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Central Heating and Power Plant Alternatives Review

Fort Wainwright, Alaska

Martin J. Savoie, John L. Vavrin, Michael R. Kemme,
Charles Schmidt, John Westerman, John Lanzarone,
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Martin J. Savoie, John L. Vavrin, and Michael R. Kemme

Construction Engineering Research Laboratory
Champaign, IL

Charles Schmidt

Schmidt & Associates, Inc.
Cleveland, OH

John Westerman

Science Applications International Corp.
Germantown, MD

John Lanzarone

Headquarters, U.S. Army Corps of Engineers (HQUSACE)
Washington, DC

Hank Gignilliat

Assistant Chief of Staff for Installation Management (ACSIM)
Alexandria, VA

Norm Miller

Fosdick & Hilmer, Inc.
Cincinnati, OH

Final Report

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Washington, DC 20314-1000

ABSTRACT: The Fort Wainwright (FWA) military community has a critical need to establish its power and heating requirements to successfully complete a series of planned capital improvements. The CHPP upgrade coincides with an expansion of FWA's mission within the next 5 years. To help the installation successfully complete these changes within the specified time frame, the Construction Engineering Research Laboratory (CERL) conducted an independent technical assessment of the FWA CHPP in which: (1) the current condition, capabilities, and maintenance status of the FWA CHPP were evaluated; (2) recent performance tests and supporting combustion data were evaluated to determine baseline-operating conditions and efficiencies; (3) regional private sector opportunities were investigated; (4) current heating and power loads and projected loads were reviewed based on master plans; and (5) alternatives to the current CHPP were developed and recommendations made to implement the most cost effective combinations of technologies that would meet required heating and power loads.

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Conversion Factors

Non-SI[*] units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
cubic feet	0.02831685	cubic meters
cubic inches	0.00001638706	cubic meters
degrees (angle)	0.01745329	radians
degrees Fahrenheit	(5/9) x (°F – 32)	degrees Celsius
degrees Fahrenheit	(5/9) x (°F – 32) + 273.15.	kelvins
feet	0.3048	meters
gallons (U.S. liquid)	0.003785412	cubic meters
horsepower (550 ft-lb force per second)	745.6999	watts
inches	0.0254	meters
kips per square foot	47.88026	kilopascals
kips per square inch	6.894757	megapascals
miles (U.S. statute)	1.609347	kilometers
pounds (force)	4.448222	newtons
pounds (force) per square inch	0.006894757	megapascals
pounds (mass)	0.4535924	kilograms
square feet	0.09290304	square meters
square miles	2,589,998	square meters
tons (force)	8,896.443	newtons
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

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[*] *Système International d'Unités* ("International System of Measurement"), commonly known as the "metric system."

Preface

This study was conducted for Assistant Chief of Staff for Installation Management under Military Interdepartmental Purchase Request (MIPR) 2JCERG4065, "Assessment of Required Power and Heat for Fort Wainwright Military Command, Alternatives to Current System and Recommendations for Future Work"; Work Unit CFM; Task GB22. The technical monitor was Hank Gignilliat, DAIM-FDF-U.

The work was performed by the Energy Branch (CF-E) of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The CERL Principal Investigator was Martin J. Savoie. Part of this work was done by Schmidt Associates, Inc, Cleveland, OH under contract No. DACA88-98-D-0001, delivery order No. 0014 and Science Applications International Corporation, Germantown, MD under contract No. DACA88-98-D-0003, delivery order No. 0013. The technical editor was William J. Wolfe, Information Technology Laboratory. Thomas Hartranft is Chief, CEERD-CF-E, and Michael Golish is Chief, CEERD-CF. The associated Technical Director was Gary W. Schanche, CEERD-CV-T. The Director of CERL is Dr. Alan W. Moore.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL John Morris III, EN and the Director of ERDC is Dr. James R. Houston.

1 Introduction

Background

The Fort Wainwright (FWA) military community has a critical need to establish its power and heating requirements to successfully complete a series of planned capital improvements. By 2005, the Central Heating and Power Plant (CHPP) will have had over $90 million worth of planned capital improvements. If unforeseen deficiencies are found, it is estimated that his figure may rise even higher. The boiler and systems upgrade, originally estimated to cost $29 million, has increased to $45 million. The baghouse project, originally awarded for $25 million, may need additional funds. The cooling system upgrade, a congressional add-on that would have been awarded in September 2002, is estimated at $23 million. FWA has recently requested an additional $60M to correct all deficiencies and for other anticipated projects. However, according to plant personnel, only about $25 million is needed to complete the current OMA project and to keep the plant operation for 10+ years.

The CHPP upgrade coincides with FWA's expanding mission. FWA is scheduled to receive the Stryker Brigade Combat Team (SBCT), a new high-tech training simulator and a new hospital, all to come on-line within the next 5 years. To help the installation successfully complete these changes within the specified time frame, the Office of the Assistant Chief of Staff for Installation Management (ACSIM) requested the U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC/CERL) to conduct an independent technical assessment of the FWA CHPP to:

1. Determine the status of the central heating plant, electrical generation capability, and distribution systems
2. Assess whether FWA can successfully operate throughout the 2002/3 Winter season with the current facility and the progress of the upgrades
3. Assess whether the long and short-term recommendations and assumptions that formed the basis for the upgrade project, are still valid
4. Recommend how the new SBCT may best be integrated with the plant modernization and capacity
5. Determine future planning considerations, in addition to the SBCT
6. Assess the reliability of the local power producer.

Objective

The objective of this project was to assess the condition of the Fort Wainwright Central Heat and Power Plant, analyze alternatives to the current system, develop recommendations for future project work, and provide feedback to senior Army leadership. The project also developed an interim solution to reduce large capital investments in a less-than-optimal strategy and allow time to develop a more detailed long term, regional solution.

