Fort Lee Fuel Oil #2

FY 94

Month	Consumption (BBL)	Consumption (KWH)	Cost	Cost/MWH
Oct '93	125	213	$4,095	$19.23
Nov	383	654	12,547	19.19
Dec	450	768	14,742	19.20
Jan '94	801	1,367	26,241	19.20
Feb	538	918	17,625	19.20
Mar	532	908	17,428	19.19
Apr	272	464	8,911	19.20
May	37	63	1,212	19.24
Jun	587	1,002	19,230	19.19
Jul	8	14	262	18.71
Aug	—	—	—	—
Sep	—	—	—	—
TOTAL	*3,733*	*6,372*	*$122,293*	*$19.19*
Min	0	0	$0	$18.71
Max	801	1,367	26,241	19.24
Avg	311	531	10,191	19.19

Figure 2.5.1.2.1

Fort Lee Fuel Oil #2

FY 94

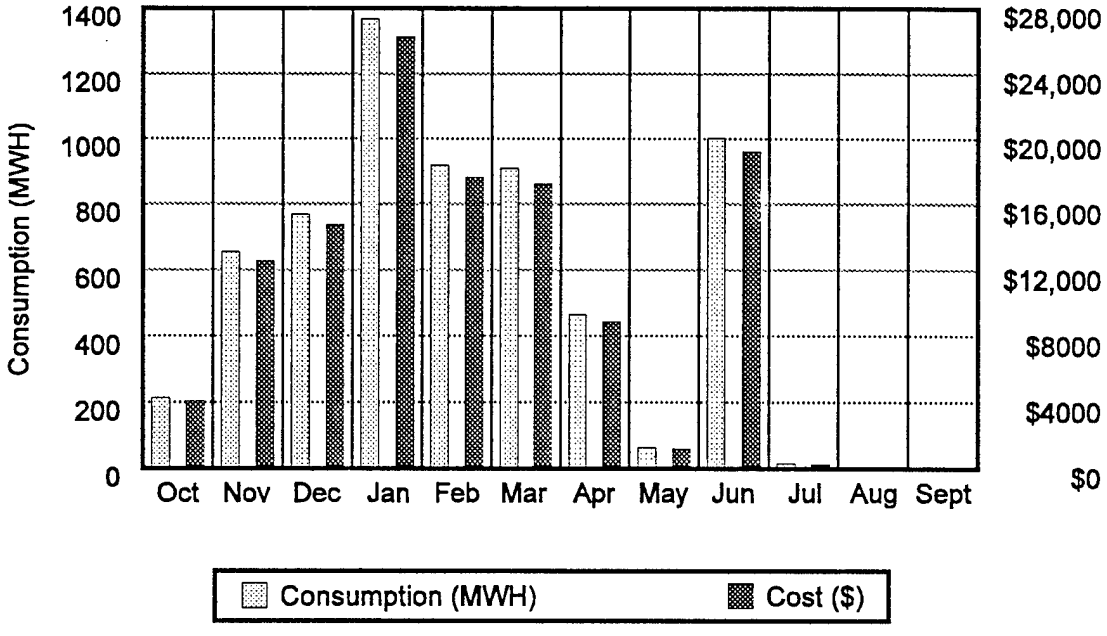


Table 2.5.1.3.1

Fort Lee Natural Gas

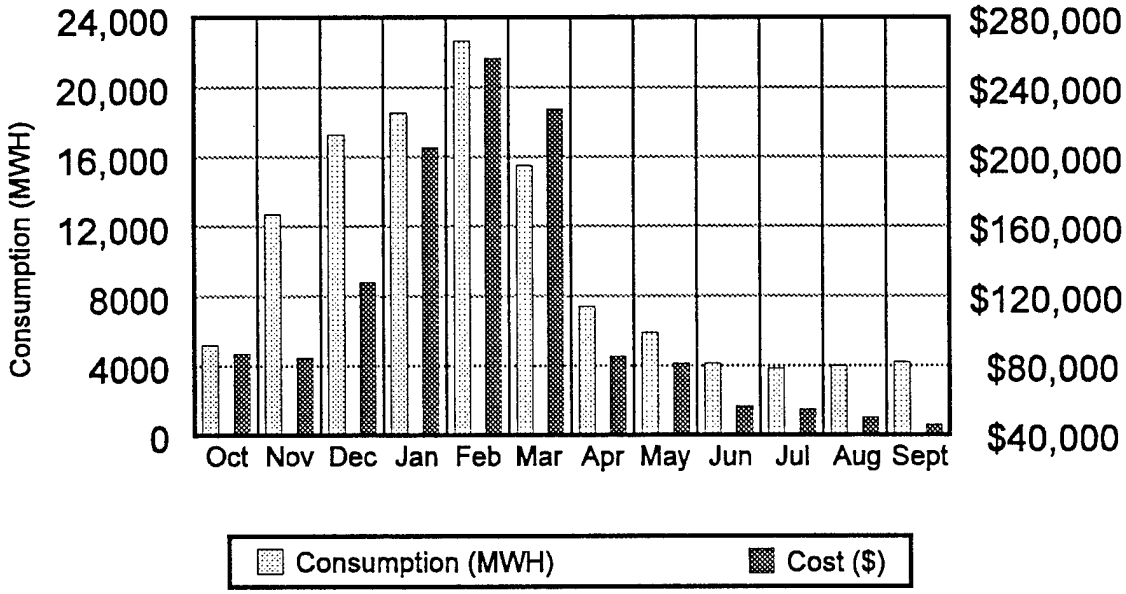
FY 94

Month	Consumption (KSCF)	Consumption (MWH)	Cost	Cost/MWH
Oct '93	17,125	5,174	$86,854	$16.79
Nov	42,067	12,711	84,408	6.64
Dec	57,201	17,284	127,928	7.40
Jan '94	61,325	18,530	205,498	11.09
Feb	74,995	22,660	256,695	11.33
Mar	51,329	15,510	227,506	14.67
Apr	24,448	7,387	85,187	11.53
May	19,460	5,880	80,972	13.77
Jun	13,564	4,098	56,535	13.80
Jul	12,684	3,832	54,581	14.24
Aug	13,146	3,972	49,834	12.55
Sep	13,894	4,198	45,685	10.88
TOTAL	*401,238*	*121,236*	*$1,361,683*	*$11.23*
Min	12,684	3,832	$45,685	$6.64
Max	74,995	22,660	256,695	16.79
Avg	33,437	10,103	113,474	11.23

Figure 2.5.1.3.1

Fort Lee Natural Gas

FY 94



This section contains a complete description of *Option 4* which was selected for ECIP project development. The first part of the section describes the project while the latter part includes project development brochures, DD1391 forms, baseline and ECO calculations, cost estimates, and catalog cut sheets.

3.1 Option 4: Description

Option 4 utilizes eight (8) 1.5 MW diesel engine generators to shave eight (8) MW of demand from Fort Lee's peak. *Figure 3.1.1* illustrates the recommended floor plan for the new facility. The new plant was approximated as 5,500 square feet. The plant will require six (6) 20,000 (or four 30,000) gallon fuel storage tanks for one month's supply of diesel fuel. *Figure 3.1.2* is a one line diagram which illustrates the electrical connections required for the plant. Utility connections for water and sewer were tied in close to the intersection of Saratoga Drive and Carver Avenue.

3.1.1 Mode of Operation

The proposed facility will operate in the peak shaving mode. *Figure 3.1.1.1* illustrates the area of operation for the plant with respect to Fort Lee's average summer peak demand profile. The plant has a capacity of twelve (12) MW which allows for one (1) MW of additional load with three (3) MW of reserve capacity. This will allow for two generators to be down at all times for maintenance and for backup in the event of the failure of another generator.

3.1.2 Summary of Savings/Costs

The savings associated with the operation of this plant include demand savings, electrical energy savings, and MSSG credit. The demand savings are based on shaving eight (8) MW of demand for annual savings of $1,130,428 per year. The electrical energy savings are based on the run hours required to peak shave eight (8) MW as well as run hours incurred during MSSG participation. The electrical energy savings were estimated to be $116,112 per year. MSSG credit is based upon operation of the plant at full capacity (12 MW instead of 8 MW) due to the limited run hours required for participation. MSSG credit amounts to $432,000 annually.

The costs associated with the operation of this plant include fuel costs, contract maintenance costs, and operator costs. The fuel costs for this plant were estimated to be $474,271 per year. This number was determined based on the annual operating hours for the plant (see *Figure 3.1.1.1*) and

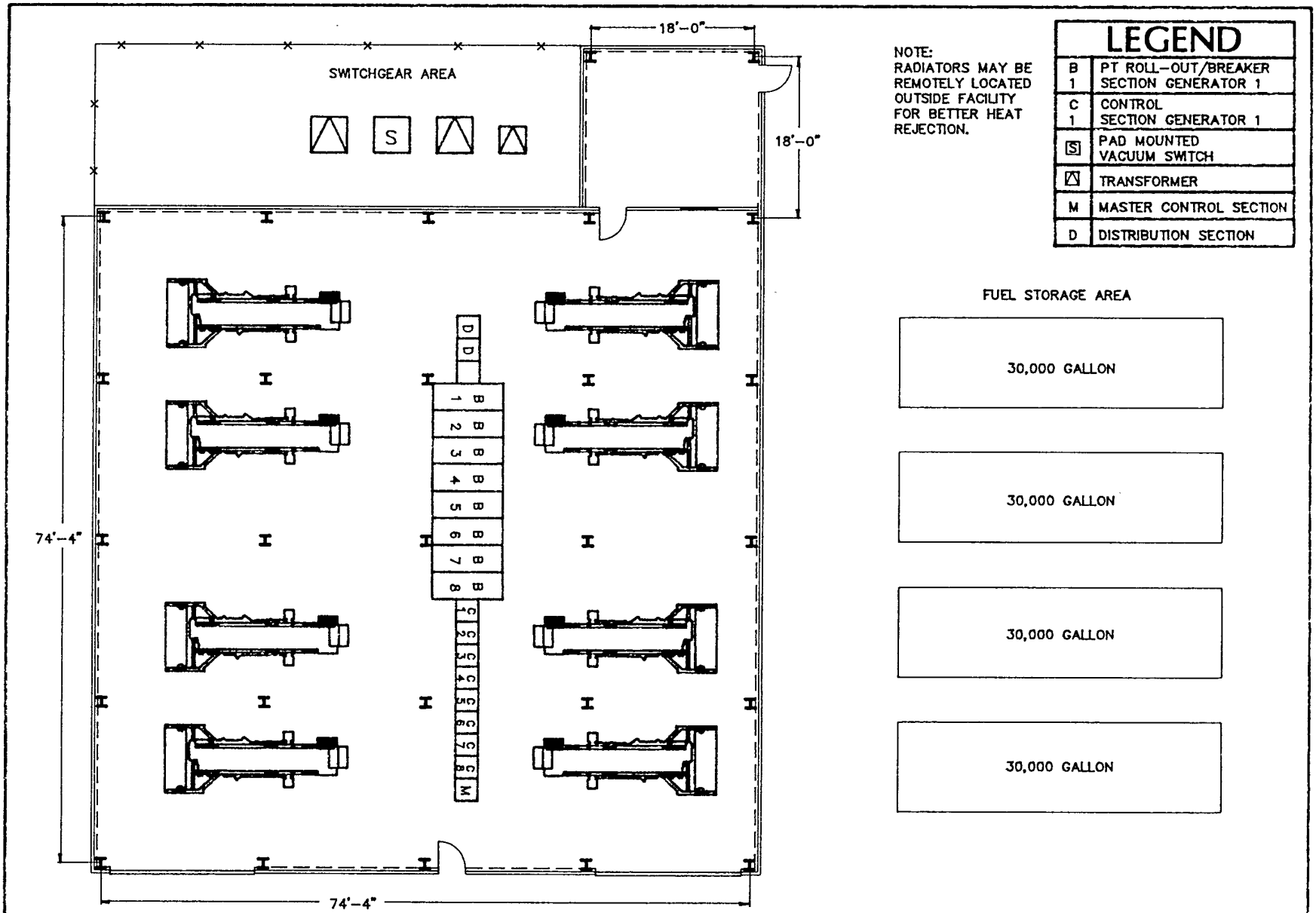


FIGURE 3.1.1 - POWER GENERATION PLANT - OPTION 4

SCALE: 1/16" = 1'-0"

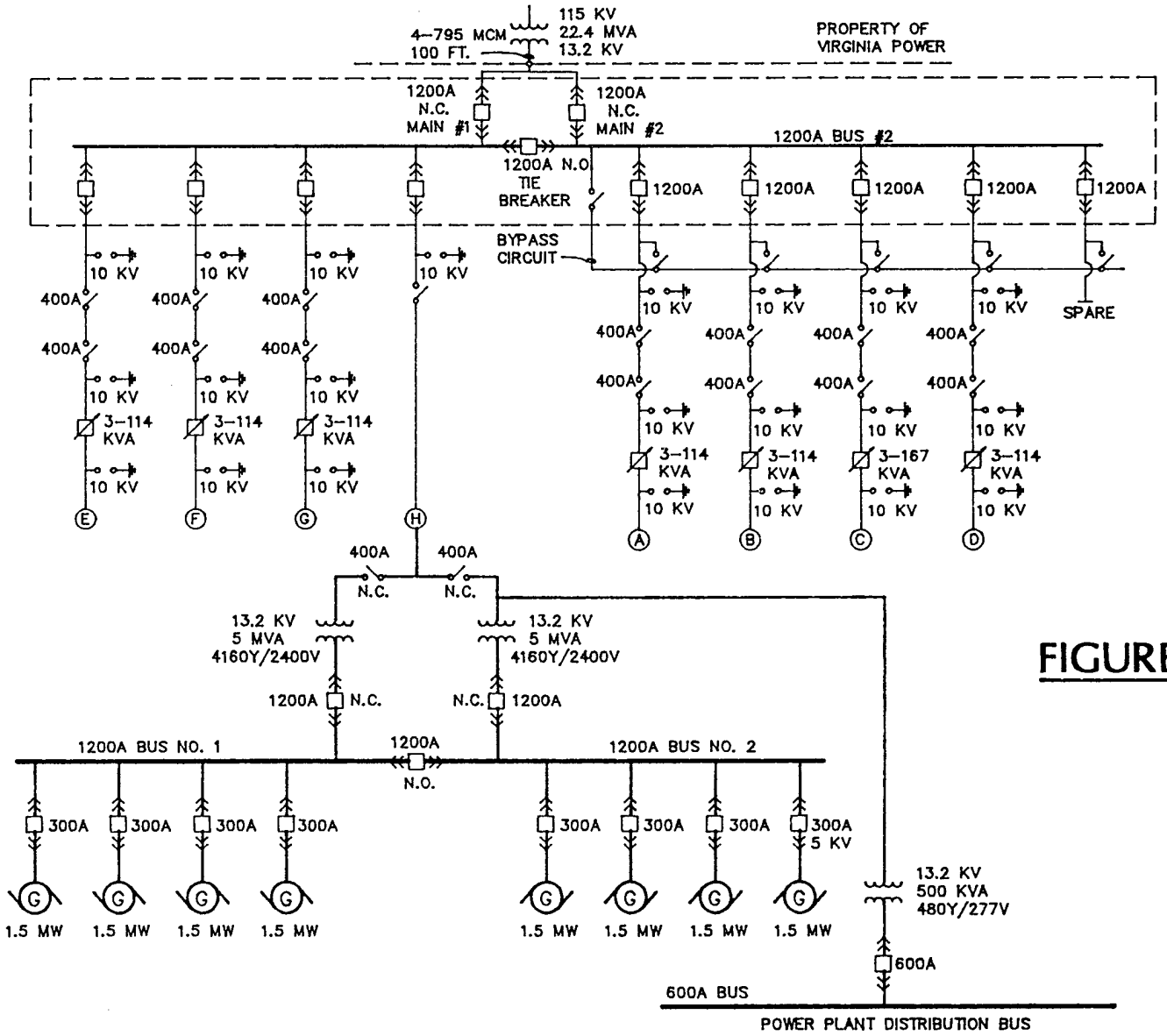
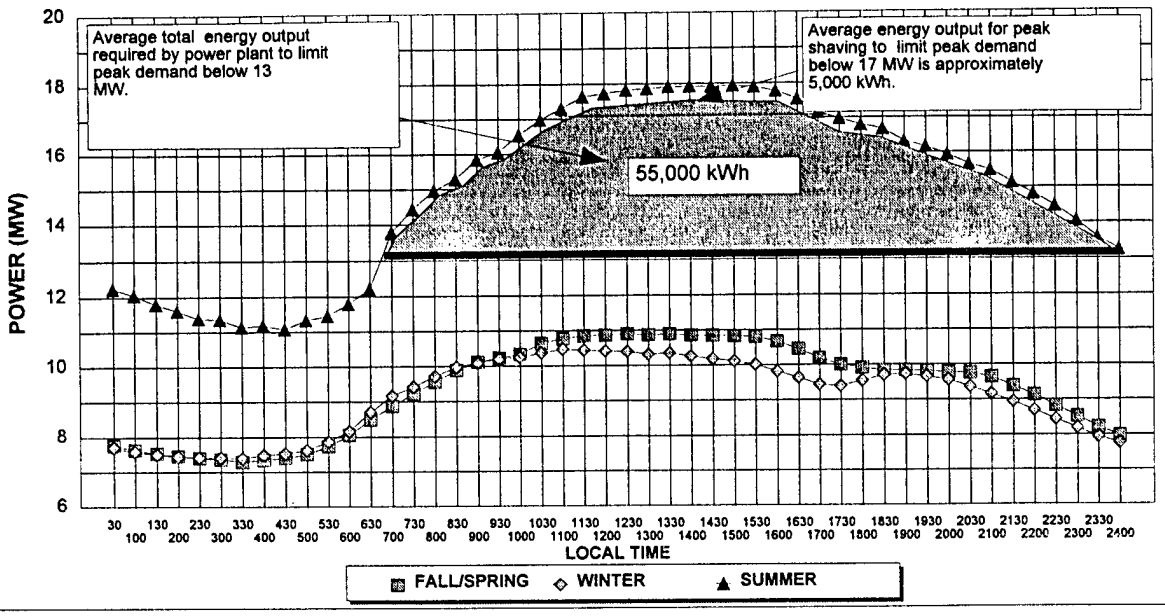


FIGURE 3.1.2

ONE LINE RISER DIAGRAM - 12 MW POWER PLAN - OPTION 4

NOT TO SCALE

FIGURE 3.1.1.1
AVERAGE DEMAND PROFILE BY SEASON



OPTION 4
Power Plant Engine-Generator Operating Hours Estimate

Total energy output required per year = 55,000 kWh x 30 days/mo x 4 mo/yr = 6,600,000 kWh

Operating hours required to reduce demand from 21 MW peak to 13 MW:
For power plant with 8-1.5 MW diesel engine-generators
Operating hours per unit = 6,600,000 kWh/12,000kw =550 hrs/yr (full load equivalent hours)

the fuel consumption rate for the generators. The annual maintenance cost for the plant was based on a vendor quote for contract maintenance. The contract maintenance based on the run-time of the plant amounts to $30,000 per year. The plant operator costs were based on two (2) full-time operators at a cost of $60,000 per year.

The construction cost for the plant was estimated to be $4,000,586.

Table 3.1.2.1 details the economic results for the project.

