

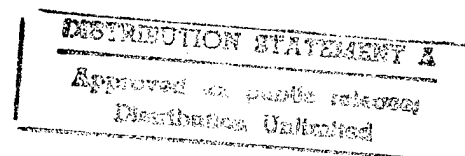
Limited Energy Study  
Postwide Share Generation/Peak Shaving Generation Plant  
Energy Engineering Analysis Program (EEAP)  
Fort Lee, Virginia

*EXECUTIVE SUMMARY*

CONTRACT #DACA01-94-D-0034  
SYSTEMS CORP PROJECT #94013.07  
DECEMBER 22, 1994



Norfolk District-  
US Army Corps  
of Engineers



**SYSTEMS***corp*

SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION

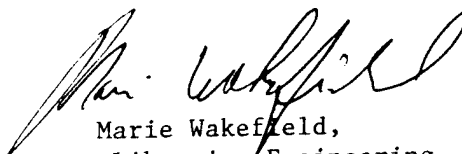


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
P.O. BOX 9005  
CHAMPAIGN, ILLINOIS 61826-9005

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## *EXECUTIVE SUMMARY*

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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: LEEOP4B  
LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

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 (+/-)

(1) DISCOUNT FACTOR (TABLE A) 14.88

(2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 179444.

\$ 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  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 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 %

## 1. EXECUTIVE SUMMARY

### *LIMITED ENERGY STUDY, FORT LEE, VIRGINIA*

#### 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.

## 1. EXECUTIVE SUMMARY

LIMITED ENERGY STUDY, FORT LEE, VIRGINIA

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:

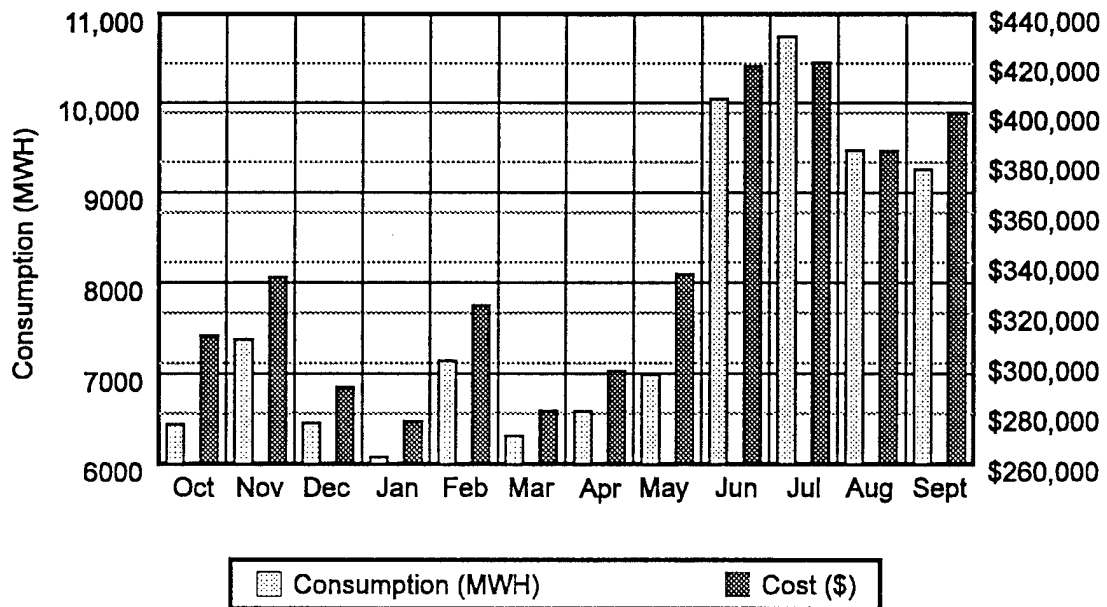
COST/KWH = \$0.01968 (No Demand)
COST/KW = \$12.62 (Monthly Demand)
COST/MWH = \$43.86 (Energy & Demand)

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
<b>TOTAL</b>	—	<b>92,870</b>	<b>\$4,073,350</b>	<b>\$43.86</b>
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. EXECUTIVE SUMMARY

### LIMITED ENERGY STUDY, FORT LEE, VIRGINIA

#### 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	—	—	—	—
<b>TOTAL</b>	<b>3,733</b>	<b>6,372</b>	<b>\$122,293</b>	<b>\$19.19</b>
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