Approach

CERL lead the assessment team with contracted assistance from Science Applications International Corp. (SAIC) and Schmidt Associates, Inc. (Appendix A includes a description of the contractors' qualifications.) Other team members were Mr. Hank Gignilliat, DAIM-FDF-UE, Mr. John Lanzarone, HQUSACE, and Mr. Norm Miller, Fosdick & Hilmer. Also critical to the investigation were coordination and information gathering efforts by the Pacific Ocean Division (POD) and Alaska District Corps of Engineers and Fort Wainwright Directorate of Public Works staff. The team made an independent technical assessment of the FWA CHPP in the following steps:

1. The current condition, capabilities, and maintenance status of the FWA CHPP were evaluated.
2. Recent performance tests and supporting combustion data were evaluated to determine baseline-operating conditions and efficiencies.
3. Regional private sector opportunities were investigated.
4. Current heating and power loads and projected loads were reviewed based on master plans.
5. Alternatives to the current CHPP were developed with an emphasis on the most cost effective combinations of technologies that would meet required heating and power loads.
6. Draft versions of this report were an integral part of the communication-feedback process that resulted in the final recommendations of this work. Appendix B summarizes developments that followed team assessment and analysis conducted June-July 2002.
7. This report attempts to document the field data and quick analysis that allowed the team to identify an interim solution to the current CHPP modernization strategy. The report also provides a not so robust life cycle cost analysis of several potential options for meeting FWA energy requirements that could support a long-term regional solution. The interim solution was subsequently investigated

in more detail by POD and ERDC/CERL during the development of 1391s for implementing the interim solution.

Mode of Technology Transfer

The results of this study will be transmitted to Fort Wainwright, USARAK, USARPAC and ACSIM for implementation, and will be made available through the World Wide Web (WWW) at URL:

www.cecer.army.mil

It is anticipated that the results of this work will be used to provide lessons learned to other CHPPs in support of both Federal and private sector goals of improving current and future heating and power requirements.

Units of Weight and Measure

U.S. standard units of measure are used throughout this report. A table of conversion factors for Standard International (SI) units is provided below.

SI conversion factors		
1 in.	=	2.54 cm
1 ft	=	0.305 m
1 yd	=	0.9144 m
1 sq in.	=	6.452 cm^2
1 sq ft	=	0.093 m^2
1 sq yd	=	0.836 m^2
1 cu in.	=	16.39 cm^3
1 cu ft	=	0.028 m^3
1 cu yd	=	0.764 m^3
1 gal	=	3.78 L
1 lb	=	0.453 kg
1 kip	=	453 kg
1 psi	=	6.89 kPa
°F	=	(°C x 1.8) + 32

2 Plant Configuration and Requirements

Plant Overview

The CHPP consists of six, 150,000 lb/hr coal-fired stoker boilers that produce 425 psig steam at 650 °F. Two original boilers (not included in this count) are no longer functional and have been abandoned in place. The CHPP has five steam turbine generators, three 5 MW condensing generators, a 2 MW condensing generator, and a 5 MW non-condensing generator.

The steam is used to run the turbines to generate electricity and provide heating to the installation through a network of utilidors. The turbines use steam at a pressure of 400 psig. Steam is supplied to the utilidors at 100 psig. The utilidors protect most of the utilities to the buildings on the installation including steam for heating, potable water, and sewer. The system has been designed so that the heat from the steam provides freeze protection to the potable water, and sewer during the extreme cold winter temperatures. Hot water heaters are used to produce domestic hot water (DHW) in each building. If these services freeze during the winter, the installation will become nonfunctional and all personnel would need to be evacuated.

Condenser cooling water is provided from a cooling pond located adjacent to the CHPP. During the winter months, this pond creates a fog that moves across the valley and onto a nearby highway, which results in an unsafe visibility situation for vehicles. To address this issue, a plan is underway to install an air-cooled condenser and eliminate the pond as a source of cooling.

Coal is delivered to the plant by rail. The coal is mined near Healy, AK and is purchased from Usibelli Coal Mine, Inc. FWA maintains a coal pile for inventory. The typical inventory is a 90-day supply.

Current Upgrade Strategy

After a study by Raytheon to evaluate options for the FWA CHPP was completed in 1996, a decision was made to move forward with the option of renovating the power plant to extend the plant's useful life by 25 years. The initial project included refurbishment and a new baghouse, but due to budgets and timing issues, the baghouse was taken out of the scope of work with the intent to pursue it at a later time. The planned refurbishment was to include rebuilding the turbine generators, retubing the condensers, new boiler stokers, new boiler grates, ID fans, a thaw shed, 12.47 kV switchgear, replacement of the ash handling piping, and steam piping modifications. The plant was initially given an approved budget of $25 million to conduct the upgrade. The budget for the core upgrade work was $19,690,000. In addition the following options were also funded:

- Coal Unloading Equipment: $ 1,278,000
- Condensate Polishers: $ 493,300
- Replace Continuous Blow Down: $ 24,700
- Coal Handling System: $ 4,504,700.

As the refurbishment project progressed, additional issues were identified, specifically, the need to replace failing super heater tubes and refractory tiles within the boilers. Currently, the boilers can only be operated at 69 percent of their capacity. In April 2002, the approved budget for the refurbishment was increased to $45 million. In addition, budgets were approved for the baghouse ($21 million) and the air-cooled condenser ($23 million).

Since that time, FWA has been served with a notice of violation and a fine of $16,000,000 from the U.S. Environmental Protection Agency (USEPA) for exceeding opacity limits from the CHPP. To stay within the environmental regulations, each boiler is limited to 85,000 lb/hr operation.

- Upgrade Project:$25M OMA approved, June 2000
    - $29M OMA re-approved, September 2000
    - $45M OMA re-approved, April 2001
    - $105M OMA re-approval required, April 2002
- Baghouse Project: $21M MCA, awarded May 2002
- Cooling System: $23M MCA, award scheduled, September 2002
- Utilidor Upgrades: > $100M OMA, $10M/year
- USEPA NOV for opacity, $2M: Limits each boiler to 85 kpph.

Current Energy Requirements

Data was provided by FWA from the CHPP control system. The focus of the data was the most recent 12-month period. However, not all data was available. A summary of the available monthly data follows.

Coal Consumption

Table 1 outlines the FWA CHPP monthly coal consumption from April 2001 through May 2002. Figure 1 shows this monthly usage.

Between June 2001 and May 2002, the CHPP consumed 197,419 tons of coal. At an average cost of about $46.50/ton ($36.50 for purchase, $9.94 for delivery), the CHPP's annual cost for coal is $8,993,851.

Table 1. Monthly coal consumption with daily and hourly averages.