TABLE 3.1.2.1
OPTION 4

Total Investment	$4,400,644
First Year Dollar Savings	$1,074,275
Simple Payback	4.10 years
SIR	3.41

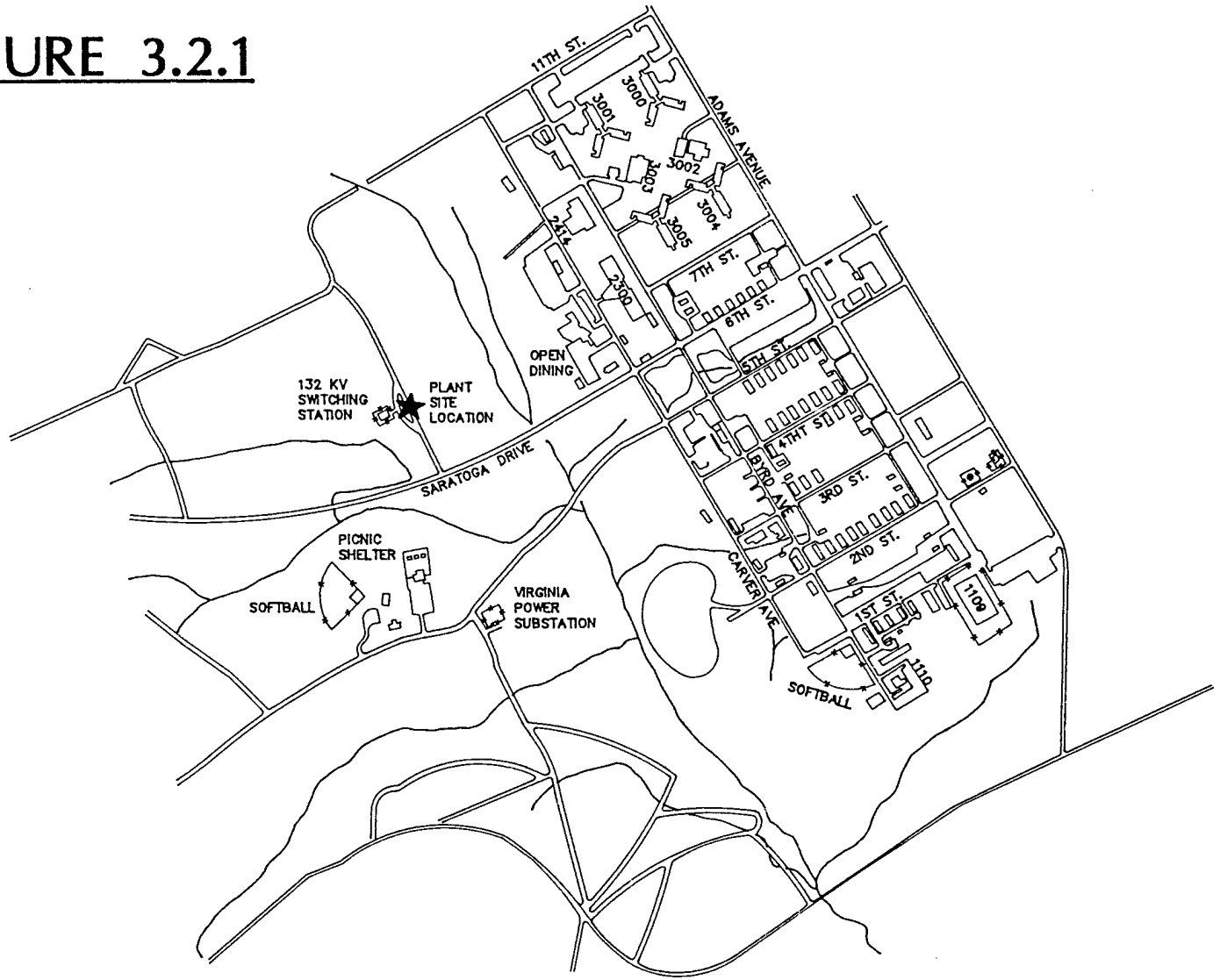
3.1.3 LCCA and Calculations

The LCCA was performed by taking the differential in savings and costs between Option 4 and the existing plants. MSSG credit was included in the figure for demand savings. A replacement cost at year one (1) was included for the existing plants since they are currently operating past their economic lives.

3.2 Site Selection and Electrical Interconnection

The proposed site for the new power plant is located near the north-west corner of the switching station off of Saratoga Drive. This location is best suited for the construction of a new power plant due to its location away from residential areas and the main administrative areas at Fort Lee. The site is level. Only minimal site work would be required for construction. Please refer to *Figure 3.2.1* for a site plan of Fort Lee for the proposed location of the plant.

FIGURE 3.2.1



FORT LEE - SITE PLAN

SCALE: 1" = 750'-0"

The utility services' tie in point for water, sewer, and natural gas is approximately 2000 feet away from the site. Thus the cost for utility services will not be prohibitive. The electrical tie-in point will be on location and near the center of Fort Lee's electrical loads which will minimize voltage drop and line losses. The site is not environmentally restricted according to the overall installation environmental survey report. An environmental assessment (EA) is still pending. For these reasons, this location appears to be the most suitable for the new power plant, both economically and environmentally. No other suitable locations were found at the time of the survey.

The power plant will operate in parallel with the utility company's power supply. The generators are synchronized and tied together to a common bus or coupled bus at an output voltage of 4160 volts. The voltage is then stepped up to 13.2 KV through a transformer(s) to match the installation's distribution voltage. The 13.2 KV power plant output will be tied directly to the switching station's 1200 amp bus, thus providing capability to back up any combination of feeder loads, up to the plant's capacity.

3.3 Project Documentation

This section includes the required documentation for submission of this project for ECIP funding. The following is an index of the information included in this section.

facility

PEAK SHAVING/SHARE GENERATION
Fort Lee, Virginia

project coordinator for using service

Mike Piner

functional requirements summary, PDB-1 | 3-8

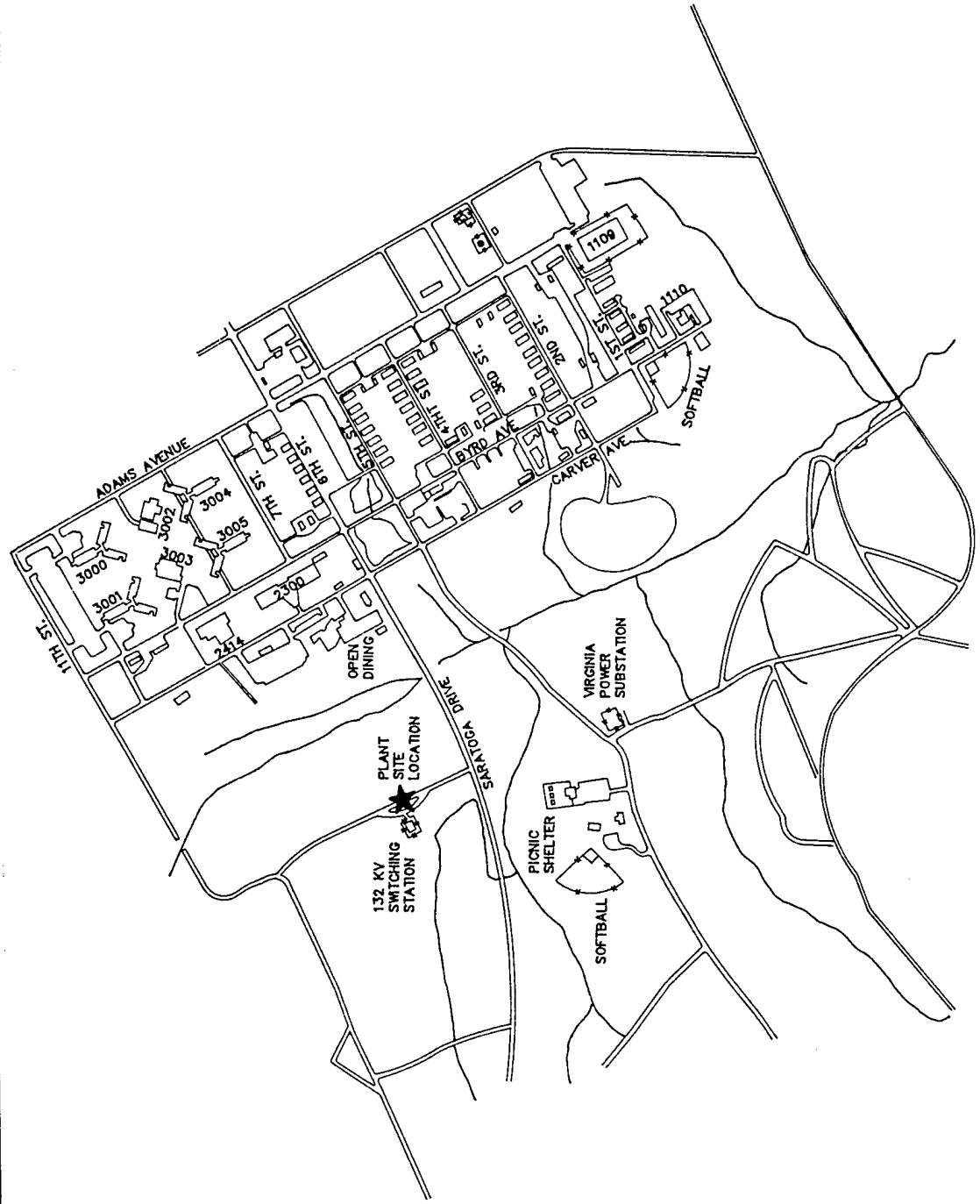
OBJECTIVE:

The objective of this project is to construct a new power generating plant for peak shaving operation at Fort Lee. The construction of this plant will reduce energy costs and life cycle operating costs for Fort Lee in accordance with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759.

functional requirements summary, PDB-1

3-9

DA FORM 5020-2-R, Feb 82



facilities requirements sketch, PDB- ½

3-10

DA FORM 5022-R, Feb 82

APPENDIX C
DOCUMENTATION CHECKLIST

A. SPECIAL CONSIDERATIONS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
A-1	Cost estimates for each primary and supporting facility	R	D		
A-2	Telecommunications system coordination with USACC and authorization for exceptions	NR			
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse ccoordination, etc.)	R	A		
A-4	Assignment of airspace	NR			
A-5	Economic analysis of alternatives	R	D		
A-6	Approval for new starts	NR			
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates)	NR			
A-8	Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation	R	A		
A-9	Exceptions to established criteria	NR			
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)	R			
A-11	Identification of related or support projects (so projects can be coordinated)	R			
A-12	Required completion date	R			
	Other Special Considerations (List and number items)				
	1. See Appendix A				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

documentation checklist

3-12

DA FORM 5023-A-R, Feb 82

B. SITE DEVELOPMENT

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
B-1	Consultation with the District Office to determine and evaluate flood plain hazards	R	A		
B-2	Preparation, submission, and/or approval of new				
(A)	General Site Plan	NR			
(B)	Annotated General Site Plan	NR			
(C)	Sketch Site Plan	NR			
(D)	Facilities Requirements Sketch	R			
B-3	Preparation of				
(A)	Site Survey	NR			
(B)	Subsoil information	NR			
B-4	Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan	NR			
	Other Site Development Considerations (List and number items)				
	1. See Project Development Brochure, PDB-1/2				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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documentation checklist

3-13

DA FORM 5023-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
C-1	Reconciliation with troop housing programs and requirements	NR			
C-2	Evaluation of existing facilities (including degree of utilization)	R	D		1
C-3	Approval for removal and relocation of existing useable facilities	NR			
C-4	Evaluation of off-post community facilities	NR			
C-5	Storage and maintenance facilities (including nuclear weapons)	NR			
C-6	Coordination hospitals, medical and dental facilities with Surgeon General	NR			
C-7	Coordination of aviation facilities with FAA	NR			
C-8	Coordination air traffic control and navigational aids with USACC	NR			
C-9	Tabulation of types and numbers of aircraft	NR			
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities	NR			
C-11	Coordination chapels with Chief of Chaplains	NR			
C-12	Review food service facilities by USATSA	NR			
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities	NR			
C-14	Coordination postal facilities with U.S. Postal Service Regional Director	NR			
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)	NR			
C-16	Tenant facilities coordination with installation where sited	NR			
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4)	NR			
C-18	Analysis of deficiencies	R	D		1
C-19	Consideration of alternatives	R	D		2
C-20	Determination whether occupants will include physically handicapped or disabled persons	NR			
C-21	As-build drawings for alterations or additions	R	C		
C-22	Availability of Standard Design or site adaptable designs	NR			
	Other Architectural & Structural (List and number items)				
	1. See Supplemental Data Detailed Project Justification Paragraph D3.				
	2. See Supplemental Data Detailed Project Justification Paragraph D4.				

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- D – Designer
- E – Other (Check Comments Attached and explain)

documentation checklist

3-14

DA FORM 5023-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Fuel considerations and cost comparison analysis	R	D		
D-2	Energy requirements appraisal (ERA)	R	D		1
D-3	Conformance with DOD Energy Reduction requirements	R	D		
D-4	Evaluation of existing and/or proposed utility systems	R	D		
	Other Mechanical and Utility Systems (List and number items)				
	1. See special Requirements, Paragraph 3 (SRP-3)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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E – Other (Check Comments Attached and explain)

documentation checklist

3-15

DA FORM 5023-D-R, Feb 82

E. ENVIRONMENTAL CONSIDERATIONS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
E-1	Environmental impact assessment	E	D		1
E-2	EIA conclusions require Environmental Impact Statement	R	D		
E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	NR			
E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	R	A		
E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
	Other environmental considerations (list and number items)				

1. See Supplemental Data
   Detailed Project Justification
   Paragraph D9

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E – Other (Check Comments Attached and explain)

documentation checklist

3-16

DA FORM 5023-E-R, Feb 82

APPENDIX D
TECHNICAL DATA CHECKLIST

A. SPECIAL CONSIDERATIONS

	ITEM	Required or Not Required	To Be Determined *	Comment Attached	Document Attached
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages	NR			
A-2	Construction phasing requirements	R	D		
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in	NR			
A-4	Equipment in place and justification	NR			
A-5	Other equipment and furniture (O&MA, OPA) and costs	NR			
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)	NR			
A-7	Type of construction (permanent, temporary, semi-permanent)	NR			
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.	NR			
	Other special considerations (list and number items)				

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

3-18

DA FORM 5024-A-R, Feb 82

B. SITE DEVELOPMENT

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
B-1	Construction restrictions or guidelines pertaining to				
(A)	site access and preferred construction routes	R	A		
(B)	Airfield clearance, explosive storage, working hours, safety, etc.	NR			
(C)	Facilities and/or functions or adjoining areas (structures, materials, impact)	R	A		
B-2	Real estate actions (acquisition, disposal, lease, right-of-way)	NR			
B-3	Demolition/relocation required (data)				
(A)	Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases	NR			
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR			
B-4	Pavement types and requirements (including traffic surveys and MTMC coordination)	NR			
B-5	Landscape considerations				
(A)	Protection of existing vegetation	R	A		
(B)	Stockpile topsoil	NR			
	Other Site Development (List and number items)				

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A – DFAE
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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

3-19

DA FORM 5024-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)	NR			
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C-5	Designation and strength of units to be accommodated	NR			
C-6	Requirements and data for special design projects	NR			
C-7	Unusual floor and roof loads (safes, equipment)	NR			
C-8	Security features (arms rooms, vaults, interior secure areas)	NR			
	Other Architectural & Structural (List and number items)				

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

3-20

DA FORM 5024-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)	R	C		
D-2	Special peak usage periods and peak leveling techniques	R	B		
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)	R	D		
D-4	Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)	R	D		
D-5	Heating—availability, general system type and characteristics (proposed and/or existing)	NR			
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing)	R	D		
D-7	Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing)	NR			
D-8	Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing)	NR			
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)	R	D		
D-10	Solar energy evaluation	NR			
	Other Mechanical & Utility Systems (List and number items)				

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-D-R, Feb 82

F. FIRE PROTECTION

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
F-1	Special fire protection systems or features (detection and suppression equipment, hazards, etc.)	NR			
	Other Fire Protection Considerations (List and number items)				

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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D – Designer
E – Other (Check Comments Attached and explain)

technical data checklist

3-22

DA FORM 5024-F-R, Feb 82

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Lee, Virginia	PEAK SHAVING PLANT AT FORT LEE

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		ECIP #1	$4,400.60

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facility				
Peak Shaving Plant	Lot	1	3,810.00	3,810.00
Subtotal				3,810.00
Contingency (10%)				381.00
Total Contract Cost				4,191.00
Supervision, Inspection and Overhead (5.5%)				209.60
Total Request				4,400.60

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The existing power plants at Fort Lee are operating past their economic lives. The proposed project will construct a new peak shaving power plant containing eight (8) 1.5 MW diesel engine generators. The existing plants will be abandoned in place. The implementation of this project will save 3,835 MWh of electrical energy, 866 MWh of natural gas, and will consume an additional 19,076 MWh of diesel energy. The first year savings are $1,074, 275 and the SIR for the project is 3.41.

11. REQUIREMENT

Project: The proposed project constructs a new peak shaving power plant. The existing plants in buildings 1109 and 1336 will no longer be required and will be abandoned in place.

Requirement: The project is required to reduce the energy costs at Fort Lee and to comply with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759. The proposed project will increase annual energy consumption by 14,375 MWh/yr and decrease annual energy costs by $1,074,275.

Current Situation: The existing plants at buildings 1109 and 1336 are operating past their economic lives. The plants are unreliable due to their age and are incurring excessive maintenance costs.

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION
Fort Lee, Virginia

4. PROJECT TITLE	5. PROJECT NUMBER
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

Impact if not provided: If the proposed project is not funded, a cost reduction of $1,074,275/yr cannot be achieved, and excessive energy costs will continue. There will be no contribution to energy reduction goals established for United States Army facilities by Army Headquarters.

Colonel, USA
Commanding

ESTIMATED CONSTRUCTION START:	September 1995	INDEX:
ESTIMATED MIDPOINT OF CONSTRUCTION:	April 1996	INDEX:
ESTIMATED CONSTRUCTION COMPLETION:	November 1996	INDEX:

DETAILED JUSTIFICATIONS

D1. GENERAL

The proposed project encompasses the construction of a new peak shaving plant at Fort Lee. The construction of this plant will significantly reduce energy costs while increasing the system reliability.

D2. ACCOMMODATIONS NOW IN USE:

The existing plants are compromised of 6-650 kW and 3-200 kW diesel engine generators of the 1950/1960 vintage. The plants are operating past their economic lives of 20 years.

D3. ANALYSIS OF DEFICIENCY:

Currently, Fort Lee is utilizing power plants in buildings 1109 and 1336. Both plants are operating past their economic lives and are thus unreliable. The current deficiency results in higher electrical energy and demand costs as well as excessive maintenance costs.

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION
Fort Lee, Virginia

4. PROJECT TITLE	5. PROJECT NUMBER
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

D4. CONSIDERATION OF ALTERNATIVES:

Multiple alternatives for this project were evaluated. The project selected had the best economic results. This project had the highest SIR and the lowest simple payback.

D5. CRITERIA FOR PROPOSED PROJECT:

The proposed project will conform with all applicable federal and United States Army Regulations.

D6. PROGRAM FOR RELATED EQUIPMENT:

No equipment funded from appropriations other than MCA are required.

D7. DISPOSAL OF PRESENT ASSETS:

The existing plants will be abandoned in place.

D8. SURVIVAL FACILITIES:

The proposed project is not suitable for inclusion of protective shelters.

D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:

The proposed project has been analyzed and will not adversely impact the environment. Energy savings resulting from the project will conserve natural resources.

D10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS:

It has been determined that these facilities are not located in a flood plain and they do not encroach on wetlands.

D11. ECONOMIC JUSTIFICATION:

The proposed project qualifies under ECIP Guidelines in AR-415-15. SIR for the project is 3.41 with a simple payback of 4.10 years.
See Economic Analysis, SRP-1

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION	
Fort Lee, Virginia	
4. PROJECT TITLE	**5. PROJECT NUMBER**
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

D12. UTILITY AND COMMUNICATION SUPPORT:

A. No related utility support projects are programmed. Adequate utilities are available to support the project.

B. No telecommunication support is required.

D13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES:

The project involves the construction of a new building. Review procedures have been implemented for this project in accordance with 36 CFT 800. The review has established that there will be no effect.

D14. PROJECT DEVELOPMENT BROCHURE (PART 1):

A Project Development Brochure was prepared on 22 December 94 and is attached as a part of the programming documentation.

D15. ENERGY REQUIREMENTS:

The proposed project will increase present energy consumption by 14,375 MWh with the cost savings of $1,074,275 per year. See Energy Requirements Appraisal (ERA) in Special Requirements, Paragraph 3 (SRP-3).

D16. PROVISION FOR THE HANDICAPPED:

No provisions for the handicapped will be made since the scope of the project is in no way applicable to designing for the handicapped.

D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA) ANALYSIS:

A. Physical impact: A new building will be constructed to house the new plant.

B. Operations and Maintenance (O&M) impact:

YEAR	O&M NET CHANGE ($000)
1995	-179
1996	-179
1997	-179

(+ = Cost / - = Savings)

C. Backlog of Maintenance and Repair (BMAR) impact:

The maintenance for the new plant will be contract maintenance. There will be no net effect on BMAR.