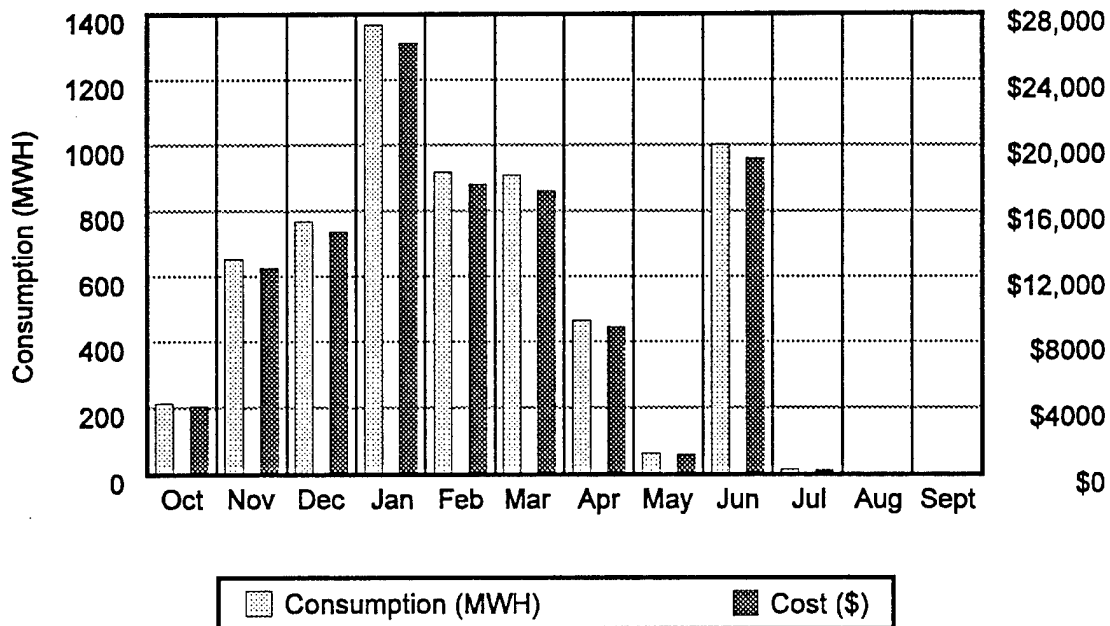
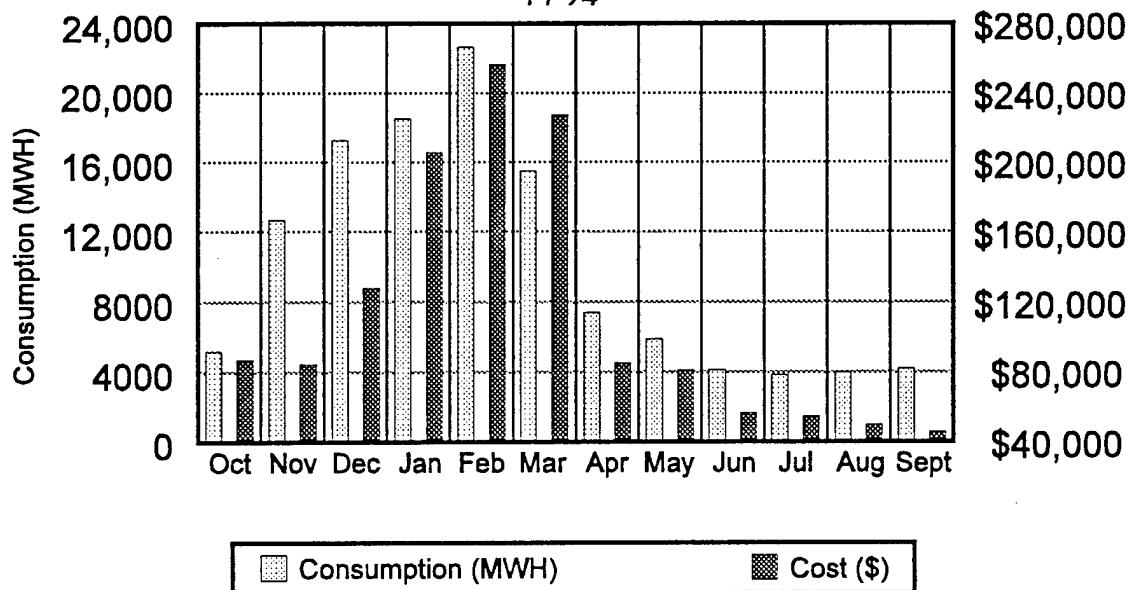


Table 1.3.3.1  
**Fort Lee Natural Gas**  
FY 94

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
<b>TOTAL</b>	<b>401,238</b>	<b>121,236</b>	<b>\$1,361,683</b>	<b>\$11.23</b>
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



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### LIMITED ENERGY STUDY, FORT LEE, VIRGINIA

- 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.

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*LIMITED ENERGY STUDY, FORT LEE, VIRGINIA*

### 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*.