Month	Coal Monthly Total Tons	Daily Average Tons	Hourly Avg.
Apr-01	13,614.2	453.8	18.9
May-01	14,532.7	468.8	19.5
Jun-01	11,517.1	371.5	15.5
Jul-01	10,745.7	346.6	14.4
Aug-01	11,837.3	381.8	15.9
Sep-01	12,619.9	420.7	17.5
Oct-01	16,442.7	530.4	22.1
Nov-01	19,616.5	653.9	27.2
Dec-01	22,216.5	716.7	29.9
Jan-02	21,066.9	679.6	28.3
Feb-02	19,681.0	702.9	29.3
Mar-02	20,265.8	653.7	27.2
Apr-02	16,853.3	561.8	23.4
May-02	14,556.3	469.6	19.6

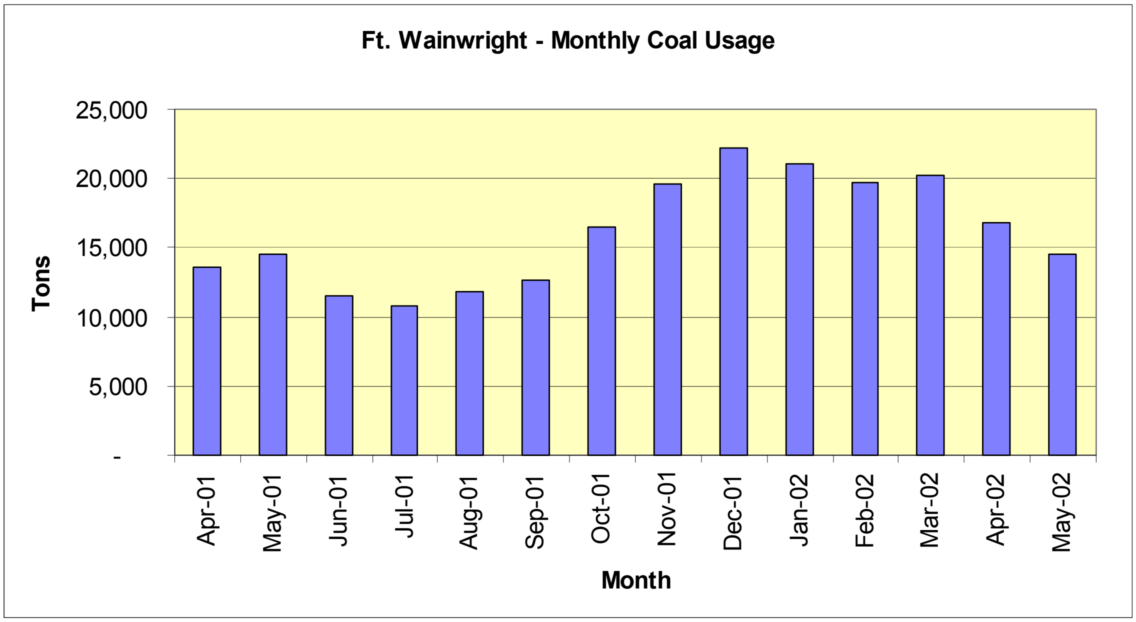

Figure 1. Monthly coal consumption (tons).

Electric Generation

Table 2 summarizes the electricity generated by the FWA plant as well as the imports and exports attributed to the Golden Valley Electric Association (GVEA), the electric utility that serves Fairbanks. The GVEA numbers are those as measured at the substation and do not include electricity transferred across the backdoor intertie. The "GVEA import" amount was to replace power unavailable due to turbine rebuild and other CHPP projects.

The consumption of electricity has a seasonal characteristic with the peak usage occurring during the winter months. Figure 2 presents the monthly totals for electricity generated by the CHPP and the net electric usage for FWA. Net usage is equal to the CHPP generation + GVEA Import – GVEA Export. The total net electric consumption by FWA between June 2001 and May 2002 was 90,783 MWh.

Steam usage for FWA and the CHPP is highest during the winter months due to the high electric demand and the high thermal demand associated with the cold weather. The data for the amount of steam used for power during the months of July through October 2001 (Table 3) appear to be incorrect as the values are extremely low. The FWA personnel were not able to explain the data anomalies. Figure 3 shows total steam usage by month.

Table 2. Fort Wainwright's monthly electrical generation, and GVEA's monthly import and export totals.

	Generator			GVEA Import		GVEA Export	
Month	Monthly Total MWh	Daily Average MWh	Hourly Avg MWh	Monthly Total	Daily Average	Monthly Total	Daily Average
Apr-01	6,355.0	211.8	8.8	640.9	21.4	374.8	12.5
May-01	7,833.5	252.7	10.5	33.2	1.1	815.4	26.3
Jun-01	6,300.0	203.2	8.5	13.9	0.4	842.1	27.2
Jul-01	5,737.1	185.1	7.7	34.2	1.1	780.3	25.2
Aug-01	5,884.0	189.8	7.9	113.2	3.7	808.8	26.1
Sep-01	5,981.4	199.4	8.3	185.3	6.2	493.7	16.5
Oct-01	8,181.2	263.9	11.0	588.1	19.0	196.4	6.3
Nov-01	8,923.5	297.5	12.4	443.7	14.8	567.0	18.9
Dec-01	9,368.1	302.2	12.6	639.1	20.6	408.7	13.2
Jan-02	10,109.2	326.1	13.6	213.6	6.9	596.1	19.2
Feb-02	9,195.5	328.4	13.7	237.2	8.5	643.7	23.0
Mar-02	9,453.9	305.0	12.7	154.3	5.0	720.2	23.2
Apr-02	7,650.3	255.0	10.6	427.8	14.3	612.6	20.4
May-02	7,605.0	245.3	10.2	500.8	16.2	487.5	15.7