D18. COMMERCIAL ACTIVITIES:

The proposed project is not a "New Start Expansion" as defined by DA Circular 235-1. The project has been reviewed in light of the requirements of commercial and industrial facilities. It has been determined that whereas the project does not affect commercial facilities, the requirements of DA Circular 235-1 does not apply.

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION	
Fort Lee, Virginia	
4. PROJECT TITLE	**5. PROJECT NUMBER**
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

Life Cycle Cost Analysis
Project Title: Peak Shaving Plant
Fiscal Year: 1995
Analysis Date: 12/22/94
Economic Life: Twenty (20) Years

1. INVESTMENT

A. CONSTRUCTION COST	4,000,586
B. SIOH	200,029
C. DESIGN COST	200,029
D. ENERGY CREDIT CALC	-0-
E. SALVAGE VALUE	-0-
F. TOTAL INVESTMENT	$4,400,644

2. ENERGY SAVINGS
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	COST $/MWh (1)	SAVINGS MWh/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	19.68	3,835	75,473	15.08	1,138,130
B. DIST	19.19	-19,076	-366,068	18.57	-6,797,891
C. RESID					
D. NG	11.23	866	9,725	18.58	180,694
E. DEMAND			1,104,637	14.88	16,437,000
F. TOTAL		-14375	823,767		10,957,930

3. NON-ENERGY SAVINGS

A. ANNUAL RECURRING		$179,444
(1)DISCOUNT FACTOR	14.88	
(2)DISCOUNTED SAVINGS		$2,670,127
B. NON-RECURRING SAVINGS		

ITEM	SAVINGS (+) COST(-)(1)	YEAR OF OCCURRENCE	(2) DISCOUNT FACTOR	DISCOUNTED SAVINGS(+) COST (-)(4)
1. Replacement	$1,421,295	1	0.97	$1,378,656
d. Total	$1,421,295			$1,378,656

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST(-) $4,048,783

DD FORM 1391
1 DEC 76

PREVIOUS EDITIONS MAY BE USED INTERNALLY
UNTIL EXHAUSTED

FOR OFFICIAL USE ONLY
(WHEN DATA IS ENTERED)

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION	
Fort Lee, Virginia	
4. PROJECT TITLE	**5. PROJECT NUMBER**
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

SPECIAL REQUIREMENTS PARAGRAPH 1 (SRP-1) (continued)

4. FIRST YEAR DOLLAR SAVINGS	$ 1,074,275
5. SIMPLE PAYBACK	4.10 Years
6. TOTAL NET DISCOUNTED SAVINGS	$15,006,720
7. DISCOUNTED SAVINGS RATIO	3.41

1. COMPONENT	FY 19 95 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		22 December 94

3. INSTALLATION AND LOCATION
Fort Lee, Virginia

4. PROJECT TITLE	5. PROJECT NUMBER
PEAK SHAVING PLANT AT FORT LEE	ECIP #1

SPECIAL REQUIREMENTS PARAGRAPH 3 (SRP-3):

Energy Requirements Appraisal (ERA)

1. Project Description: Construct new 12 MW peak shaving power plant with eight 1.5 MW diesel engine generators.

2. Estimated Energy Consumption: The existing plants have a net energy consumption of -4433 MWh/yr. The new plant will have a new energy consumption of -18,808 mWh/yr. The new plant generates significant electrical demand and maintenance savings.

3. Energy Sources: No new energy sources are required for the proposed project. The use of solar energy for this project is impractical.

4. Energy Use Impacts: The proposed project reduced the amount of electricity required to be purchased. The project also reduces electrical demand costs charges by the utility company.

5. Energy Conservation: The proposed project will increase annual energy consumption by 14,375 MWh/yr with annual energy cost savings of $1,074,275. The project complies with Army Resources Management Plan (ERMP) and Executive Order 12759.

6. Energy Alternatives: The proposed project represents the greatest possible reduction in energy costs.

7. Energy Effects: The proposed project provides positive environmental effects. It reduces the current consumption of non-renewable fuel sources. The degrading of environmental standards would not make more efficient energy sources available.

8. Basis of Approval: Total energy requirements and alternative fuel sources have been considered and included in this appraisal or discarded as applicable.

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: LEEOP4B
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEE — REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 94013.07 PEAK SHAVING/SHARE GENERATION
FISCAL YEAR 95 DISCRETE PORTION NAME: GENERATORS
ANALYSIS DATE: 12-02-94 ECONOMIC LIFE 20 YEARS PREPARED BY: K DERRINGTON

1. INVESTMENT

A. CONSTRUCTION COST	$ 4000586.		
B. SIOH	$ 200029.		
C. DESIGN COST	$ 200029.		
D. TOTAL COST (1A+1B+1C)	$ 4400644.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$	0.	
F. PUBLIC UTILITY COMPANY REBATE	$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 4400644.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST $/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 19.68	3835.	$ 75473.	15.08	$ 1138130.
B. DIST	$ 19.19	-19076.	$ -366068.	18.57	$ -6797891.
C. RESID	$ .00	0.	$ 0.	21.02	$ 0.
D. NAT G	$ 11.23	866.	$ 9725.	18.58	$ 180694.
E. COAL	$ .00	0.	$ 0.	16.83	$ 0.
F. PPG	$ .00	0.	$ 0.	17.38	$ 0.
M. DEMAND SAVINGS			$ 1104637.	14.88	$ 16437000.
N. TOTAL		-14375.	$ 823767.		$ 10957930.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 179444.
(1) DISCOUNT FACTOR (TABLE A) — 14.88
(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 2670127.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
1. REPLACEMENT	$1421295.	1	.97	1378656.
d. TOTAL	$1421295.			1378656.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 4048783.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1074275.

5. SIMPLE PAYBACK PERIOD (1G/4) — 4.10 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) — $ 15006720.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= — 3.41
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): — 9.52 %

ADJUSTED RATE SCHEDULE (GS-4) BASELINE CALCULATION SHEET 3-200 KW AND 6-650 KW			
Engine Annual Operating Hours			**Total Operating Hours**
MS and MSSG	FY 93 total engine hours (plant log)		3804
TOTAL			**3804**
Construction Cost			**Construction Cost**
	Equipment Replacement Cost (see cost estimate)		**$1,421,295**
Annual Fuel Consumption	Rates: Diesel @ 0.78 $/gal (19.19$/MWH)		**Expenses**
	Rates: NG @11.23 $/MWH		
	FY 93 diesel consumption (plant log) 138,608 gal/yr x 1 barrel/42 gal x5.825 MBtu/barrel		138,608 gal/yr 19,223.6 MBtu/yr (5,632.5 MWH/yr)
	0.78$/gal x 138,608 gal/yr		$108,114/yr
	FY 93 gas consumption (plant log)		2,955 MBtu/yr (865.8 MWH/yr)
	11.23 $/MWH x 865.8 MWH/yr		$9,723/yr
Annual Maintenance Cost			
Unscheduled maintenance and repair existing plant (Maintenance and Repair Account Report))		$75,599.00	
Routine scheduled Maintenance ($0.059/KWH x 2,065,166KWH)		$121,845.00	$197,444/yr
Plant Operator Cost			
	2 persons x 30,000 $/yr + 20% indirect labor		$72,000/yr
Total Expenses Dollars			**$387,281/yr**
Savings:			**Savings**
Demand	Load Shaved 4,000 KW x 12.402 $/KW x (4 mo + .75 x 8 mo)		4,000 KW $496,080/yr
Energy	Metered data FY 93 2,065,166 KWH/yr x .01848$/KWH		2,065,166 KWH/yr $38,164/yr
MSSG Credit	Actual billing credit FY 93		$152,454 $/yr
Total Energy Dollar Savings			**$686,698/yr**

OPTION 4 CALCULATION SHEET 8-1.5 DIESEL ENGINE-GENERATOR PLANT		
Engine Annual Operating Hours		**Total Operating Hours**
MS	550 hours per unit per year x 8	4,400
MSSG	125 hours per unit per year x 8	1,000
TOTAL		**5400**
Construction Cost		**Construction Cost**
	(see cost estimate)	**$4,000,586**
Annual Fuel Consumption	Rates: @ Full Load: 112.6 gph @ 0.78 $/gal (19.19$/MWH)	**Expenses**
	5400 hr/yr x 112.6 gal/hr	608,040 gal/yr
	608,404 gal/yr x 1 barrel/42 gal x5.825 MBtu/barrel	84,329 MBtu/yr (24,708.5 MWH/yr)
	0.78$/gal x 608,040 gal/yr	$474,271/yr
Annual Maintenance Cost	(see contractor quote, Appendix G)	$30,000/yr
Plant Operator Cost	2 persons x 30,000 $/yr	$60,000/yr
Total Expenses Dollars		**$564,271/yr**
Savings:		**Savings**
Rate Schedule Changes, MS to GS-4	(see Rate Schedule Analysis)	$331,489/yr
Energy Dollars Adjustment Factor to Account for Rate Adjusted Baseline (LCCID)		($71,612)
Demand	Load Shaved	8,000 KW
	8,000 KW x 12.402 $/KW x (4 mo + .75 x 8 mo)	$992,160/yr
Energy		
	8,000KW x 550 hr/yr + 12,000 KW x 125 hr/yr	5,900,000 KWH/yr
	5,900,000 kWH/yr x 0.01848$/KWH	$109,032/yr
MSSG Credit	12,000 KW x 6.00$/KW x 6 mo	$432,000 $/yr
Total Energy Dollar Savings		**$1,864,681/yr**

Estimate:	POWER PLANT	Date:	28 July 1994
Description:	OPTION 4		
Project:	Power Plant Study	Bid Date:	
Location:	Ft Lee	Job #:	
Sq. footage:		City indx:	

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0100000001	GENERAL REQUIREMENT					1.00 LOT	
	Unit values	0.00	4000.00	9500.00	0.00	0.00	13500.00
	Totals	0.00	$4,000	$9,500	$0	$0	$13,500
U01 GENL RQMT		0	$4,000	$9,500	$0	$0	$13,500

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0200000002	SITEWORK					1.00 LOT	
	Unit values	0.00	1720.00	1560.00	0.00	0.00	3280.00
	Totals	0.00	$1,720	$1,560	$0	$0	$3,280
0222583100	TRENCH EXCVTNG 40HP CHAIN TRNCHR&BKFL 16"W24"D					2000.00 L.F.	
	Unit values	0.01	0.00	0.27	0.27	0.00	0.54
	Totals	22.00	$0	$540	$540	$0	$1,080
U02 SITEWORK		22	$1,720	$2,100	$540	$0	$4,360

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
0300000001	CONCRETE FOUNDATION 8" REENFORCEMENT AND ACCESSORIES				1.00 LOT	
Unit values	0.00	16650.00	12960.00	0.00	0.00	29610.00
Totals	0.00	$16,650	$12,960	$0	$0	$29,610
U03 CONCRETE	0	$16,650	$12,960	$0	$0	$29,610

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
0500000007	METAL STRUCTURE W/ SOUND INSULATED PANEL				5500.00 S.F.	
Unit values	0.00	4.75	2.25	0.00	0.00	7.00
Totals	0.00	$26,125	$12,375	$0	$0	$38,500
U05 METALS	0	$26,125	$12,375	$0	$0	$38,500

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
1156200001	HVAC SYSTEM				5500.00 SF	
Unit values	0.00	1.00	0.56	0.00	0.00	1.56
Totals	0.00	$5,500	$3,080	$0	$0	$8,580
U11 EQUIPMENT	0	$5,500	$3,080	$0	$0	$8,580

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1514011260	PIPE, COPPER, TYPE K TUBING, 2" DIAMETER SLDR CPLG & HNGR 10'OC					2000.00 L.F.	
Unit values		0.20	6.90	5.65	0.00	0.00	12.55
Totals		400.00	$13,800	$11,300	$0	$0	$25,100
1515514180	PIPE PLASTIC DWV SCH 40 ABS 4" DIAM W/C PLG&HNGRS					2000.00 L.F.	
Unit values		0.33	4.69	8.50	0.00	0.00	13.19
Totals		666.00	$9,380	$17,000	$0	$0	$26,380
1517014870	PIPE STEEL THREADED SCH80 BLACK 2-1/2"DIAM W/COUPLINGS & HANGERS 10'OC					0.00 L.F.	
Unit values		0.36	7.75	9.25	0.00	0.00	17.00
Totals		0.00	$0	$0	$0	$0	$0
1521001660	PLUMBING SYSTEM					5500.00 SF	
Unit values		0.00	0.33	0.66	0.00	0.00	0.99
Totals		0.00	$1,815	$3,630	$0	$0	$5,445
1550000001	FUEL PUMPING SYSTEM INCLUDING PIPPING					3.00 LS	
Unit values		0.00	1700.00	1300.00	0.00	0.00	3000.00
Totals		0.00	$5,100	$3,900	$0	$0	$9,000
1556716370	20,000 GAL STEEL, DOUBLE WALL STI-P3 CORROSION PROTECTED					6.00 EA	
Unit values		0.00	18250.00	2450.00	0.00	0.00	20700.00
Totals		0.00	$109,500	$14,700	$0	$0	$124,200
1556716440	HOLD-DOWN 20,000 GAL TANK AND MANWAYS					6.00 EA	
Unit values		0.00	1300.00	92.00	0.00	0.00	1392.00
Totals		0.00	$7,800	$552	$0	$0	$8,352
1556730010	LEAK DETECTION SYSTEM					6.00 EA	
Unit values		0.00	1295.00	495.00	0.00	0.00	1790.00
Totals		0.00	$7,770	$2,970	$0	$0	$10,740
U15 MECHANICA		1066	$155,165	$54,052	$0	$0	$209,217

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1611052150	ARMD CBL 3C PVC JAC TRAY 5KV 350MCM					240.00 L.F.	
Unit values		0.08	20.50	2.10	0.00	0.00	22.60
Totals		18.24	$4,920	$504	$0	$0	$5,424
1632452700	PANEL BOARD NEHB 600A 4W 277/480V MAIN CB INC 20A SP BKRS 42 CIR					1.00 Ea.	
Unit values		34.78	4575.00	1150.00	0.00	0.00	5725.00
Totals		34.78	$4,575	$1,150	$0	$0	$5,725
1632640200	DISTRIBUTION SECTION, 277/480V, 4 WIRE, 600A					1.00 Ea.	
Unit values		16.00	1525.00	440.00	0.00	0.00	1965.00
Totals		16.00	$1,525	$440	$0	$0	$1,965
1632660490	FEED SECTION, CIRCUIT BREAKER 1200A					3.00 Ea.	
Unit values		10.00	5175.00	275.00	0.00	0.00	5450.00
Totals		30.00	$15,525	$825	$0	$0	$16,350
1641205440	HV XFRMR 3P5KV TO 277/480V 500KVA DRY, PAD MOUNT					1.00 Ea.	
Unit values		57.14	17900.00	1550.00	296.00	0.00	19746.00
Totals		57.14	$17,900	$1,550	$296	$0	$19,746
1641205700	HV XFRMR 3P15KV TO 4160V 5 MVA LIQUID, PAD MOUNTED, FORCED AIR COOLED					2.00 Ea.	
Unit values		136.00	50000.00	3750.00	575.00	0.00	54325.00
Totals		272.00	$100,000	$7,500	$1,150	$0	$108,650
1642250130	COPPR BUS DUC FEED WP 3PH4WR1350AMP					60.00 L.F.	
Unit values		1.00	305.00	27.50	0.00	0.00	332.50
Totals		60.00	$18,300	$1,650	$0	$0	$19,950
1650200003	LOAD CONTROL SYSTEM /HARDWARE					1.00 EA	
Unit values		0.00	5500.00	1500.00	0.00	0.00	7000.00
Totals		0.00	$5,500	$1,500	$0	$0	$7,000
1650200007	LOAD CONTROL SYSTEM/SOFT WARE					1.00 EA	
Unit values		0.00	8000.00	550.00	0.00	0.00	8550.00
Totals		0.00	$8,000	$550	$0	$0	$8,550
1651200001	1.5 MW DEISEL ENGINE-GENERATOR PACKAGE SUPPORTING EQUIPMENT INCLUDED					8.00 EA	
Unit values		0.00	250000.00	5340.00	0.00	0.00	255340.00

Totals	0.00	$2,000,000	$42,720	$0	$0	$2,042,720
1651200003	SWITCHGEAR BRK./CONTROL - 1.5 MW ENGINE-GENERATOR				8.00	EA
Unit values	48.00	60000.00	1320.00	0.00	0.00	61320.00
Totals	384.00	$480,000	$10,560	$0	$0	$490,560
1651200004	ENGINE-GENERATOR MASTER CONTROL				1.00	EA
Unit values	96.00	60000.00	3640.00	0.00	0.00	63640.00
Totals	96.00	$60,000	$3,640	$0	$0	$63,640
1661000001	LIGHTING SYSTEM, LOW BAY HPS, 50 FC				5500.00	S.F.
Unit values	0.00	3.76	2.27	0.00	0.00	6.03
Totals	0.00	$20,680	$12,485	$0	$0	$33,165
1691302300	3W SWITCHES, 15KV				1.00	Ea.
Unit values	69.84	10300.00	1700.00	1125.00	0.00	13125.00
Totals	69.84	$10,300	$1,700	$1,125	$0	$13,125
1691503060	SUBSTATION EQUIPMENT DISCONNECTING SWITCHES GANG OPER. MANUAL 13-26KV				1.00	Ea.
Unit values	33.94	3150.00	850.00	350.00	0.00	4350.00
Totals	33.94	$3,150	$850	$350	$0	$4,350

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
U16 ELECTRICA		1072	$2,750,375	$87,624	$2,921	$0	$2,840,920
ESTIMATE TOTA		2160	$2,959,535	$181,691	$3,461	$0	$3,144,687
SALES TAX		5.00%	$147,977				
MATL MARKUP		0.00%	$0				
LABOR MARKUP		0.00%		$0			
EQUIPT MARKUP		0.00%			$0		
SUB MARKUP		0.00%				$0	
TOTAL BEFORE CONTINGE			$3,107,512	$181,691	$3,461	$0	$3,292,664
CONTINGENCY		10.00%					$329,266
BOND		1.50%					$49,390
PROFIT		10.00%					$329,266
JOB TOTAL							$4,000,586

Estimate: POWER PLANT Date: 28 July 1994
Description: OPTION 4
Project: Power Plant Study Bid Date:
Location: Ft Lee Job #:
Sq. footage: City indx:

SUMMARY

	Manhours	Matl	Labor	Equipment	Sub	Total
U01 GENL RQMT	0	$4,000	$9,500	$0	$0	$13,500
U02 SITEWORK	22	$1,720	$2,100	$540	$0	$4,360
U03 CONCRETE	0	$16,650	$12,960	$0	$0	$29,610
U05 METALS	0	$26,125	$12,375	$0	$0	$38,500
U11 EQUIPMENT	0	$5,500	$3,080	$0	$0	$8,580
U15 MECHANICA	1066	$155,165	$54,052	$0	$0	$209,217
U16 ELECTRICA	1072	$2,750,375	$87,624	$2,921	$0	$2,840,920
TOTAL	2160	$2,959,535	$181,691	$3,461	$0	$3,144,687
SALES TAX	5.00%	$147,977				
MATL MARKUP	0.00%	$0				
LABOR MARKUP	0.00%		$0			
EQUIPT MARKUP	0.00%			$0		
SUB MARKUP	0.00%				$0	
TOTAL BEFORE CONTINGE		$3,107,512	$181,691	$3,461	$0	$3,292,664
CONTINGENCY	10.00%					$329,266
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PROFIT	10.00%					$329,266
JOB TOTAL						$4,000,586

CATERPILLAR®

3516

Generator Sets Diesel Powered 50 Hz/60 Hz Prime Power

1275 – 1825 kW 60 Hz
1500 – 1944 kV•A 50 Hz

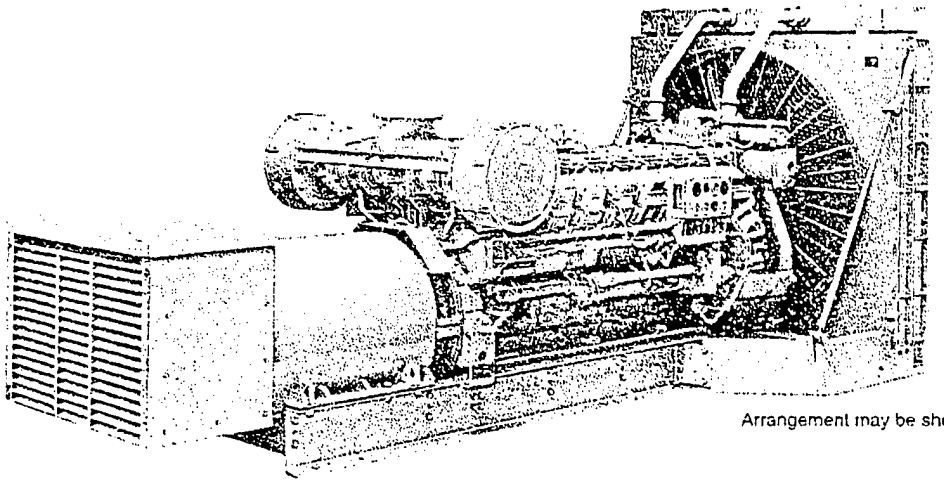
FEATURES

• CAT® DIESEL GENERATOR SETS
Factory Designed, Certified Prototype Tested with Torsional Analysis . . . Production Tested and delivered to you in a package that is ready to be connected to your fuel and power lines...EPG Designer (Computer sizing) available...Supported 100% by your Caterpillar® Dealer with Warranty — Parts and Labor . . . Extended Warranty available in some areas . . . Generator Set and Components meet or exceed the following specifications: AS1359, AS2769, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO DIS 8528, NEMA MG1-22.