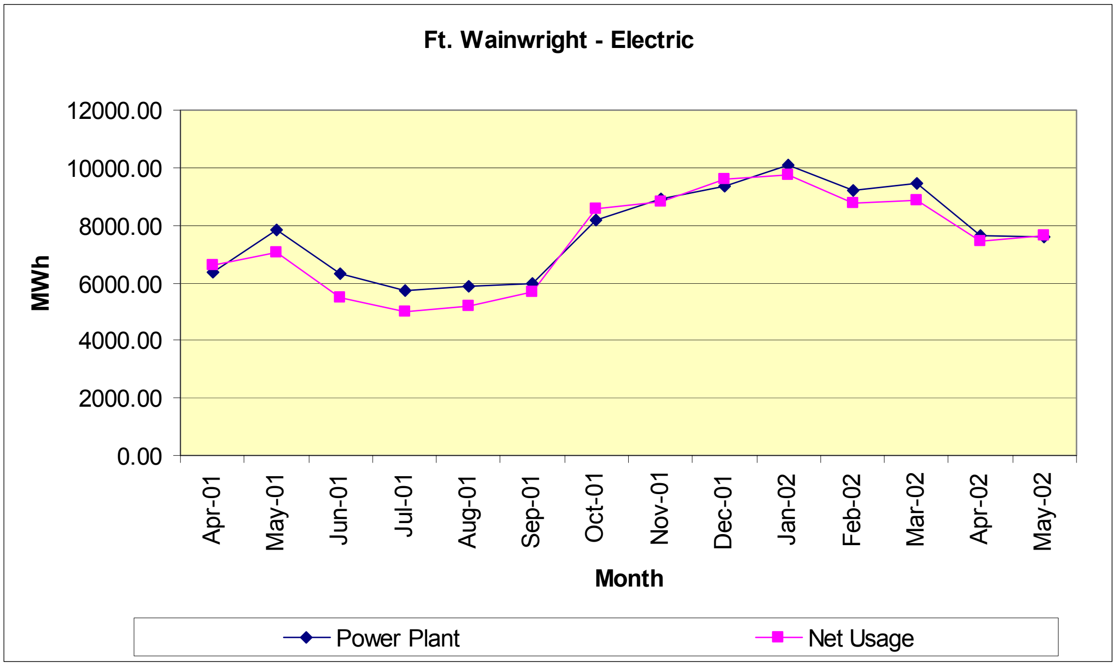

Figure 2. FWA's CHPP monthly totals of electrical generation, and the net electric usage for FWA.

Table 3. FWA monthly steam usage for heat and power.

	Total Steam		Steam or Heating		Steam for Power	
Month	**Monthly Total klbs**	**Daily Average klbs**	**Monthly Total klbs**	**Daily Average klbs**	**Monthly Total klbs**	**Daily Average klbs**
Apr-01	149,806.2	4993.5	109,839.6	3661.3	39,994.5	1,333.2
May-01	159,925.9	5158.9	114,358.0	3689.0	45,583.6	1,470.4
Jun-01	126,734.8	4088.2	87,850.9	2833.9	38,903.2	1,254.9
Jul-01	118,245.3	3814.4	102,660.0	3311.6	15,603.9	503.4
Aug-01	130,244.0	4201.4	124,039.4	4001.3	6,239.6	203.1
Sep-01	138,844.8	4628.2	135,945.3	4531.5	2,947.0	98.2
Oct-01	180,947.3	5837.0	177,890.5	5738.4	3,070.9	99.1
Nov-01	215,829.7	7194.3	158,748.6	5291.6	57,145.6	1,904.9
Dec-01	244,484.8	7886.6	142,141.7	4585.2	102,364.7	3,302.1
Jan-02	231,799.9	7477.4	122,446.6	3949.9	109,409.9	3,529.4
Feb-02	216,574.5	7734.8	109,076.6	3895.6	107,525.4	3,840.2
Mar-02	223,010.8	7193.9	106,102.8	3422.7	116,936.5	3,772.1
Apr-02	149,806.2	4993.5	109,839.6	3661.3	39,994.5	1,333.2
May-02	160,149.8	5166.1	64,992.9	2096.5	95,210.9	3071.3

Heating Loads

The total annual steam requirement for heating between June 2001 and May 2002 was 1,441,735 klb. To better characterize the heat load requirements for FWA, the heating data was analyzed on a daily basis and then simple daily averages were calculated to identify representative heating rates. Table 4 lists those heat load requirements by month, with daily and hourly averages. Figure 4 charts the maximum, minimum, and average hourly heating loads by month.

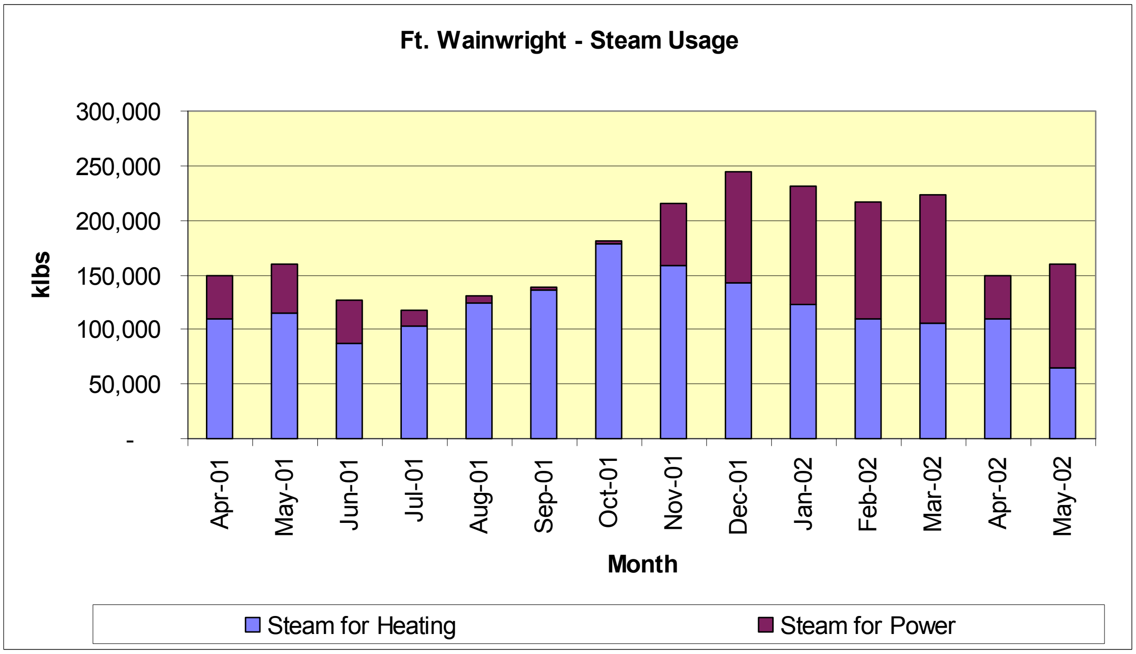

Figure 3. FWA monthly steam usage for heat and power.

Table 4. FWA daily and hourly steam requirements for heat (k-lbs).

Month	Daily			Hourly		
	Ave	Max	Min	Ave	Max	Min
May-01	3,689.0	4,892.9	2,346.8	153.7	203.9	97.8
Jun-01	2,833.9	4,467.9	2,567.8	118.1	186.2	107.0
Jul-01	3,311.6	4,241.3	2904.3	138.0	176.7	121.0
Aug-01	4,001.3	4,516.5	3,240.7	166.7	188.2	135.0
Sep-01	4,531.5	5,414.0	3,592.5	188.8	225.6	149.7
Oct-01	5,738.4	6,861.5	2,381.7	239.1	285.9	99.2
Nov-01	5,291.6	6,525.8	3,870.7	220.5	271.9	161.3
Dec-01	4,585.2	5,306.3	3,596.1	191.1	221.1	149.8
Jan-02	3,949.9	5,062.5	3,395.1	164.6	210.9	141.5
Feb-02	3,895.6	4,413.6	2,979.0	162.3	183.9	124.1
Mar-02	3,422.7	3,909.2	2,790.0	142.6	162.9	116.2
Apr-02	3,286.8	3,938.5	1,206.1	137.0	164.1	50.3
May-02	2,096.5	3,034.7	1,176.3	87.4	126.4	49.0

Data initially received for July 2001 showed a minimum demand of zero. This was assumed to be a data anomaly, and was changed to the average of June and August 2001.

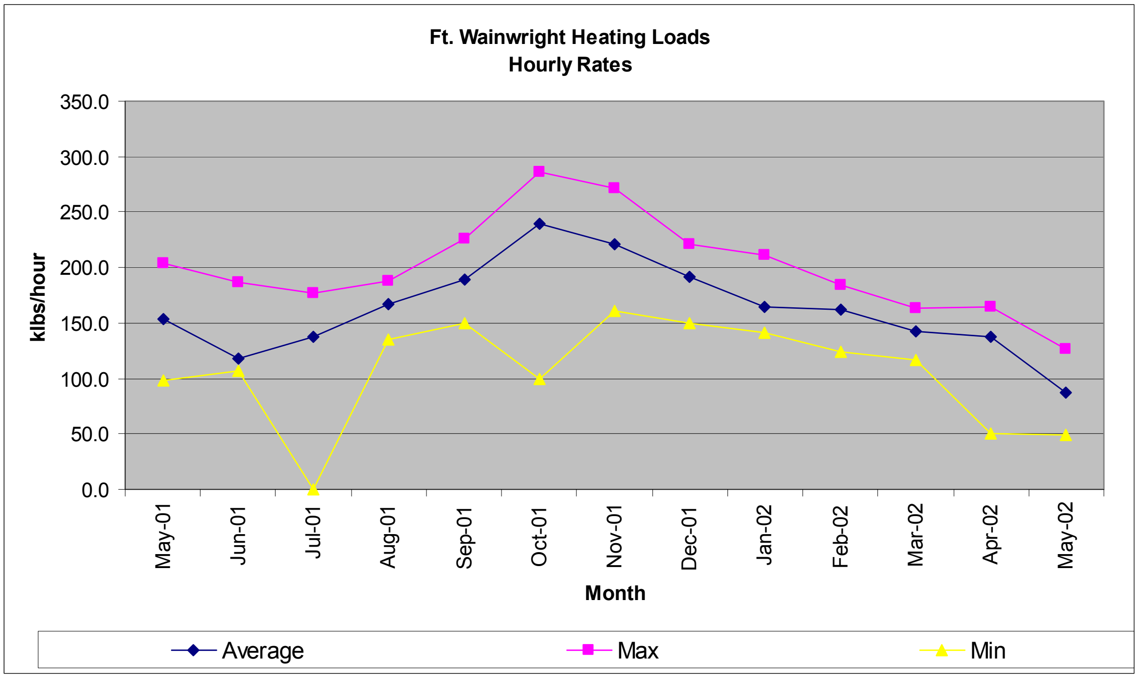

Figure 4. FWA hourly steam requirements for heat.

Electric Loads

To better characterize the electric load requirements for FWA, the electric data was analyzed on a daily basis and then simple daily averages were calculated to identify representative electric demands. Table 5 summarizes the daily FWA generator loads by month. Data for July 2001 shows that the minimum demand was zero, but this is assumed to be an anomaly in the data.

Table 5. FWA daily generator loads.

	Generator Loads (MW)		
Month	Average	Max	Min
May-01	10.5	11.5	7.3
June-01	8.5	11.4	7.6
Jul-01	7.7	8.5	0.0
August-01	7.9	8.5	5.0
Sep-01	8.3	11.3	5.5
October-01	10.9	13.9	6.1
Nov-01	12.4	15.8	8.6
December-01	12.5	14.9	6.8
Jan-02	13.5	15.5	11.6
February-02	13.7	14.9	9.0
Mar-02	12.7	14.0	9.8
April-02	10.6	12.9	3.1
May-02	10.2	12.1	8.0

During the period of data analyzed, the peak electric output from the CHPP occurred in November 2001 and was approximately 16 MW for the day. Figure 5 shows a chart crated from the information listed in Table 5.

Peak Day Profile

To gain insight into the hourly load profile of steam and electric generation, the peak electric day data was obtained from FWA. The peak day was 6 November 2001. Table 6 lists the hourly data for 6 November.

The peak electrical output for the day was 17.22 MW. The maximum total steam generation was 349.47 kph, which was coincident with the peak heating load of 264.9 kph. The peak steam load for generation was 86.55 kph. Figure 6 shows the thermal load profile, and Figure 7 shows the generator load profile as listed in Table 6.

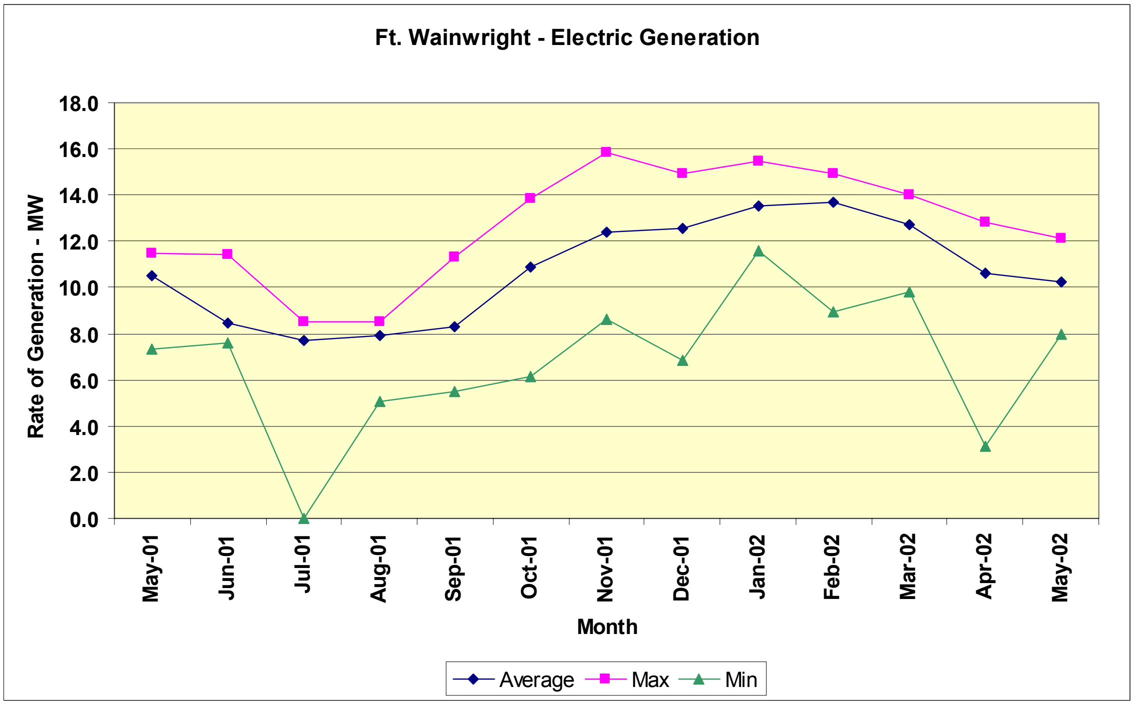

Figure 5. FWA daily generator loads.