• RELIABLE, FUEL EFFICIENT DIESEL
The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

• THE CATERPILLAR SR4 GENERATOR
Single bearing, wye connected, static regulated, brushless excited generator designed to match the performance and output characteristics of the Caterpillar Diesel Engine that drives it.

• EXCLUSIVE CAT VOLTAGE REGULATOR
Three phase sensing and Volts per Hertz regulation give precise control, excellent Block Loading, and constant voltage in the normal operating range.



Arrangement may be shown with optional equipment.

STANDARD PACKAGE ARRANGEMENT

ENGINE

Aftercooler
Air Cleaner,
  Regular Duty
Breather, Crankcase
Cooler, Lubricating Oil
Exhaust Fitting and Flange
Filters, right hand
  Fuel, & Lubricating Oil
Flywheel Housing SAE 00
  Standard Rotation
Governor,
  2301A, Speed Control
  with EG10P Actuator
Manifold, Exhaust, Dry
Oil Pan, Shallow
Pumps,
  Fuel Transfer,
  Lubricating Oil, gear driven
  Jacket Water, gear driven
Radiator
Rails, Mounting
Shutoff, Manual
Starting, Electric, 24 volt DC
Turbochargers
Vibration Damper

GENERATOR

SR4 Brushless
  with VR3 Voltage Regulator

ELECTRONIC MODULAR CONTROL PANEL (EMCP)

Mounted on generator terminal

Standard Generator Controls and Monitoring:
  Digital Ammeter, Voltmeter and Frequency Meter
  Ammeter/Voltmeter Phase Selector Switch
  Voltage Adjust Rheostat

Standard Engine Controls and Monitoring:
  Automatic/Manual Start-Stop Control
  Engine Control Switch for:
    Off/Reset, Auto Start, Manual Start, Stop
    Cycle Cranking
    Cool Down Timer
    Emergency Stop Pushbutton

Safety Shutoff Protection and LED Indicators for:
  High Coolant Temperature
  Low Oil Pressure
  Overcrank
  Overspeed
  Emergency Stop Pushbutton

GENERAL SPECIFICATIONS - 50/60 Hz

CAT 3516 ENGINE

Type — Watercooled Diesel
Piston Displacement — 69 liter (4210 cu in)
Compression Ratio — 13.5:1
Cycle — Four Stroke
No of Cylinders — V-16
Bore — 170 mm (6.7 in)
Stroke — 190 mm (7.5 in)

CATERPILLAR SR4 GENERATOR

Type — Brushless, Revolving Field, Solid-State Exciter
Construction — Single Bearing, Close Coupled
Three Phase — Wye Connected
Insulation — Class H with Tropicalization and Antiabrasion
Enclosure — Drip Proof IP 22
Alignment — Pilot Shaft
Overspeed Capability — 150%
Wave Form — Less than 5% Deviation
Paralleling Capability — Standard with adjustable Voltage Droop
Voltage Regulator — 3 Phase Sensing with Volts per Hertz
Voltage Regulation — Less than ± ½%
Voltage Gain — Adjustable to compensate for engine speed droop and line loss
TIF — Less than 50
THF — Less than 3%

CATERPILLAR CONTROL PANEL

24 VOLT DC CONTROL
Terminal Box Mounted
Vibration Isolated
NEMA 1,IP 22 Enclosure
Dead Front
Lockable Hinged Door
Generator Instruments meet ANSI C-39-1

VOLTAGES AVAILABLE

50 Hz	60 Hz
230/400, 3300	277/480, 346/600, 380, 4160

(Adjustable a minimum of ± 10%)
Other Voltages available — Consult your Caterpillar Dealer
Some voltages require derating

PRIME POWER OPTIONAL EQUIPMENT

ENGINE

Air Cleaners
Charging Systems
Cooling Systems
Fan Drives, Radiators, Fans, Expansion Tanks
Control Systems
Governor, Woodward 3161, 2301A Load Share
Exhaust System
Fittings, Elbows, Flanges, Muffler
Fuel System
Lube System
Mounting Systems
Protection Devices
Starting System
Torsional Vibration Damper

GENERATORS

Installation Arrangements
Manual Voltage Controls
RFI Filters -
N Level (VDE 875), BS800
MIL Std 461B
Space Heater Kits

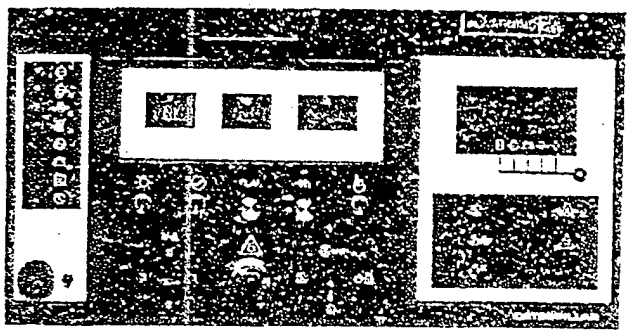
CONTROL PANEL

Attachments for EMCP:
Enclosure, Dust Proof NEMA 12 / IP 44
Gauges and Instrument Panels
Governor Raise/Lower Switch
Prime Power Alarm Module
Customer Interface Module
Illumination Lights & Switch
Switchgear Conversion
The following attachments meet NFPA 99 or NFPA 110:
Alarm Module
Remote Annunciator Panel
Battery Charger

Caterpillar® EMCP

Electronic Modular Control Panel

The Electronic Modular Control Panel (EMCP) is a generator-mounted control panel, available on all Caterpillar packaged generator sets. It utilizes environmentally sealed, solid-state, microprocessor-based modules for engine control and AC metering. This new application of mature, high-tech electronics to generator monitoring provides more features, accuracy and reliability than present electro-mechanical and many competitive panel systems.



The EMCP provides these standard control and monitoring features, many of which are options on other panels:

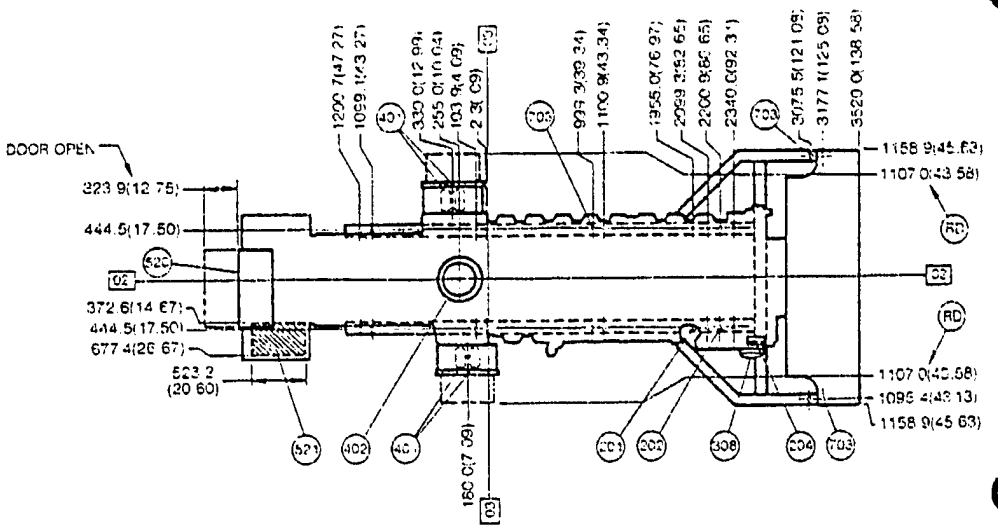
- Automatic/manual start-stop engine control with programmable safety shutdowns and associated flashing LED indicators for low oil pressure, high coolant temperature, overspeed, overcrank and emergency stop.
- Cycle cranking . . . adjustable 1-60 second crank/rest periods.
- Cooldown timer . . . adjustable 0-30 minutes.
- Energized to run or shut down fuel control systems.
- LCD digital readout for: Engine Oil Pressure; Coolant Temperature; Engine RPM; System DC Volts; Engine Running Hours; Eight System Diagnostic Codes; Generator AC Volts; Generator AC Amps; and Generator Frequency.
- Engine Control Switch.
- Ammeter-Voltmeter Phase Selector Switch.
- Emergency Stop Pushbutton.
- Indicator/Display Test Switch.
- Voltage Adjust Potentiometer.
- Rugged NEMA 1/IP 22 Cabinet.

TECHNICAL DATA

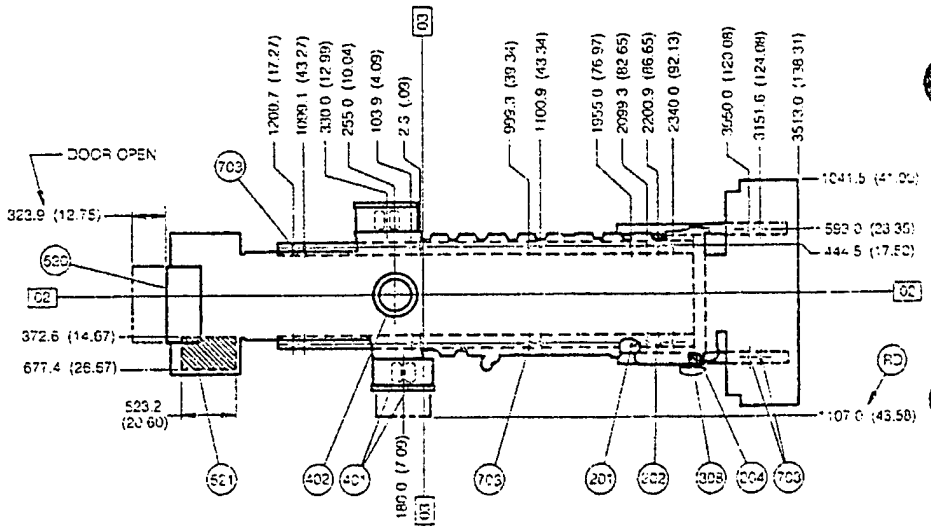
3516 Prime Power Generator Sets			50 Hz–1500 RPM					60 Hz–1800 RPM			
Rating Information	Power Rating @ 0.8 PF with Fan	kW	1,088	1,200	1,280	1,460	1,555	1,275	1,360	1,600	1,825
	Power Rating @ 0.8 PF with Fan	kV•A	1,360	1,500	1,600	1,825	1,944	1,750	1,575	2,188	2,281
	Engine Hp with Fan		1,556	1,749	1,864	2,095	2,219	1,840	1,957	2,304	2,598
Package Dimensions	Length	mm	5,737	5,813	5,813	5,921	6,280	5,720	5,737	5,813	6,280
		in	226	229	229	233	247	225	226	229	247
	Width	mm	2,092	2,092	2,092	2,319	2,319	2,319	2,319	2,319	2,319
		in	82.4	82.4	82.4	91.3	91.3	91.3	91.3	91.3	91.3
	Height	mm	2,459	2,459	2,459	2,545	2,545	2,545	2,545	2,545	2,545
		in	96.8	96.8	96.8	100.2	100.2	100.2	100.2	100.2	100.2
	Shipping Weight	kg	12,850	13,235	13,235	14,660	14,920	12,620	12,850	13,235	14,700
		lb	28,330	29,120	29,120	32,320	32,900	27,630	28,330	29,120	32,420
	Generator Frame Size		805	806	807	808	809	805	806	807	809
Lubrication & Cooling Systems	Engine Lubricating Oil Capacity	L	470	470	470	470	470	470	470	470	470
		qt	497	497	497	497	497	497	497	497	497
	Engine Cooling Capacity with Radiator	L	375	375	375	440	440	440	440	440	440
		gal	99	99	99	116	116	116	116	116	116
	Standard Radiator Arrangement Data:										
	Air Flow (Max @ Rated Speed)	m³/min	1,330	2,040	2,040	2,325	1,900	2,295	2,295	2,295	2,295
		cfm	46,970	71,975	71,975	82,000	67,000	81,000	81,000	81,000	81,000
	Air Flow Restriction (after radiator)	kPa	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
		in H_20	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Ambient Temperature Capability (TMI)	Dec. C	45	49	46	50	46	54	50	44	42
		Deg. F	113	120	115	122	114	130	122	110	106
	Radiator Size		72/25	72/25	72/25	46/CV	46/CV	46/CV	46/CV	46/CV	46/CV
Exhaust System	System Backpressure (Max Allowable)	kPa	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
		in H_20	27	27	27	27	27	27	27	27	27
	Exhaust Flange Size (Internal Diameter)	mm	292	292	292	292	292	292	292	292	292
		in	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Engine Performance Data @ Rated Conditions	Fuel Consumption (100% load) with Fan Per ISO3046/1: +5%, -0% tolerance	L/Hr	267.5	299.7	318.3	368.5	383.1	335.9	358.9	426.4	464.9
		gph	70.7	79.1	84.1	97.4	101.3	88.8	94.9	112.6	122.8
	Fuel Consumption (75% load) with Fan	L/Hr	204.0	230.9	244.7	276.0	289.6	256.2	271.7	317.7	353.5
		gph	53.9	61.0	64.7	72.9	76.5	68.2	71.6	83.9	93.3
	Fuel Consumption (50% load) with Fan	L/Hr	157.1	162.3	171.4	190.7	199.3	186.2	195.6	224.6	236.7
		gph	37.5	42.9	45.3	50.3	52.7	49.2	51.7	59.0	62.6
	Combustion Air Inlet Flow Rate	m³/min	101	113	120	133	120	127	134	153	176
		cfm	3,565	3,995	4,225	4,680	4,250	4,490	4,740	5,400	6,205
	Exhaust Gas Flow Rate	m³/min	248	277	293	336	335	323	344	405	450
		cfm	8,745	9,770	10,335	11,875	11,850	11,395	12,155	14,310	15,850
	Heat Rejection to Coolant (total)	kW	567	643	688	797	840	746	798	953	1,045
		BTU/min	32,245	36,565	39,125	45,325	47,830	42,425	45,380	54,200	59,430
	Heat Rejection to Exhaust (total)	kW	1,065	1,195	1,275	1,475	1,595	1,425	1,522	1,825	1,980
		BTU/min	60,455	67,845	72,340	83,770	90,540	81,040	86,566	103,731	112,545
	Heat Rejection to Atmosphere from Engine	kW	148	157	162	173	139	161	166	181	142
		BTU/min	8,415	8,930	9,215	9,840	7,905	9,156	9,440	10,293	8,075
	Heat Rejection to Atmosphere from Generator	kW	48.9	52.5	57.5	62.4	58.1	58.7	58.1	68.4	66.2
		BTU/min	2,780	2,990	3,270	3,550	3,305	3,340	3,305	3,890	3,765
	Exhaust Gas Stack Temperature	Deg. C	459	457	458	486	553	483	491	516	480
		Deg. F	858	854	856	907	1,028	902	916	960	910
	Deration for Engine:										
	Altitude – 3% per 305m (1000 ft) above (at 30° C [86° F])	m	4,000	3,250	2,625	1,475	1,495	3,900	3,275	1,750	975
		ft	13,123	10,663	8,612	4,839	4,900	12,795	10,745	5,741	3,200

Prime Power Gen Set Package —Top Views

02	- CENTERLINE OF ENGINE
03	- REAR FACE OF CYLINDER BLOCK
201	FUEL INLET
202	EXCESS FUEL RETURN
204	FUEL FILTER
308	OIL FILTER
401	AIR INLET
402	EXHAUST
520	CONTROL PANEL
521	CONDUIT ENTRANCE
703	CUSTOMER MOUNTING HOLES



Top View of Generator Set with 46/CV Radiator



Top View of Generator Set with 72/25 Radiator

For overall length see technical data section.

Note: General configuration not to be used for installation. See general dimension drawings for detail.

CONDITIONS & DEFINITIONS

Prime - Output available with varying load for an unlimited time. Prime power in accordance with ISO8528. Overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO 3046/1, DIN 6271 and BS 5514 standard conditions. Fuel rates are based on fuel oil of 35 deg. API (16 deg C or 60 deg. F) gravity having an LHV of 42780 kj/kg (18,390 Btu/lb) when used at 29 deg. C (85 deg. F) and weighing 838.9 g/l (7.001 lbs/U.S. gal).

-GKPGN1 TMI - ENGINE AND COMP PERF DATE: 10/25/94
09 - PACKAGE SET PERFORMANCE TIME: 13:28:31

3516 DI TA JW DRY MANF TURBO QTY 4 PARALLEL WDWRD GOV PACKAGE-DIE
DM0319-02 PRIME 60 HERTZ
GEN 1600.0 W/F KW 1635.0 W/O F KW FLY W/F HP 2304 W/O F HP @ 1800 RPM

INFO CODE 01 - GENERAL PERFORMANCE DATA *

GEN W/F KW	PER CENT LOAD	ENG PWR HP	ENG BMEP PSI	S FUEL CONSUM LB/HP-HR	FUEL RATE GPH	INTAKE MANF T DEG F	INTAKE MANF P IN-HG	INTAKE AIR FL CFM	EXH MANF T DEG F	EXH STK T DEG F	EXH GAS FL CFM
1600.0	100	2288	239	.342	111.7	203	62.0	5494	1177	904	13933
1440.0	90	2063	216	.344	101.5	199	55.1	5099	1127	892	12793
1280.0	80	1840	192	.349	91.6	195	48.2	4714	1079	878	11734
1200.0	75	1729	181	.352	86.7	193	44.7	4537	1055	870	11218
1120.0	70	1618	169	.353	81.8	191	41.2	4347	1030	863	10678
960.0	60	1396	146	.358	71.5	187	34.4	3838	982	855	9382
800.0	50	1176	123	.365	61.2	180	27.9	3330	933	848	8090
640.0	40	960	100	.373	51.3	171	22.1	2899	879	825	6907

INFO CODE 02 - HEAT REJECTION DATA *

GEN W/F KW	PER CENT LOAD	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXH BTU/MN	EXH RCOV TO 350F BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	WORK ENERGY BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN
1600.0	100	52662	7962	100546	56927	12909	14786	97020	239763	255403
1440.0	90	47429	7848	90707	51467	11658	11545	87523	217755	231972
1280.0	80	42368	7734	81495	46292	10464	8701	78025	196599	209395
1200.0	75	39866	7677	77002	43790	9895	7393	73305	186135	198248
1120.0	70	37420	7621	72566	41344	9327	6199	68585	175500	186988
960.0	60	32586	7507	63694	35942	8132	4095	59202	153378	163387
800.0	50	27866	7393	54993	30653	6995	2332	49875	131313	139900
640.0	40	23260	7279	46576	25421	5914	967	40719	109986	117152

INFO CODE 03 - SOUND (NOISE) DATA - EXHAUST @ 49.2 FEET * * * * * * * * *

GEN W/F KW	PER CENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1600.0	100	94	85	88	93	89	88	87	87	84
1440.0	90	93	84	87	92	88	87	86	86	83
1280.0	80	93	83	86	91	87	86	85	85	82
1200.0	75	92	82	86	90	87	85	85	85	82
1120.0	70	92	82	85	90	86	85	84	84	81
960.0	60	91	81	84	89	85	84	83	83	80
800.0	50	89	80	83	88	84	83	82	82	79
640.0	40	88	79	82	87	83	82	81	81	78

INFO CODE 04 - SOUND (NOISE) DATA - MECHANICAL @ 49.2 FEET * * * * * * * * *

GEN W/F KW	PER CENT LOAD	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1600.0	100	92	94	103	94	86	85	82	79	73
1440.0	90	92	94	103	94	86	85	82	79	73
1280.0	80	92	94	103	94	86	85	82	79	73
1200.0	75	92	94	103	94	86	85	82	79	73
1120.0	70	92	94	103	94	86	85	82	79	73
960.0	60	92	94	103	94	86	85	82	79	73
800.0	50	92	94	103	94	86	85	82	79	73
640.0	40	92	94	103	94	86	85	82	79	73

INFO CODE 05 - EMISSIONS DATA * * * * * REFERENCE NOTES * * * * * * * * * * * *

EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH CFR 40 PART 86 SUB PART D FOR HYDROCARBONS, CO, CO2 AND NOX. THE PARTICULATE MATTER WAS MEASURED USING ISO PROCEDURE 8178-1. SOX IS BASED ON FUEL SULFUR CONTENT OF .2 PERCENT BY WEIGHT.

DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.42 IN HG AND NO.2 DIESEL FUEL WITH 35 DEG API AND LHV OF 18,390 BTU/LB. THE DATA SHOWN IS SUBJECT TO INSTRUMENTATION, MEASUREMENT, FACILITY AND ENGINE-TO-ENGINE VARIATIONS.

TO PROPERLY APPLY THIS DATA YOU MUST REFER TO PERFORMANCE PARAMETER DM1176 FOR ADDITIONAL INFORMATION.

INFO CODE 05 - EMISSIONS DATA * * * * * RATED SPEED * * * * STANDARD TIMING

"NOMINAL DATA"

GEN PWR KW	% LOAD	ENG PWR BHP	NOX (AS NO2) LB/HR	CO LB/HR	TOTAL HC LB/HR	CO2 LB/HR	SOX (AS SO2) LB/HR	PART MATTER LB/HR	O2 (DRY) IN EXH (VOL) %	SMOKE OPAC %	BOSCH SMOKE NO.
1600.0	100	2288	53.93	6.98	.67	2494.1	3.15	.762	8.84	4.7	1.40
1200.0	75	1729	48.46	4.27	.97	1926.0	2.44	.493	10.25	3.2	1.25
800.0	50	1176	34.67	2.43	.98	1356.3	1.71	.440	11.18	2.9	1.28
400.0	25	629	17.60	1.67	.82	801.4	1.01	.402	13.12	2.5	1.29
160.0	10	286	9.84	1.98	.98	467.4	.60	.519	15.76	3.5	1.31

RATED CONDITIONS:		NOX (AS NO2)	CO	TOTAL HC	PART MATTER
SELECTED EMISSION UNITS	G/BHP-HR	10.660	1.380	.133	
	PPM @ 5% O2(DRY)	2010	439	72	
	MG/NORM CU M @ 5% O2	3454	447	43	

AT RATED:

EXHAUST FLOW RATE	23898 LB/HR
EXHAUST FLOW (904 DEG F STACK TEMP)	13935 CFM
EXHAUST FLOW RATE (77 DEG F AND 29.98 IN HG)...	5481 STD CFM
FUEL FLOW RATE	111.2 GAL/HR

APPENDIX "A"

CONTRACT NO. DACA01-94-D-0034

DELIVERY ORDER NO. 0007

GENERAL SCOPE OF WORK

FOR

LIMTED ENERGY STUDY FOR A POSTWIDE SHARE GENERATION/PEAK SHAVING GENERATION PLANT AT

FORT LEE, VIRGINIA

SCOPE OF WORK
LIMTED ENERGY STUDY FOR A POSTWIDE
SHARE GENERATION/PEAK SHAVING GENERATION PLANT AT
FORT LEE, VIRGINIA

TABLE OF CONTENTS

ANNEXES

1.0 BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Identify the various Virginia Power rate schedules which Fort Lee could use to purchase electric power in combination with on-site generators. The A-E shall identify which electrical grid at Fort Lee where it would be most advantageous to install a new electric power generating plant.

1.2 Determine the most life cycle cost effective combination of self generated and purchased electric power to meet Fort Lee's electric power requirements.

1.3 Calculate the energy, demand, operating and maintenance savings for each alternative that is evaluated.

1.4 Perform a limited site survey of buildings or facilities to verify electrical system and energy consumption for analysis.

1.5 Provide complete programming or implementation documentation for all recommended projects.

1.6 Prepare a comprehensive report to document the work performed, the results, and the recommendations.

1.7 Provide a Environmental Assessment of the areas in which proposed equipment will be located.

2.0 GENERAL:

2.1 This Study is limited to the evaluation of the specific buildings, systems, or ECO's listed in APPENDIX A, DETAILED SCOPE OF WORK.

2.2 The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

2.3 For the purposes of this scope of work, an Energy Conservation Opportunity (ECO) is defined as all methods of a rate reduction as it relates to the application of one or more Virginia Power rate schedules which Fort Lee could use to purchase electric power in combination with on-site generators. All opportunities which produce a rate reduction dollar savings shall be documented in this report. Any rate reduction opportunity considered unfeasible shall also be documented in the report with reasons for elimination.

2.4 The AE shall ensure that all ECOs which will reduce the energy consumption or cost of operation of the installation have been considered and documented.

2.5 The most recent "Energy Conservation Investment Program (ECIP) Guidance", described in the letter from DAIM-FDF-U, dated 10 Jan 1994 establishes criteria for ECIP projects and shall be used for performing the economic analysis of all ECO's and projects. The Program Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must be in the mode of calculations specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.6 Energy conservation opportunities determine to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar buildings/projects into larger packages which will qualify for ECIP or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.7 Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP index. The Tri-Service MCP index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) Bulletin.

2.8 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings-to-Investment Ratios (SIR).

2.9 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

3.0 PROJECT MANAGEMENT:

3.1 Project Managers The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. . The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and Liaison for all work under this contract. This individual will be the Government's representative.

3.2 Installation Assistance The Commanding Officer at each point of installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 Public Disclosures The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract, as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences. The AE's contract will be modified to include labor and costs to attend additionally scheduled meetings.

3.5 Site Visits, Inspections, and Investigations The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/ or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed, and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer, within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry The entry interview shall thoroughly describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

A. Schedules.

B. Names of energy analysts who will be conducting the site survey.

C. Proposed working hours.

D. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit The exit interview shall include a thorough briefing describing the items surveyed and probably areas of energy conservation. The interview shall also solicit input and advice from the Director of Public Works.

4.0 SERVICES AND MATERIALS: All services, materials (except those specifically enumerated to be furnished by the Government), labor, superintendent and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5.0 PROJECT DOCUMENTATION: All rate reduction opportunities or projects which the AE has considered shall be included in one of the following categories and reported in the report as such.

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000, a Savings to Investment Ratio greater than 1.25 and a simple playback period of less than ten years. For ECAM projects, the $300,000 limitation may not apply in such cases, the AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have an SIR greater than 1.25. All projects meeting the above criteria shall be arranged as specified in paragraph 2.6.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure(PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs.

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or play back period, but which have a SIR greater than 1.25 shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.6.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, i.e., energy savings calculations and cost estimate(s), and the simple play back period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

5.2.1. 0 & M Energy Projects: An O&M Energy project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, i.e., $300,000 construction cost, SIR n 1.25, and simple play back period of less than ten years. In addition, if the project would replace a system or equipment that is considered failed or failing' due solely to obsolete technology or inefficiency, the equipment to be replaced must have been in use for at least three years; and the simple play back period must be three years or less.

5.2.2. Low Cost/No Cost Projects. These are projects which the Director of Public Works (DPW) can perform using his resources. Documentation shall be as required by the DPW.

5.3 Non-feasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6.0 DETAILED SCOPE OF WORK: The detailed Scope of Work is contained in Annex A.

7.0 WORK TO BE ACCOMPLISHED:

7.1 Review Data for Existing Power Generation and Rate Schedules The AE shall review for general information the construction drawings and specifications and the manufacturer's drawings and operations and maintenance manuals for the existing Power Generation. This review should acquaint the AE with the details of the existing rate schedule and power generation system. Much of the information the AE may need to perform his evaluations will be contained in this data.

7.2 Perform a Limited Site Survey A limited field survey of electrical generation systems in all buildings listed in the Detailed Scope of Work shall be conducted. A detailed field investigation will then be made of all buildings using the outline provided in the Detailed Scope of Work. The AE shall document his site survey on forms developed for the survey, and submit these completed forms as part of the report.

7.3 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in APPENDIX A, DETAILED SCOPE OF WORK,. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRS) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the CEO were figured. Calculations shall be an orderly step by step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. Construction cost estimates shall be provided and shall break out the costs associated with rehab work (architectural, electrical, mechanical) where applicable. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.4 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph 7.5.1, the AE will be advised of the DPW's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par 7.5.2 and 7.5.3.

7.5 Submittals, Presentations, and Reviews The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The AE shall prepare slides or view graphs showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved, or action items assigned. The AE shall provide the comments from all reviewers and written notification of the action taken on each comment, to all reviewing agencies, within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation of the date(s) agreeable to the Director of Engineering and Housing, the AE, and the Government's representative. The Contracting Officer may require a resubmitted of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.5.1 Interim Submittal An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the CEOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken, and contain a plan of the work remaining to complete the study. The simple playback period of all CEOs/projects shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. a narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the Director of Engineering and Housing and provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassemble of the material contained within.

7.5.2 Prefinal Submittal The AE shall prepare and submit the prefinal report when all sections of the report are complete. The AE shall submit the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations.

The report shall integrate all aspects of the study. The report shall list the recommended projects in order of descending SIR. The synergistic effects of all of the applications programs proposed for any particular building shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for the recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, separately bound Executive Summary, and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include the following:

A. A separately bound Executive Summary, to give a brief overview of what was accomplished and the results of this study, using graphs, tables, and charts as much as possible.

B. The narrative report, containing a copy of the Executive Summary at the beginning of the volume, and describing in detail what was accomplished and the results of this study.

C. Appendices, to include the detailed calculations and all backup material.

D. The programming and implementation documentation.

A list of all projects and ECOs developed during this study shall be included in the Executive Summary, and shall include the following data from the LCCA summary sheet: The cost (construction plus SIOH); the annual energy savings (type and amount); the annual dollar savings; the SIR; the simple payback period; and the analysis date. For all programmed projects, also include the year in which it is programmed and the programmed year cost.

7.5.3 Final Submittal Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference, and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report, with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages.

ANNEX A
DETAILED SCOPE OF WORK

1. LOCATION

A. General description. The Architect Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, and travel as required in connection with the feasibility study for the below identified project in accordance with the contract and all furnished instructions:

INSTALLATION	DESCRIPTION
Fort Lee, VA	Postwide Share Generation/Peak Shaving Generation Plant

2. AUTHORIZATION (Not Required)

3. STUDY INSTRUCTIONS

3.1 Government Furnished Information: The following documents are available for the use of the AE.

- As built drawings (as available) of buildings/systems
- Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994
- ETL 11103282, Energy Conservation
- TM 58002, Cost Estimates, Military Construction
- AR 41515, 1 Jan 84, Military Construction, Army (MCA) Program Development
- Architectural and Engineering Instructions, Design Criteria; Chapter 12, Electrical Criteria, 9 December 1991
- The latest MCP Index

If the Design Manuals, Guide Specifications, and/or Project Engineering Instructions do not cover a specific condition in question, the AE shall contact the Contracting Officer before proceeding. If there is a conflict in Engineering Instructions or other reference data, such questions or conflicts should be brought to the attention of the Contracting Officer before proceeding.

4. INSTALLATION REPRESENTATIVE

The installation representative for this contract will be Mr. Mike Piner, DPW Master Planner.

5. COMPLETION SCHEDULE

The following schedule shall be used as a guide in approving payments on this contract. The interim report for shall be due not later than 180 days after Notice to Proceed. The prefinal report shall be due not later than 45 days after the interim report review conference. The final report shall be due not later than 30 days after the prefinal review conference. The Contracting Officer's Representative (COR) will be Mr. Bryant Wilkins at the Norfolk Districts, COE.

6. METHOD OF PAYMENT

A. Title I. The AE shall prepare and submit to the US Army Engineer District, Norfolk, partial payment estimates in accordance with the attachment entitled "Instructions for Completion of ENG Form 93". Payment under this contract, for which property or services are provided in a series of partial executions or deliveries, will be made within 30 days after receipt of an invoice which has been properly executed by the AE.

B. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend additional conferences, when so requested in writing by the Contracting Officer, will be made at a rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations in effect at the time travel is performed and actual cost of transportation.

7. SUBMITTAL REQUIREMENTS

ORGANIZATION	COPIES REQUIRED (Correspondence); Interim; Final and Prefinal Review	Executive Summary, Only
Norfolk District Attn: CENAO-EN-MC, Jim Kendall 803 Front Street Norfolk, VA 23510	5	
Headquarters, Forces Command Attn: FCEN-RDF, Mr. Naresh Kapur Energy Office, Building 200 Ft. McPherson, Ga 30330-6000	1	
U.S. Army Engineer District, Mobile Attn: CESAM-EN-DM (Mr. Battaglia) Post Office Box 2288 109 St. Joseph Street Mobile, AL 36602	1	
Commander USAED, North Atlantic ATTN: CENAD-EN-MM (Mr Wong) 90 Church Street New York, NY 10007		1

7. SUBMITTAL REQUIREMENTS (Continued)

ORGANIZATION	COPIES REQUIRED (Correspondence); Interim; Final and Prefinal Review	Executive Summary, Only
Commander US Army Corps of Engineers ATTN: CEMP-ET (Mr Gentil) 20 Massachusetts Avenue NW Washington, DC, 20314 1000		1 (Final Only)
Commander US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr Keath) New Cumberland Army Depot New Cumberland, PA, 17070 5007		1 (Final Only)

Progress reports will be prepared on a monthly basis to highlight the significant events of the prior month. This is especially true of actions completed, problems discovered, schedule changes and ECO developments. The progress reports will accompany monthly billings and will form the basis for progress meetings.

8. A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 3333977 or (800) 8425278.

9. METHOD

9.1 INVESTIGATION OF EXISTING CONDITIONS

The Contractor will collect information on the existing electrical utility systems and operations so as to have a reasonable understanding of operations, costs, energy use, problems, limitations, future needs, etc. This will be accomplished in the following steps.

Data Gathering. The Contractor will collect available data that will assist in energy use evaluations and recommendations. A partial list of data that will be sought are:

- Energy bills and summaries
- Prior studies and energy reports (if any)
- Schedules
- Maintenance records
- Electrical demand profiles
- Energy management system profile
- Others

Site Visits, Inspections. The Contractor design/study team (normally two or three people) will visit the facility. Site inspection will be done of areas covered in the study. Operators may be briefly interviewed on the basic function and normal time of use of individual areas and systems.

10. ANALYSIS OF SYSTEMS

The Contractor will utilize standard methods of engineering calculations to understand current energy consumption in such detail as to permit identification of further improvement options.

The current situation at Fort Lee is such that a negotiated rate schedule with Virginia Power with the assistance of on-site generators is used. The existing on-site generators are used to insure that Fort Lee does not exceed the negotiated electrical demand level. Fort Lee installed these on-site generators with no real set plan other than to avoid paying penalties issued by Virginia Power when the demand level was exceeded. The existing generators are 15 years old and cost as much to operate as they save.

The overall purpose is to identify the various Virginia Power utility rate schedules which Fort Lee could use to purchase electric power in combination with on-site generators. The A-E shall identify which electrical grid at Fort Lee where it would be most advantageous to install a new electric power generating plant. The A-E shall determine the most life cycle cost effective combination of self generated and purchased electric power to meet Fort Lee's electric power requirements.

11. SHARE GENERATION/PEAK SHAVING OPPORTUNITY INVESTIGATIONS

The Contractor shall investigate all reasonable options of Rate Reduction in the operation of the Share Generation/Peak Shaving. The approach used to identify each option is briefly described below.

Existing Conditions. This section describes the nature of the existing operating system, its energy use, costs, advantages and disadvantages. Data is usually transferred to this section from the calculations.

Share Generation/Peak Shaving. This section describes improvement ideas that are different from the existing conditions. They may describe a capital projects, modifications, or O&M procedures. The resulting improvements are described, energy costs, quantities and arrangements are briefly noted. Sufficient conceptual studies will be executed to determine feasibility, generate anticipated operational data and estimating values.

Construction Cost Estimate. A feasibility cost estimate in the format prescribed will be performed. The estimate breakdown will be included in the report showing known quantities and costs. Allowances for indirect costs and contingencies are included.

Annual Savings. The report will show the annual savings in utility costs. As the report is written, these savings are merely the difference between existing and proposed.

Discussion. This section of the report describes a number of relevant factors including payback period, impact on labor or non-energy costs, O&M concerns, appearances, comfort, life extension, etc. The intent of this section is to address normal impacts or uncertainties of various improvement ideas.

12. REPORT PREPARATION PHASE

The Contractor will prepare an Limited Energy Study report which will fully document the steps previously described. The report will be prepared as follows.

Executive Summary - Section 1. The outline of the executive section is shown on Appendix C.

Methodology - Section 2. This part of the report describes the approach, sequence, assumptions, calculations methods, computer programs, sample outputs, etc. that were used for the study.

Facility Description - Section 3. The report will briefly discuss the buildings and systems covered by the study. It will show floor plans, layout flow diagrams, facility age and condition, major equipment characteristics by system, hours of operation, and concerns expressed by occupants and managers.

Electrical Use and Costs - Section 4. The report will describe individual and combined electrical consumption for the past two years. The report will describe rate structures, incremental cost calculations, trends, and analysis of use by source. This section critically establishes baseline use of electricity for later improvement possibilities.

ECOs Recommended - Section 5. This section describes in detail each of the Energy Conservation Opportunities (ECOs) that are recommended for adoption and funding. The approach to each ECO write-up is described in Section 5, Project Documentation.

ECOs Not Recommended - Section 6. The report will also show ECOs that were investigated but not recommended for adoption due to economics, conflicts, with other ECOs or concerns of operations.

Discussion - Section 7. This part of the report will cover interesting findings of the study not related to other sections of the report. It may include recommendations for non-energy problems, further studies, O&M procedures, training, etc.

Attachments. As part of the report, there will be enclosures for photos, backup calculations, referenced materials such as rate tariffs, codes, etc.

Applications and Funding Requests. As part of this study, applications for project funding will be made in accordance with Section 5, Project Documentation and directions from local authorized persons. The exact level of funding and funding program (expected to be ECIP), will be at the direction of the facility manager.

Suggested Implementation Schedules. The report will also contain a suggested timetable for implementing various projects or programs. This recommendation will be made in consultation with various facility managers.

Operation and Maintenance Instructions. Where appropriate, the study will recommend the formation of procedures or changes to processes that relate to improved energy usage and costs through Operation and Maintenance.

APPENDIX B,
REQUIRED FORM DD1391 DATA,

To facilitate ECIP project approval, the following supplemental data shall be provided:

1. In title block clearly identify projects as "ECIP."

2. Complete description of each item of work to be accomplished including quantity, square footage, etc.

3. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

4. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

4.1. If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

4.2. Identify weather data source.

4.3. Identify infiltration assumptions before and after improvements

4.4. Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

5. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

6. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

7. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

8. Any requirements required by ECIP guidance dated 10 Jan 1994 and any revisions thereto. Note that non-escalated costs and savings are to be used in the economic analyses.

9. The five digit category number for all ECIP projects except for Family Housing is 8000. The category code number for Family Housing projects is 71100.

APPENDIX C
EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes etc.)

3. Present Electric Utility Usage Costs or Systems Studied.

4. Reevaluated Projects Results.

5. Energy Conservation Analysis.

- ECOs Investigated.
- ECOs Recommended.
- ECOs Rejected. (Provide economics or reasons)
- ECIP Projects Developed. (Provide list)*
- Non-ECIP Projects Developed. (Provide list)*
- Operational or Policy Change Recommendations.
-

* Include the following data from the life cycle cost analysis summary sheet; the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple pay back period and the analysis date.