Table 6. FWA steam and electrical generation during peak demand day, 6 November 2001.

	Steam Flow (klbs/hr			Electric Generation (MW)
Total	Total	Heating	Power	
01:00:00	301.5	245.2	58.7	14.3
02:00:00	302.5	246.2	56.4	14.1
03:00:00	298.3	247.0	51.3	14.1
04:00:00	306.0	250.3	55.5	14.0
05:00:00	309.6	255.2	54.5	14.1
06:00:00	317.9	259.8	58.0	14.6
07:00:00	325.0	259.5	65.6	15.3
08:00:00	344.5	262.7	82.0	16.8
09:00:00	349.4	264.9	84.3	17.2
10:00:00	341.5	261.5	79.9	16.7
11:00:00	343.1	259.2	83.7	16.8
12:00:00	343.2	258.6	84.6	16.9
13:00:00	338.1	254.8	83.1	16.7
14:00:00	337.0	253.9	83.0	16.7
15:00:00	334.6	251.5	83.1	16.6
16:00:00	334.5	252.1	82.3	16.6
17:00:00	337.6	252.3	85.3	16.8
18:00:00	336.7	250.1	86.5	16.8
19:00:00	330.0	248.6	81.3	16.6
20:00:00	326.3	248.3	78.0	16.2
21:00:00	322.8	247.6	75.0	15.8
22:00:00	321.1	246.8	74.4	15.7
23:00:00	316.6	247.9	68.7	15.2
24:00:00	314.0	250.8	63.0	14.7
Average	***326.3***	***253.1***	***73.3***	***15.8***
Maximum	***349.4***	***264.9***	***86.5***	***17.2***
Minimum	***298.3***	***245.2***	***51.3***	***14.0***

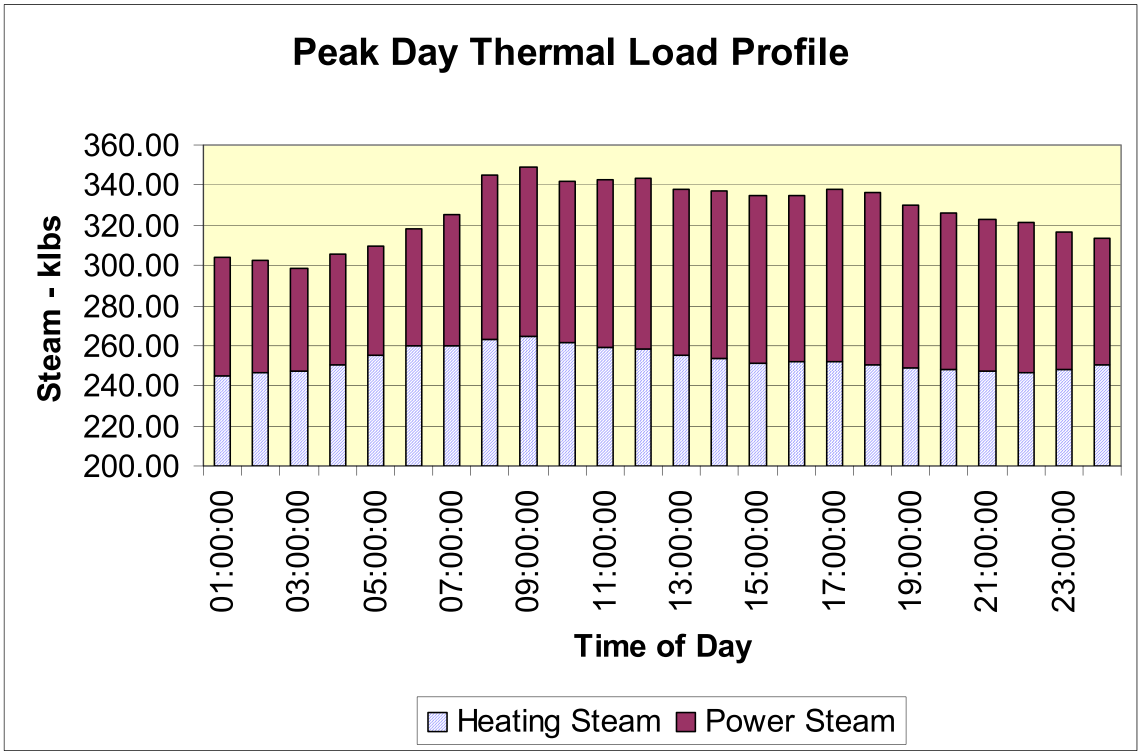

Figure 6. Thermal load profile during peak demand day, 6 November 2001.