6. Cost Savings.

- Total Potential reduction in the Electric Rate and Cost Savings.
- Electric Rate Cost Before and After the Energy Conservation opportunities are Implemented.

INTERIM REVIEW MEETING MINUTES

02 December 1994

Attendees:

Keith A. Derrington	Systems Corp
Komson Wagner	Systems Corp
Ron Brown	DPW Fort Lee
Mike Piner	DPW Fort Lee
Jim Kendall	Norfolk District COE
Mehhoah Munshi	DPW Fort Lee
Gene Miller	DPW Fort Lee
William H. Barna	DPW Fort Lee
Joe M. Baassin	DPW Fort Lee

Systems Corp presented in slide format the project results from the Interim Report. Komson Wagner presented the material and discussed the methodology and approach used in the analysis.

Option 4, utilizing the GS-4 rate, was selected as the option to be developed into a project to be submitted for ECIP funding.

Report reviewers agreed to have all comments submitted to Jim Kendall and in turn to Systems Corp by 16 December 1994 so that the final report could be completed and submitted by year end.

INTERIM REPORT COMMENTS

Reviewer: Ron Brown
Fort Lee DPW

Comment 1: What parameters of operation will be available to the operator on the EMCS?

Response: The main parameters available to operators are minimum on, minimum off setting, sample period and demand interval, load add/shed table (set generator on off sequence), operator enable/disable of program or loads, and many others.

Comment 2: We need to meter both electrical output and the fuel input as a minimum for each unit.

Response: Agreed. The cost of metering has been included with the cost of the generator switchgear and with the generators' supporting equipment.

Comment 3: VA Power has a metering specification. We need to include if they are going to purchase the electricity generated during the winter.

Response: The VA Power metering specification can be included with the project in the design phase.

Comment 4: What does the personnel area look like? Need to provide a small office, kitchen, and break area.

Response: The layout of the personnel area has not yet been determined at this stage. Your input should be incorporated in the pre-design phase of the project.

Comment 5: Will the startup sequence move to the next unit if one or two fail to come on line? Or, will the EMCS operator or the on site operator have to do something at the controls?

Response: Yes. The software program can set engine start priority accordance to the input position of engine-generator on the shed table. If the demand reached the Minimum On set point, the program will execute the command for the next engine-generator to come on line until the demand level is satisfied, without operator input.

Comment 6: Will the requirement for number of units on line be stepped according to the shed MW needed? In 1.5 MW increments and not all 8 MW if 4 MW is needed.

Response: Yes, the engine-generators will follow the load and in start-up sequence as set by the shed table as described in Response 5. The engine-generators will sequence off-line, in reverse order, when the demand minimum off is reached.

Comment 7: Need an Excel Panel with all the necessary programs resident in the power plant facility in case of communication problems. This is in addition to the control and operating at the control console at 6206.

Response: Agreed, some redundancy is needed to cover the loss of communication lines. Excel Controllers along with local load control systems will provide local control. To be evaluated in detail during design stage.

Comment 8: Check the MSSG contract for exact requirements, but as I recall it will only allow the standby generators to be used for purposes other than standby 10% of the contracted hours. Not sure we can do any peak shaving with them.

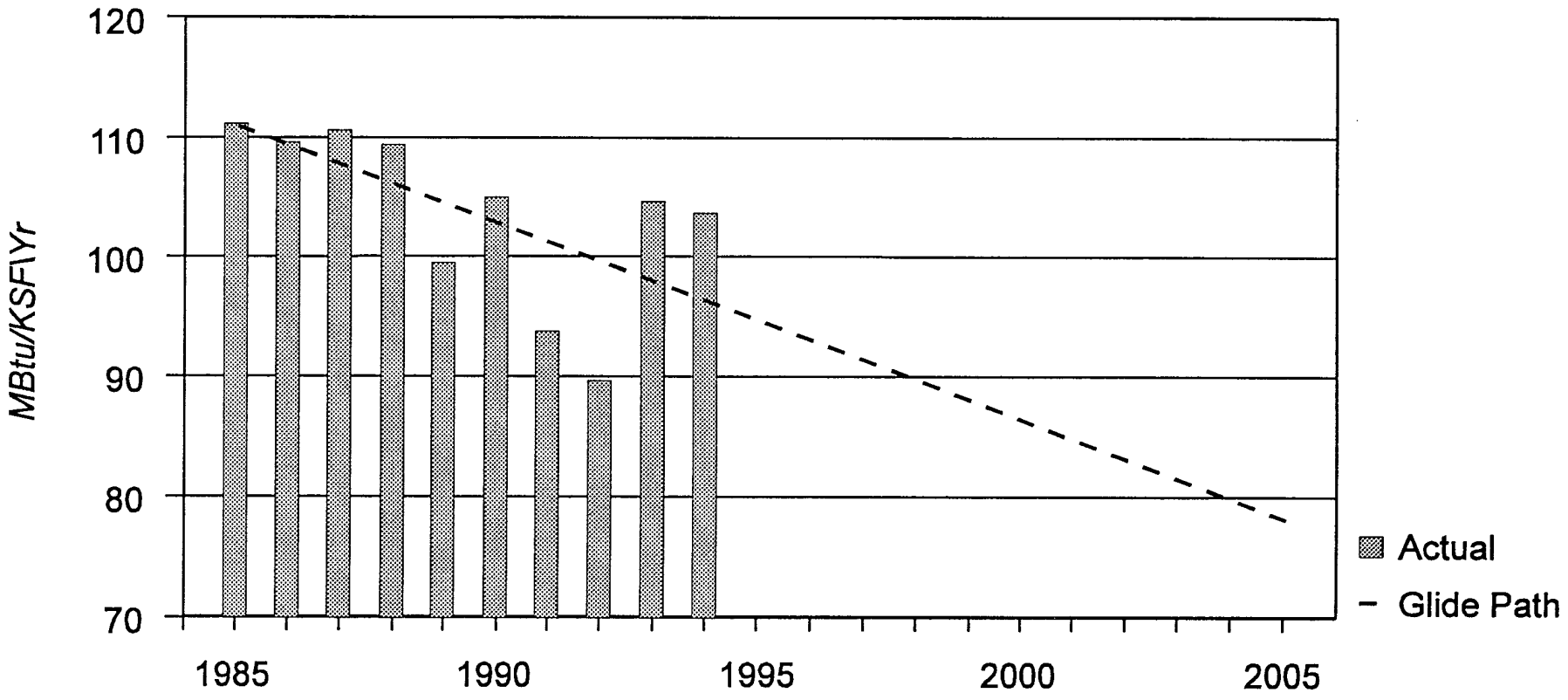
Response: The study parameter is based on Fort Lee participating in MSSG only during the winter months (no MSSG credit was earned during the summer months) and peak shaving during the summer months which is the current mode of operation. In the event Virginia Power will no longer allow Fort Lee to practice current mode of operation, we recommend Fort Lee discontinue MSSG and just peak shave. The project will still be economically sound with the payback less than 6.5 years.

Interim Review
Limited Energy Study
Postwide Share Generation/Peak
Shaving Generation Plant

Fort Lee, Virginia

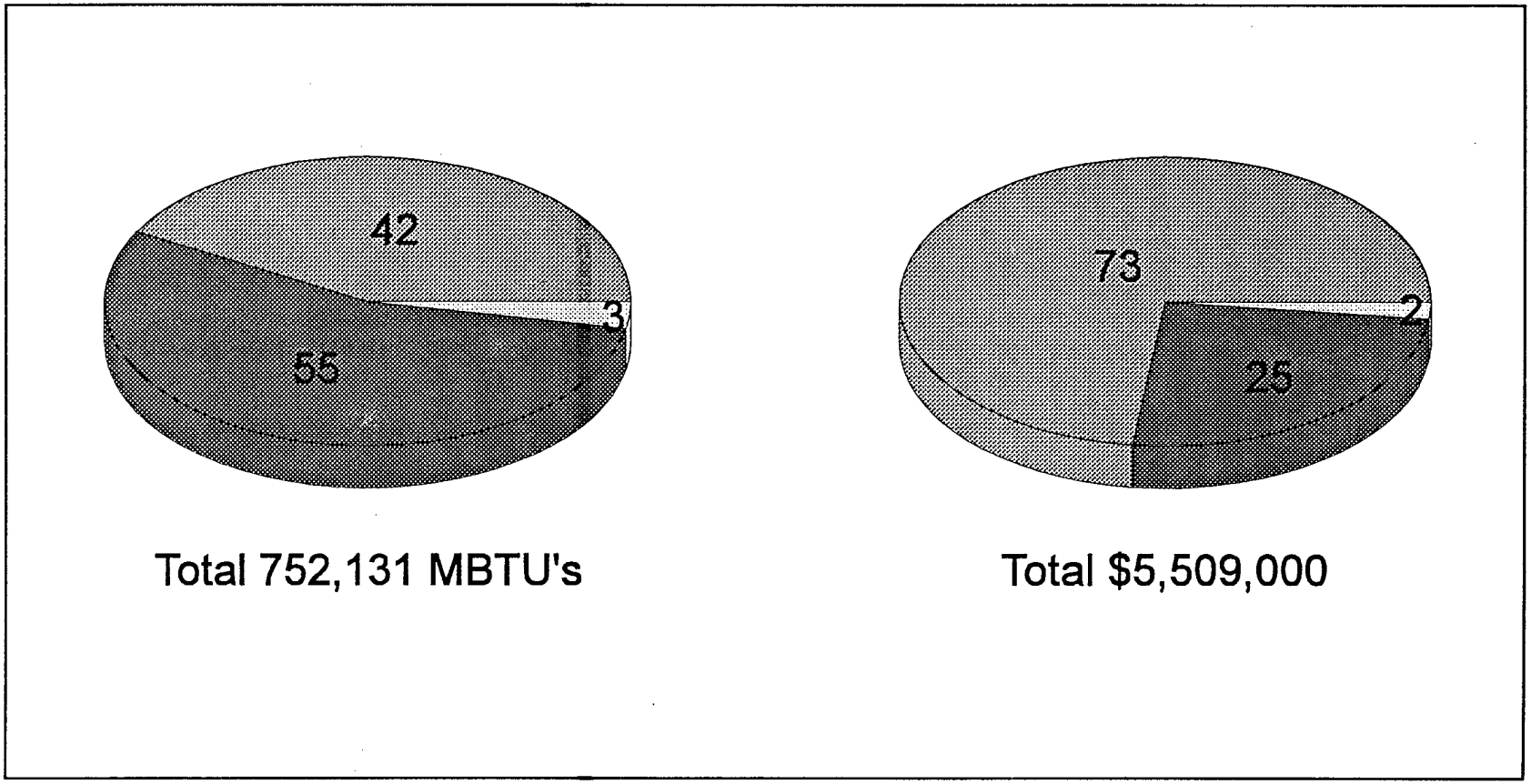
Energy Consumption

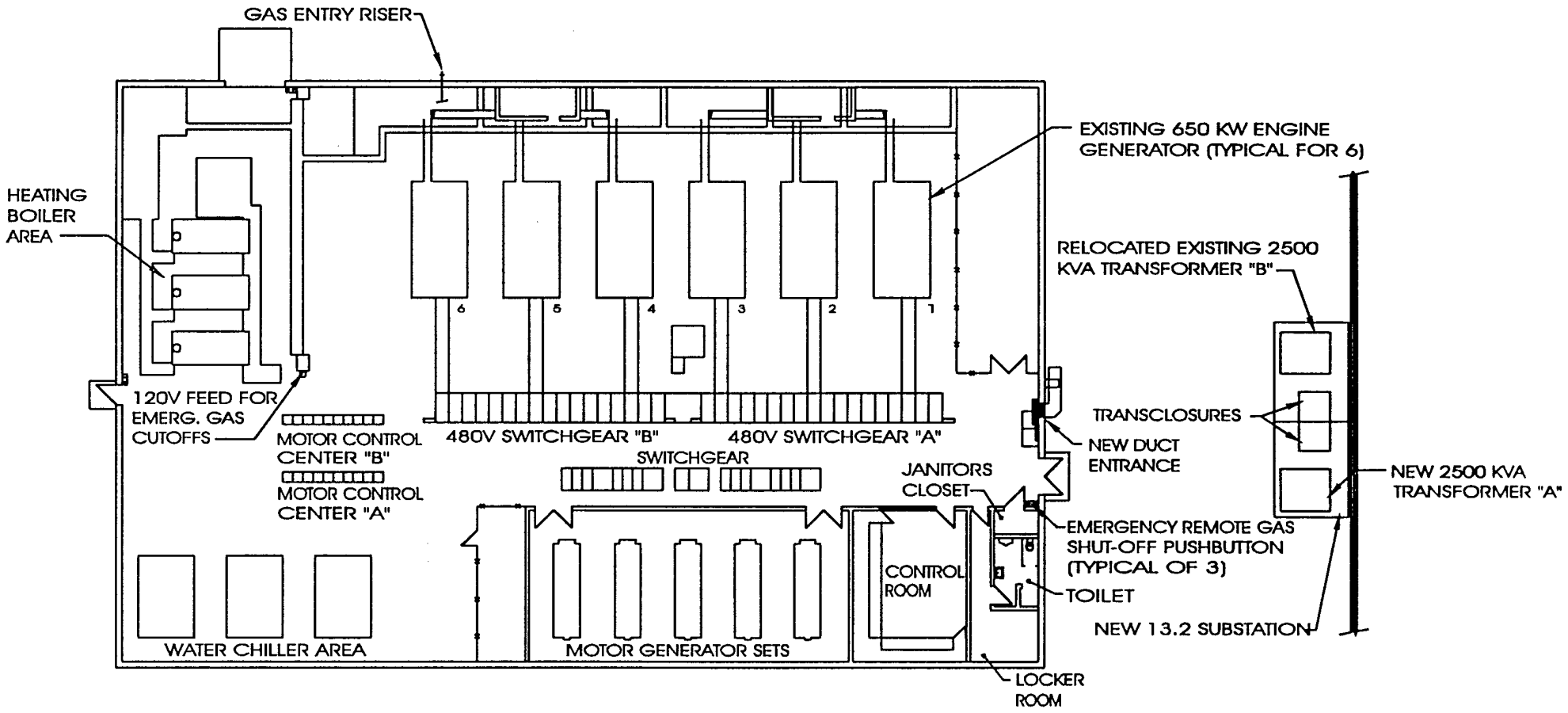
Fort Lee



Fort Lee Consumption vs Cost

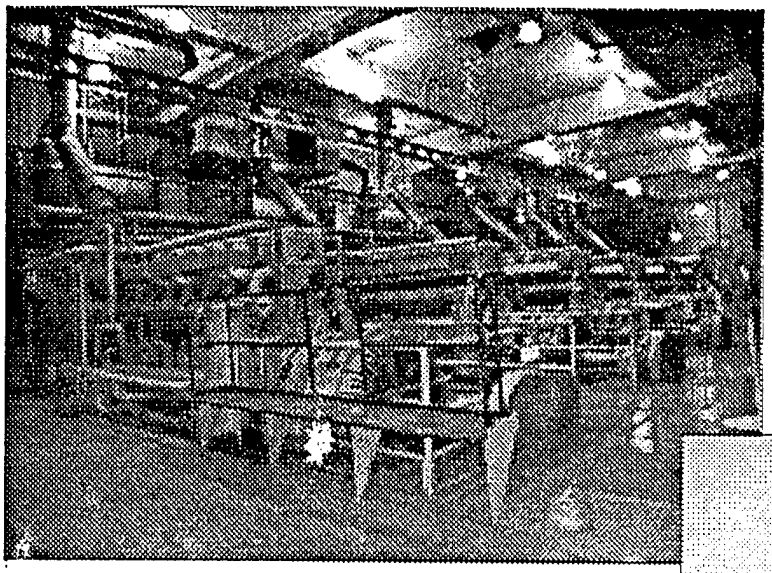
FY 94



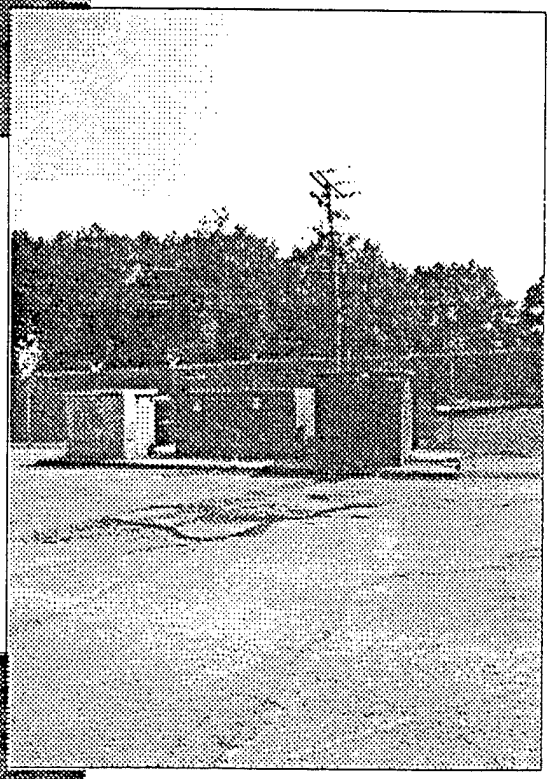


FLOOR PLAN - BUILDING 1109

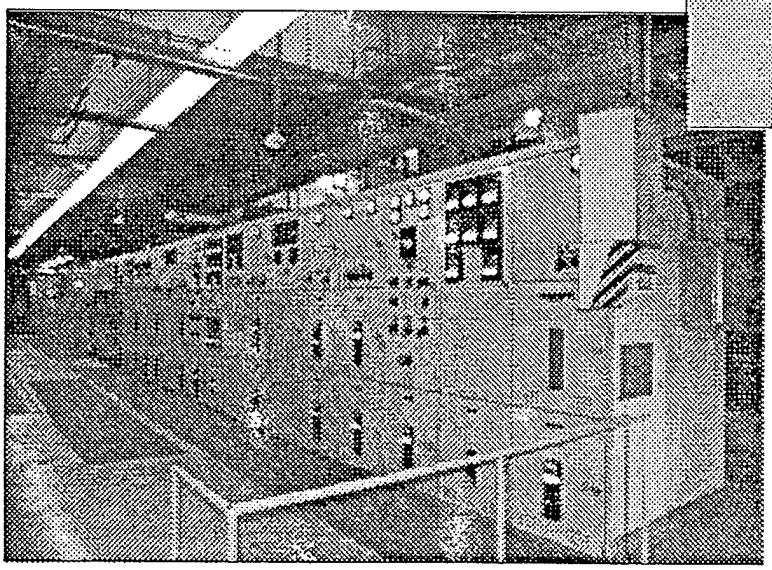
SCALE: 1/32" = 1'-0"