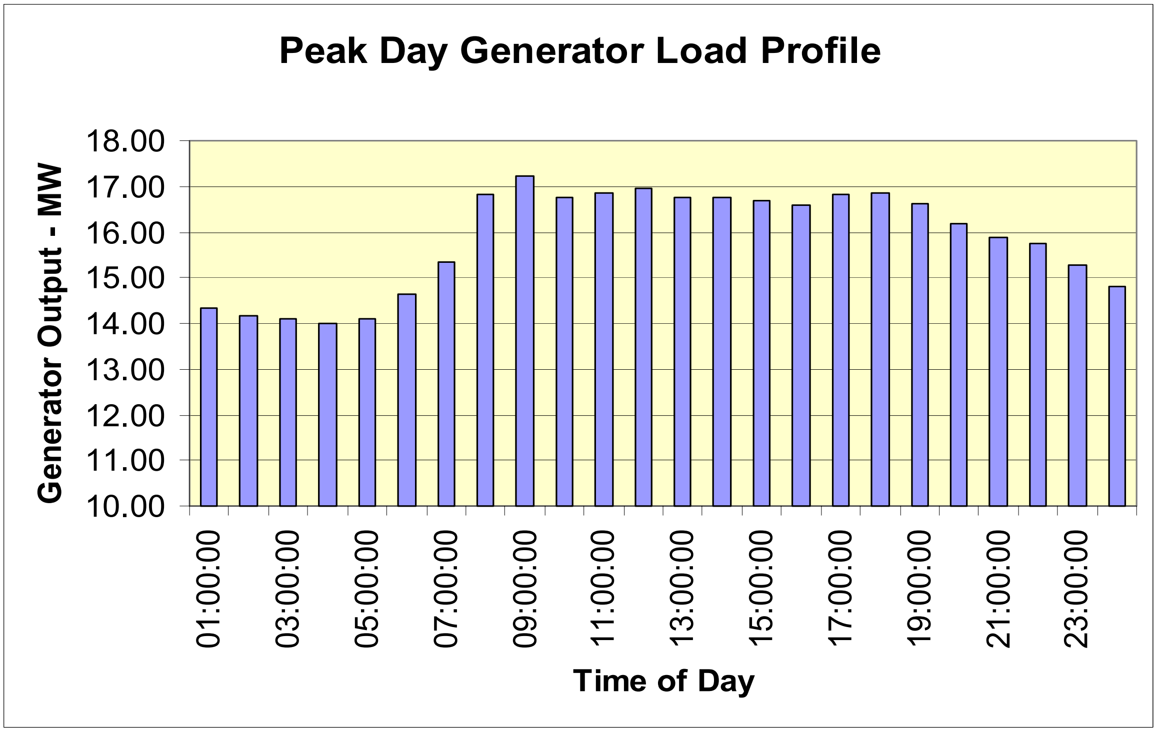

Figure 7. Generator load profile during peak demand day, 6 November 2001.

3 Peak Load Growth

FWA personnel indicated that the observed peak electric output from the CHPP that was 18.4 MW. This is slightly higher than the peak output identified in the data of 17.22 MW. The FWA personnel also mentioned that the peak heating load is approximately 275 kph, which is also slightly higher that the 265 kph identified in the data.

FWA is expected to have growth in electric and heating loads over the next several years. The three major projects that will affect increased demand are:

1. 2003/2004 New Combat Simulator
   a. Electric Demand: 2.0 MW
   b. Heating Demand: 10 kph
   c. New hospital heating demand: 5 kph
2. 2005/2006 New Hospital
   a. Electric Demand: 3.8 MW
   b. Heating Demand: 20 kph
   c. Hospital construction complete; reduce heating load: -5 kph
3. 2006/2007 SBCT and New Family Housing
   a. Electric Demand: 2.0 MW
   b. Heating Demand: 15 kph.

Table 7 lists the resulting peak load requirements.

Table 7. FWA peak load requirements.

Winter of	Heat (kph)	Electric (MW)	Total Steam (kph)
2002/2003	275	18.4	440
2003/2004	290	20.4	454
2004/2005	290	20.4	454
2005/2006	305	24.2	468
2006/2007	320	26.2	482

FWA Climate

Several unique aspects of the climate in the Fairbanks, AK area raise concerns for reliability and safety that do not apply Army facilities in more temperate locations. Low temperatures below 0 °F occur regularly, and extremes of –60 °F have been recorded in 3 of the winter months. FWA has indicated that a power outage for longer than 4 hours during one of the extreme temperature events would result in complete freeze-up of the buildings and facilities, causing irreparable damage. The sustained below 0 °F temperatures, atmospheric stability, and presence of airborne particulates (pollution) lead to ice fog for various sources of moisture. Ice fog stars to develop at –40 °F, but will occur at warmer temperatures of –20 °F when the air contains particles such as those from vehicle emissions and coal power plants. One large moisture source is the evaporative cooling pond for the CHPP. A resolution of the fog problems caused by the cooling pond has been requested by the local air quality agency. Appendix C contains a brief discussion of the climate and ice fog issues for Fairbanks.

ASHRAE provides the following climate conditions for the Fairbanks region:

- Elevation: 436 ft
- Winter Outdoor Design Dry Bulb Temperature (99%): -51 °F
- Summer Outdoor Design Dry Bulb Temperature (1%): 82 °F
- Summer Outdoor Design Wet Bulb Temperature (1%): 64 °F.

Table 8 lists the annual average degree days (Base 65) based on 50-year data.

Table 9 lists the monthly average temperatures based on data collected between 1949 and 2000.

As expected the minimum temperatures occur in December, January, and February where the average minimum temperature is –16.5 °F. Extreme minimum temperatures for these months are:

- December: -62 °F occurred on 12/22/99
- January: -61 °F occurred on 01/15/81
- February: -58 °F occurred on 02/23/87.

Table 8. Heating and Cooling Degree Days for FWA (50 year average, source: Western Regional Climate Center).

Month	Heating Degree Days (Base 65)	Cooling Degree Days (Base 65)
January	2,342	0
February	1,937	0
March	1,672	0
April	1,011	0
May	508	1
June	174	21
July	121	31
August	272	6
September	601	0
October	1,253	0
November	1,853	0
December	2,240	0
Total	**13,984**	**59**

Table 9. Monthly average temperatures (max, min, mean) for FWA (source: Western Regional Climate Center).

	Monthly Averages (^{o}F)		
Month	**Max**	**Min**	**Mean**
January	-1.5	-19.2	-10.5
February	7.5	-14.7	-3.5
March	24.1	-2.3	11.1
April	42.3	20.3	31.3
May	59.8	37.5	48.6
June	70.8	49.0	59.9
July	72.4	51.8	62.1
August	66.2	46.6	56.4
September	54.5	35.5	45.0
October	31.9	17.1	24.6
November	11.5	-5.0	3.2
December	1.2	-15.7	-7.2

FWA Correlation of Temperature to Steam Load for Heating

FWA provided SAIC with historical weather data covering the same time period as the CHPP operational data. The weather data contained the maximum and minimum temperature temperatures for each day. The data contained information for only Monday through Friday. The weather data was matched to the steam heating data. An XY plot and linear regression was developed to identify the correlation between the outdoor ambient temperature and the steam heating load (Figure 8).

Figure 8 shows that the data is scattered and that a tight correlation between temperature and heating load is not likely. The regression that was run on the data has an R^2 of 0.17, which indicates that the outdoor daily average minimum temperature explains 17 percent of the variation in the daily average steam heating load. Thus, additional drivers (not identified) influence the heating load of the CHPP. Figure 9 shows the regression line along with the raw data.