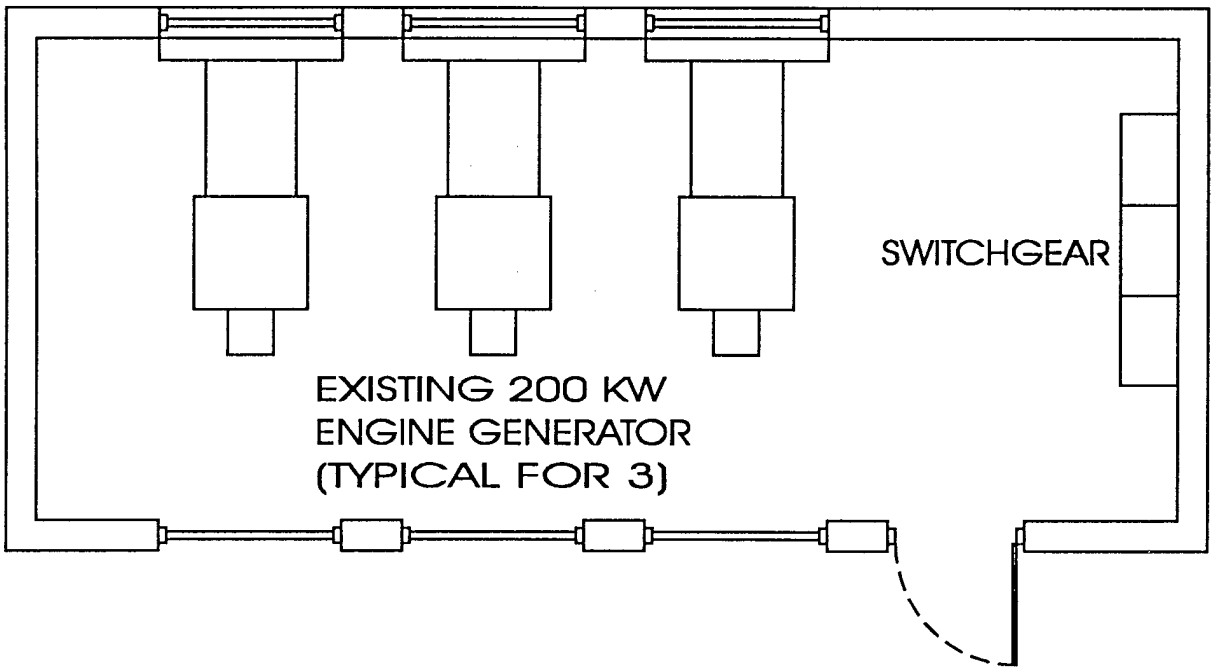
Building 1109 Diesel Engine Generators



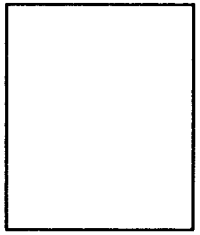
Building 1109 Transformers



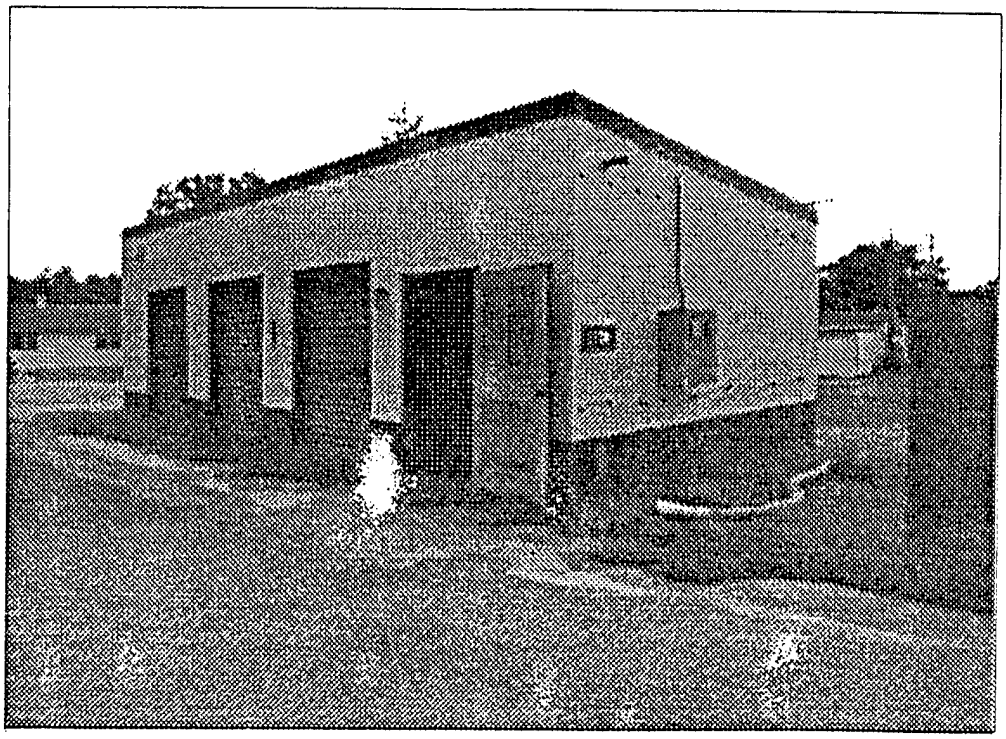
Building 1109 Switchgear



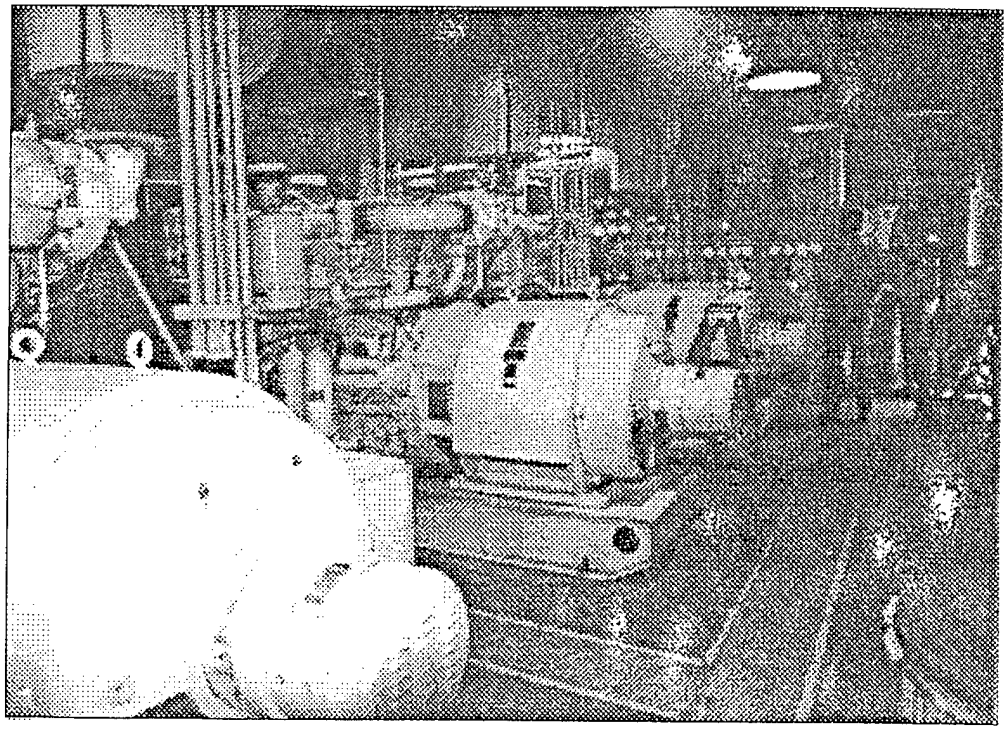
EXISTING 750 KVA
TRANSFORMER



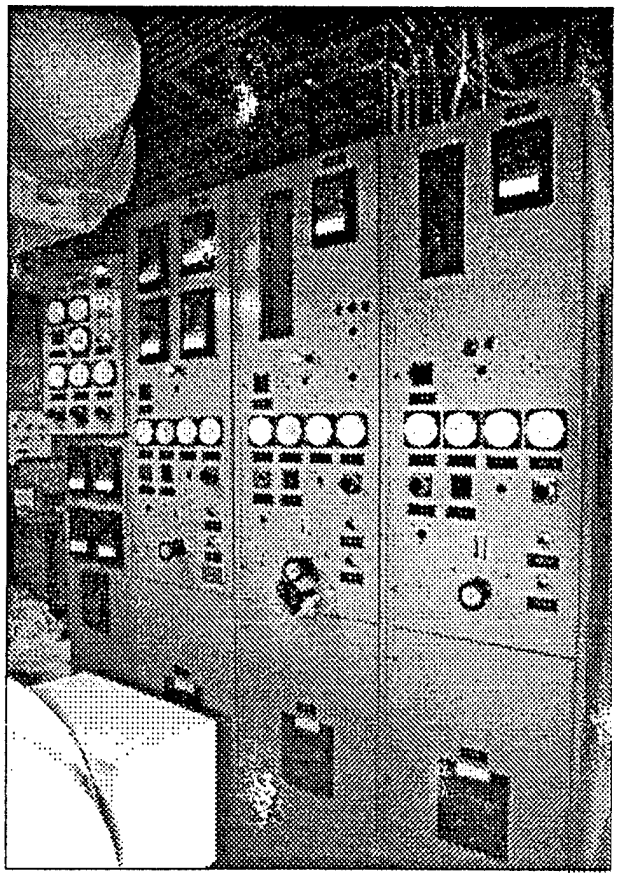
FLOOR PLAN - BUILDING 1336



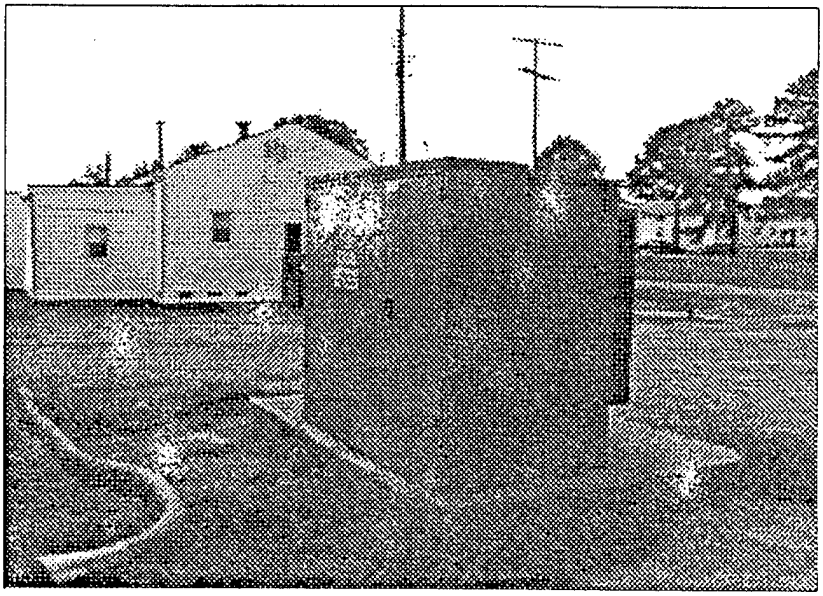
Building 1336



Building 1336 Diesel Engine Generators



Building 1336 Switchgear



Building 1336 Transformer

Fort Lee Rate Schedule Options

- Schedule MS
- Schedule MSSG
- Schedule GS-4

Schedule MS

Demand Charge:	*$12.62/KW/Mo*
90% Ratchet Charge	
Energy Charge:	*$0.01968/KWH*

Schedule MSSG
Standby Generator Program

≤ 125 hrs runtime per generator per season

Payment: $6.00/KW/Mo

Winter - November - April Payment
December - March Operation

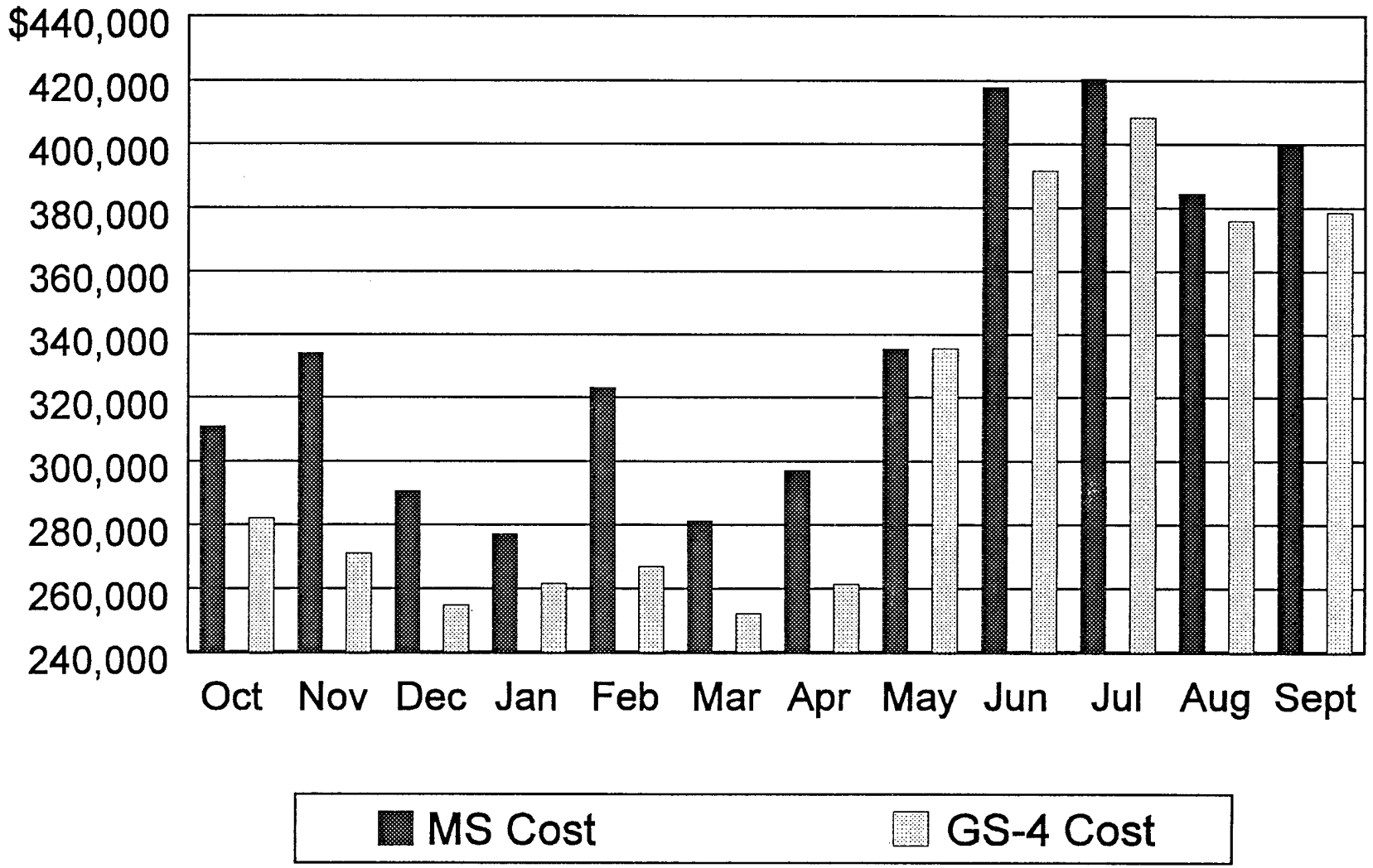
Schedule GS-4

Demand Charge:	$12.40/KW
75% Ratchet Charge	
Energy Charge:	$0.0043/KWH On-Peak
	$0.0029/KWH Off-Peak
	$0.01418/KWH Fuel Charge Rider

Schedule MS vs Schedule GS-4

- Based on FY94 Consumption
  $331,000 savings by using GS-4

Schedule MS vs GS-4



Options Evaluated

Option 1: Leased Generators, Replace Existing Plant

Option 2: New 6 MW Power Plant - 4-1.5 MW Diesel Engine Generators

Option 3: New 6 MW Power Plant - 4-1.5 MW Natural Gas Engine Generators

Option 4: New 12 MW Power Plant - 8-1.5 MW Diesel Engine Generators

Option 5: New 12 MW Power Plant - 4-1.5 MW Diesel & 4-1.5 MW Natural Gas Engine Generators

Baseline Costs & Savings

Replacement Cost	$1,421,295
Annual Fuel Costs	$117,837/Yr
Annual O & M Costs	$269,444/Yr
Electrical Savings (Energy, Demand, MSSG)	$758,310/Yr

Option 1

Total Investment	$1,889,888
Annual Fuel Costs	$466,714/Yr
Annual O & M Costs (Including Lease)	$484,710/Yr
Electrical Savings (Energy, Demand, MSSG)	$1,591,972/Yr

Option 1 - LCCA Summary

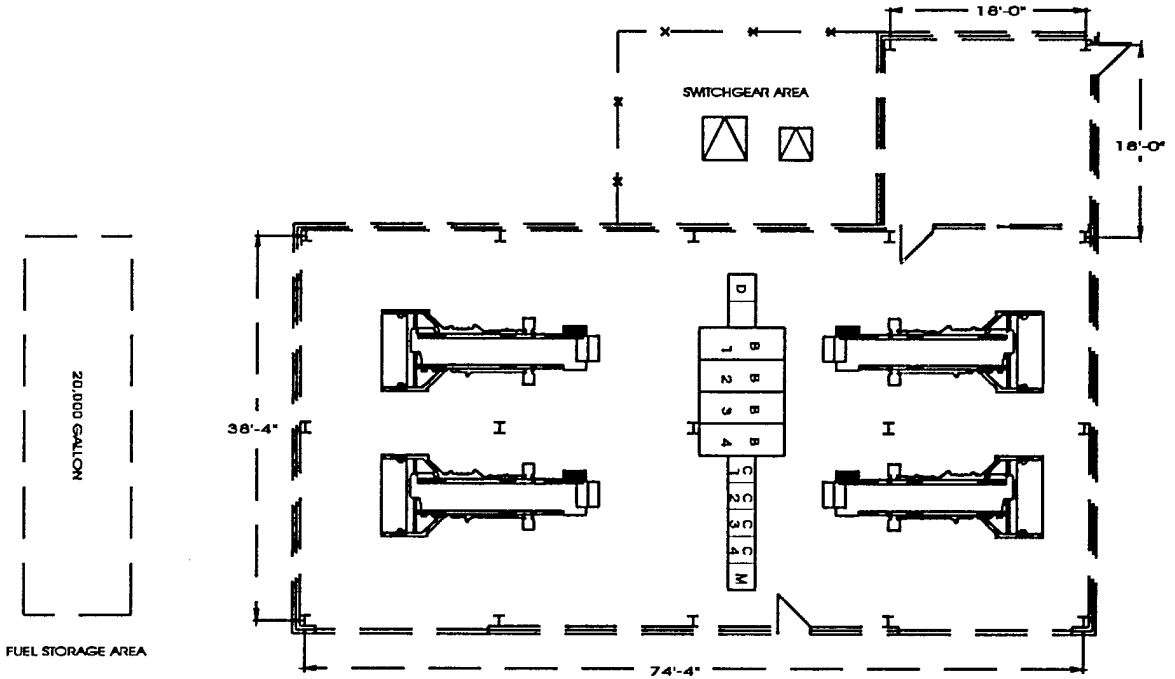
Total Investment	$1,889,888
First Year Savings	$269,601
SPB	7.01 Yrs
SIR	1.62

Option 2

Total Investment	$2,243,848
Annual Fuel Costs	$79,045/Yr
Annual O & M Costs	$67,500/Yr
Electrical Savings (Energy, Demand, MSSG)	$803,846/Yr

NOTE:
RADIATORS MAY BE REMOTELY LOCATED OUTSIDE FACILITY FOR BETTER HEAT REJECTION.

LEGEND	
B 1	PT ROLL-OUT/BREAKER SECTION GENERATOR 1
C 1	CONTROL SECTION GENERATOR 1
S	PAD MOUNTED VACUUM SWITCH
	TRANSFORMER
M	MASTER CONTROL SECTION
D	DISTRIBUTION SECTION



POWER GENERATION PLANT - OPTION 2

SCALE: 1/16" = 1'-0"

Option 2 - LCCA Summary

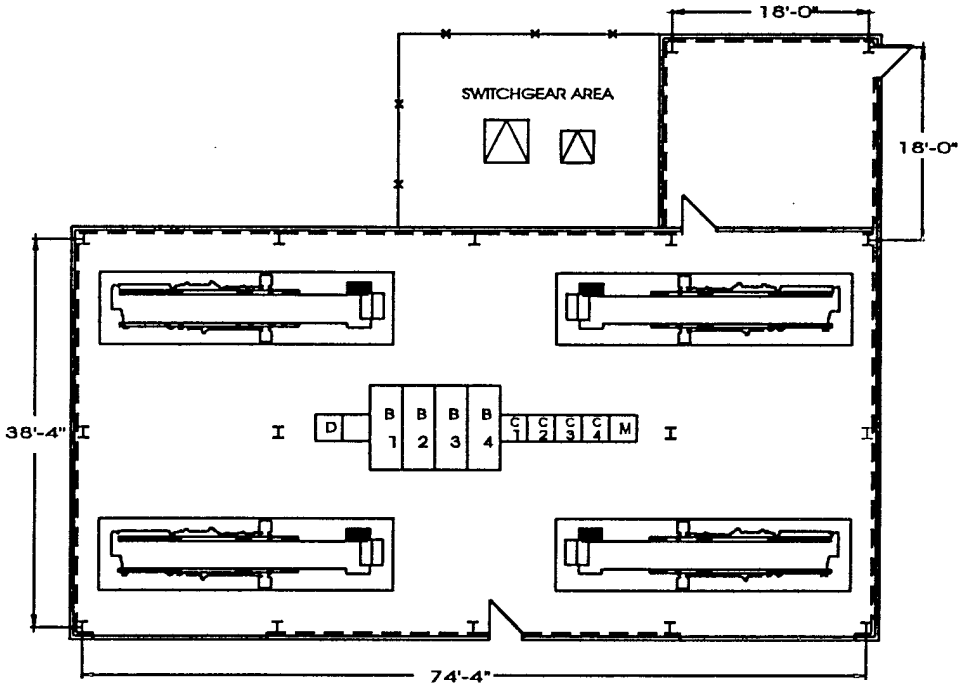
Total Investment	$2,243,848
First Year Savings	$357,330
SPB	6.28 Yrs
SIR	2.55

Option 3

Total Investment	$5,768,210
Annual Fuel Costs	$41,630/Yr
Annual O & M Costs	$67,500/Yr
Electrical Savings (Energy, Demand, MSSG)	$803,846/Yr

NOTE:
RADIATORS MAY BE REMOTELY LOCATED OUTSIDE FACILITY FOR BETTER HEAT REJECTION.

LEGEND	
B 1	PT ROLL-OUT/BREAKER SECTION GENERATOR 1
C 1	CONTROL SECTION GENERATOR 1
S	PAD MOUNTED VACUUM SWITCH
	TRANSFORMER
M	MASTER CONTROL SECTION
D	DISTRIBUTION SECTION



POWER GENERATION PLANT - OPTION 3

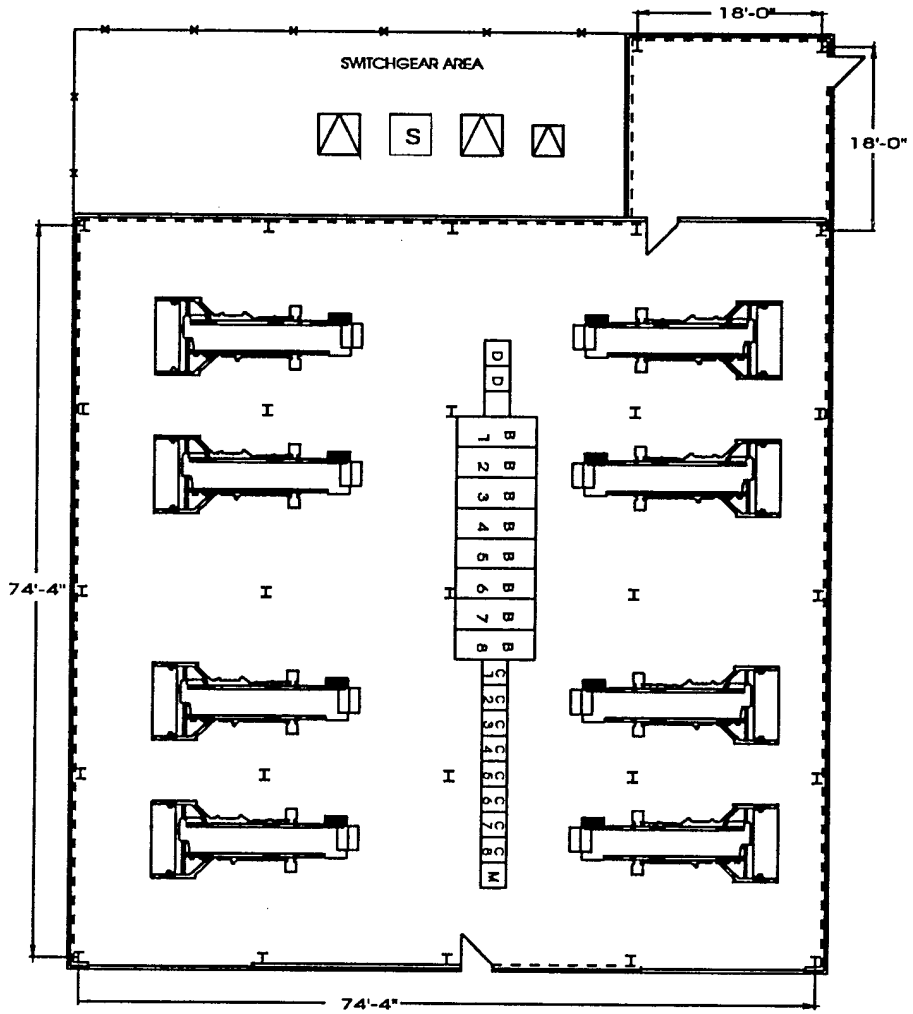
SCALE: 1/16" = 1'-0"

Option 3 - LCCA Summary

Total Investment	$5,768,210
First Year Dollar Savings	$394,725
SPB	14.61 Yrs
SIR	1.08

Options 4A and 4B

Total Investment	$4,400,645
Annual Fuel Costs	$474,271/Yr
Annual O & M Costs	$90,000/Yr
Electrical Savings - 4A	$1,678,540/Yr
Electrical Savings - 4B (Energy, Demand, MSSG)	$1,864,681/Yr



NOTE:
RADIATORS MAY BE REMOTELY LOCATED OUTSIDE FACILITY FOR BETTER HEAT REJECTION.

LEGEND	
B 1	PT ROLL-OUT/BREAKER SECTION GENERATOR 1
C 1	CONTROL SECTION GENERATOR 1
S	PAD MOUNTED VACUUM SWITCH
	TRANSFORMER
M	MASTER CONTROL SECTION
D	DISTRIBUTION SECTION

FUEL STORAGE AREA

30,000 GALLON

30,000 GALLON

30,000 GALLON

30,000 GALLON

POWER GENERATION PLANT - OPTION 4

SCALE: 1/16" = 1'-0"

Option 4A

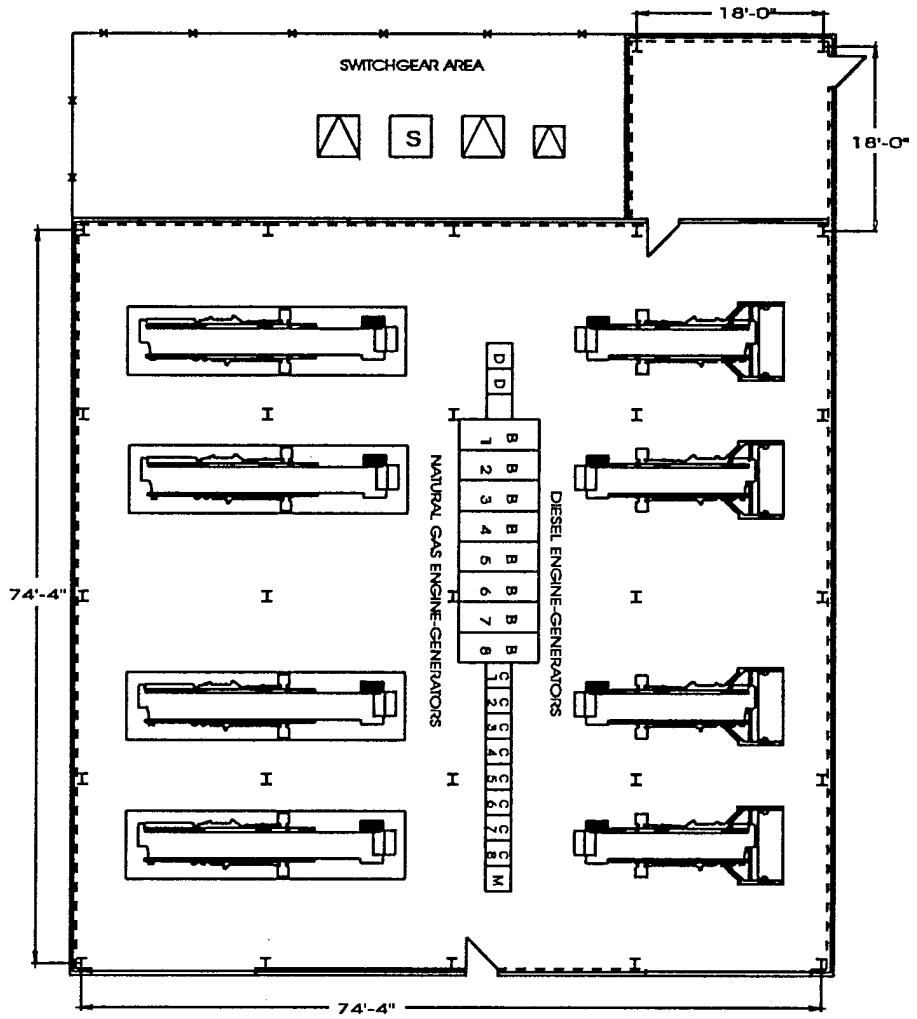
Total Investment	$4,400,645
First Year Savings	$814,393
SPB	5.40 Yrs
SIR	2.60

Option4B

Total Investment	$4,400,645
First Year Savings	$1,069,668
SPB	4.11 Yrs
SIR	3.45

Option 5

Total Investment	$7,077,797
Annual Fuel Costs	$287,182/Yr
Annual O & M Costs	$92,000/Yr
Electrical Savings (Energy, Demand, MSSG)	$1,678,540/Yr



NOTE:
RADIATORS MAY BE REMOTELY LOCATED OUTSIDE FACILITY FOR BETTER HEAT REJECTION.

LEGEND	
B 1	PT ROLL-OUT/BREAKER SECTION GENERATOR 1
C 1	CONTROL SECTION GENERATOR 1
S	PAD MOUNTED VACUUM SWITCH
	TRANSFORMER
M	MASTER CONTROL SECTION
D	DISTRIBUTION SECTION

FUEL STORAGE AREA

POWER GENERATION PLANT - OPTION 5

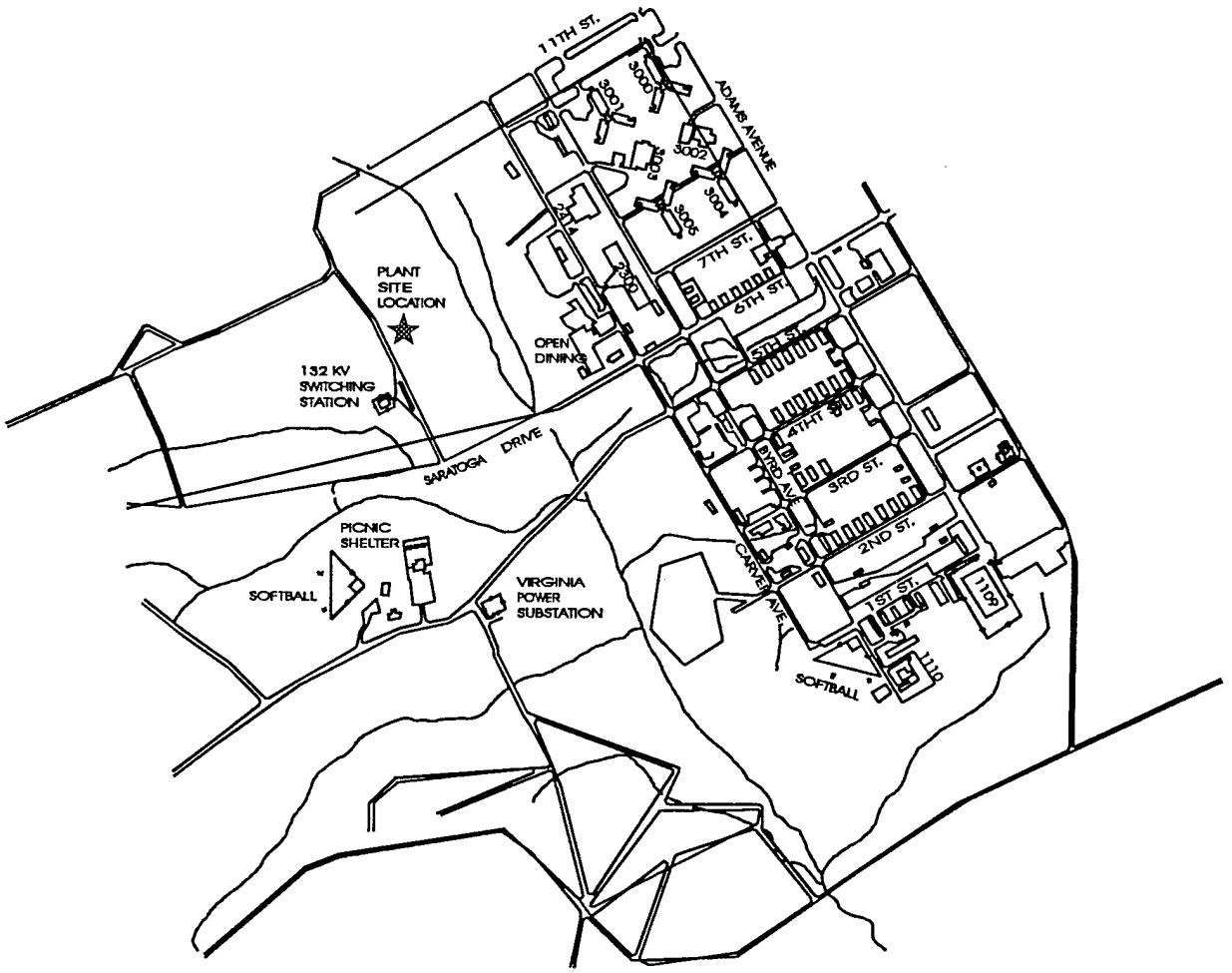
SCALE: 1/16" = 1'-0"

Option 5 - LCCA Summary

Total Investment	$7,077,797
First Year Dollar Savings	$999,386
SPB	7.79 Yrs
SIR	1.80

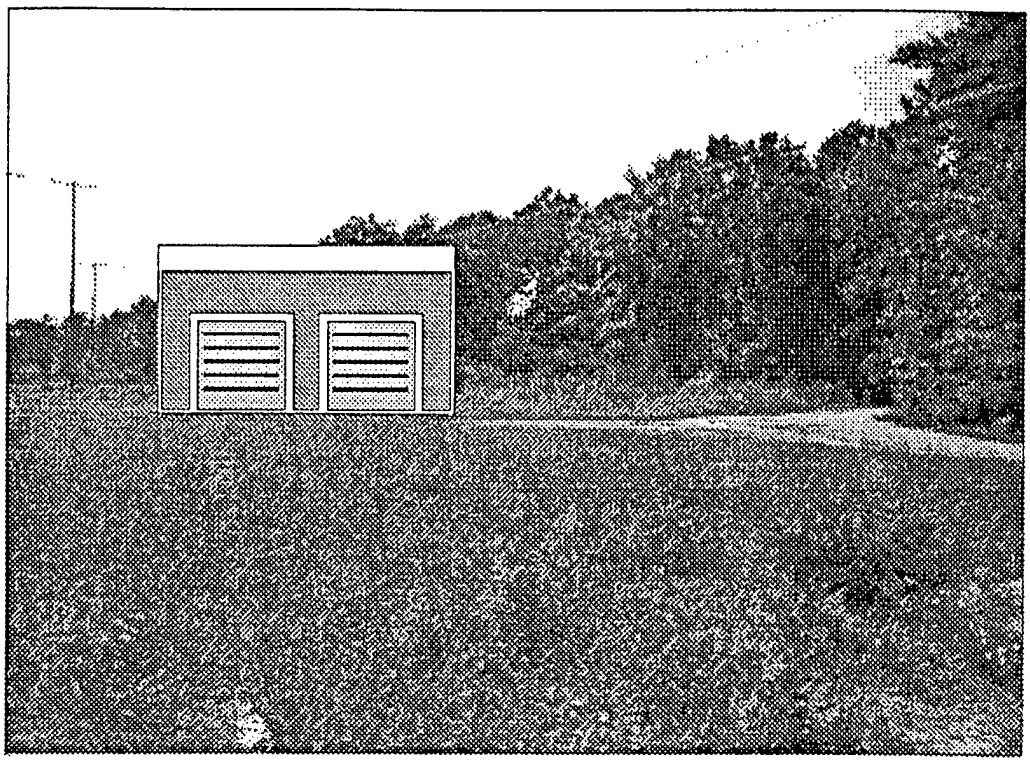
Project Summary by SIR

Option	*Total Investment*	*1st Yr Savings*	*SIR*	*SPB (Yrs)*
4B	$4,400,645	$1,069,668	3.45	4.11
4A	$4,400,645	$814,393	2.60	5.40
2	$2,243,848	$357,330	2.55	6.28
5	$7,785,577	$999,386	1.80	7.79
1	$1,889,888	$269,601	1.62	7.01
3	$5,768,210	$394,725	1.08	14.61



FORT LEE - SITE PLAN

SCALE: 1" = 750'-0"



Proposed Plant Location & Facility

SYSTEMScorp
SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION

21 December 1994

Norfolk District
ATTN: CENAO-EN-MC, Jim Kendall
803 Front Street
Norfolk, VA 23510

Dear Mr. Kendall:

RE: Minutes from Interim Review meeting and responses to comments

Enclosed with this letter are the minutes from the Interim Review meeting at Fort Lee on 02 December 1994. Also enclosed are the responses to the comments submitted by Ron Brown, DPW Fort Lee. Please contact me if there are any questions or comments regarding the enclosures.

Sincerely,

Keith A. Derrington

Keith A. Derrington, P.E.
Executive Vice President

CMA/kb

Enclosures

cc: Blaney Hill, ATBO-GFE
Mike Piner, ATCM-EP
Tony Battaglia, CESAM-EN-CM

INTERIM REVIEW MEETING MINUTES

02 December 1994

Attendees:

Keith A. Derrington	Systems Corp
Komson Wagner	Systems Corp
Ron Brown	DPW Fort Lee
Mike Piner	DPW Fort Lee
Jim Kendall	Norfolk District COE
Mehhoah Munshi	DPW Fort Lee
Gene Miller	DPW Fort Lee
William H. Barna	DPW Fort Lee
Joe M. Baassin	DPW Fort Lee

Systems Corp presented in slide format the project results from the Interim Report. Komson Wagner presented the material and discussed the methodology and approach used in the analysis.

Option 4, utilizing the GS-4 rate, was selected as the option to be developed into a project to be submitted for ECIP funding.

Report reviewers agreed to have all comments submitted to Jim Kendall and in turn to Systems Corp by 16 December 1994 so that the final report could be completed and submitted by year end.

INTERIM REPORT COMMENTS

Reviewer: Ron Brown
Fort Lee DPW

Comment 1: What parameters of operation will be available to the operator on the EMCS?

Response: The main parameters available to operators are minimum on, minimum off setting, sample period and demand interval, load add/shed table (set generator on off sequence), operator enable/disable of program or loads, and many others.

Comment 2: We need to meter both electrical output and the fuel input as a minimum for each unit.

Response: Agreed. The cost of metering has been included with the cost of the generator switchgear and with the generators' supporting equipment.

Comment 3: VA Power has a metering specification. We need to include if they are going to purchase the electricity generated during the winter.

Response: The VA Power metering specification can be included with the project in the design phase.

Comment 4: What does the personnel area look like? Need to provide a small office, kitchen, and break area.

Response: The layout of the personnel area has not yet been determined at this stage. Your input should be incorporated in the pre-design phase of the project.

Comment 5: Will the startup sequence move to the next unit if one or two fail to come on line? Or, will the EMCS operator or the on site operator have to do something at the controls?

Response: Yes. The software program can set engine start priority accordance to the input position of engine-generator on the shed table. If the demand reached the Minimum On set point, the program will execute the command for the next engine-generator to come on line until the demand level is satisfied, without operator input.

Comment 6: Will the requirement for number of units on line be stepped according to the shed MW needed? In 1.5 MW increments and not all 8 MW if 4 MW is needed.

Response: Yes, the engine-generators will follow the load and in start-up sequence as set by the shed table as described in Response 5. The engine-generators will sequence off-line, in reverse order, when the demand minimum off is reached.

Comment 7: Need an Excel Panel with all the necessary programs resident in the power plant facility in case of communication problems. This is in addition to the control and operating at the control console at 6206.

Response: Agreed, some redundancy is needed to cover the loss of communication lines. Excel Controllers along with local load control systems will provide local control. To be evaluated in detail during design stage.

Comment 8: Check the MSSG contract for exact requirements, but as I recall it will only allow the standby generators to be used for purposes other than standby 10% of the contracted hours. Not sure we can do any peak shaving with them.

Response: The study parameter is based on Fort Lee participating in MSSG only during the winter months (no MSSG credit was earned during the summer months) and peak shaving during the summer months which is the current mode of operation. In the event Virginia Power will no longer allow Fort Lee to practice current mode of operation, we recommend Fort Lee discontinue MSSG and just peak shave. The project will still be economically sound with the payback less than 6.5 years.