At the extreme minimum temperature of –60 °F, the steam heating load is estimated to be 221 kph based on the regression. This is less than the 275 kph estimated as the current peak demand.

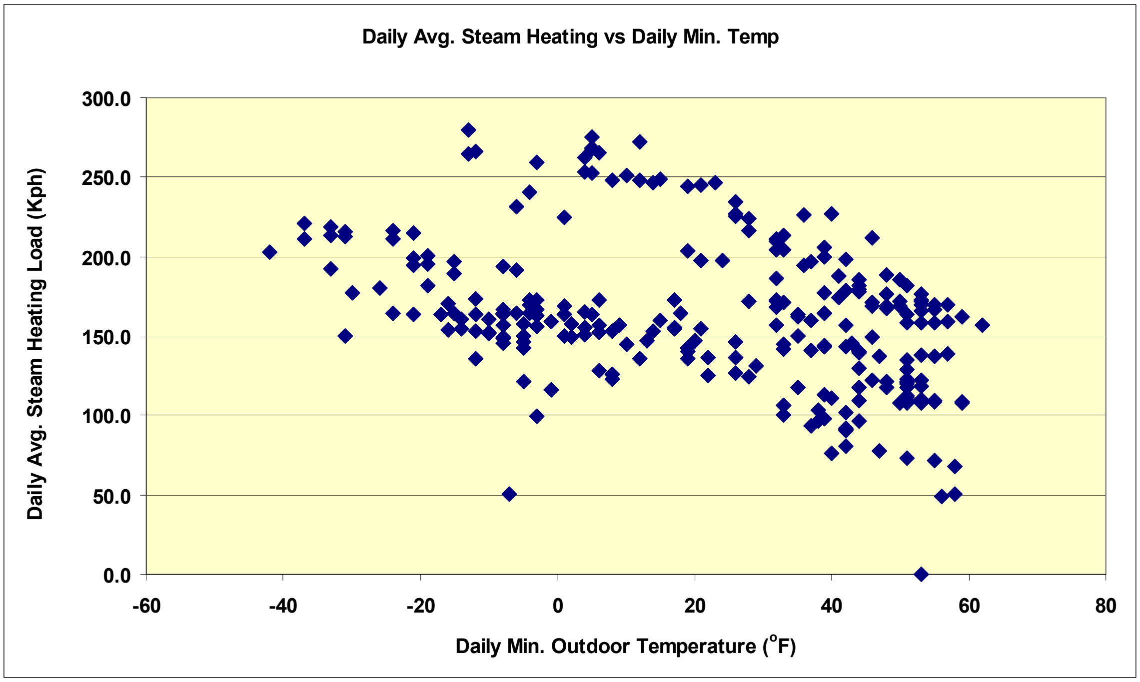

Figure 8. Steam heating load (Kph) vs. outdoor ambient temperature (°F).

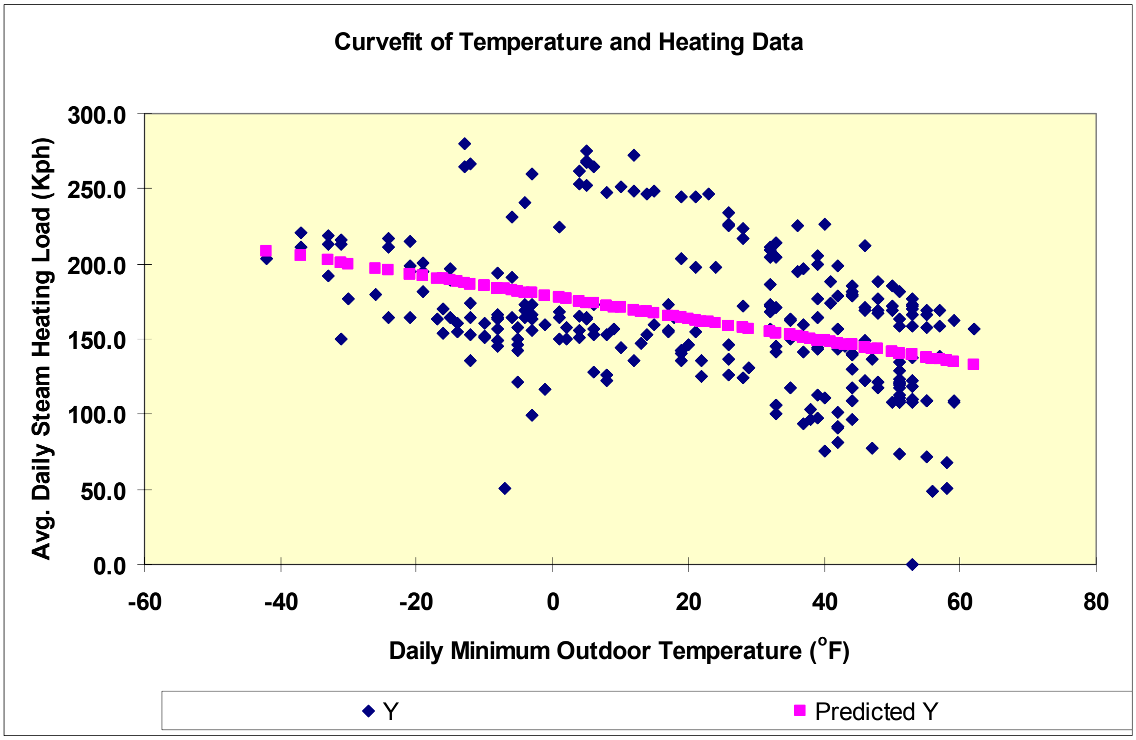

Figure 9. Regression line for the steam heating load (Kph) vs. outdoor ambient temperature (°F).

4 Air Quality Issues

This chapter discusses air pollution compliance issues related to proposed changes at the FWA CHPP.

FWA was subject to a formal complaint from USEPA because of emissions from the CHPP. The USEPA calculated a fine of $27.02M: $750K due to seriousness of violation, $12M due to recapture of economic benefit, and $14M due to size of business. Even though this penalty was reduced to a maximum of $2M in Section 314 of the FY01 DOD Authorization Act, the Army was (and at this writing still is) contesting this penalty. The Army believes the penalties were not calculated properly and did not want this case to set a precedent. During the negotiations with USEPA, certain dates were set for completing work at the CHPP. While the details of this schedule are not directly relevant to this study, it is assumed that any delays in the schedule could adversely affect the Army's case in this action.

FWA has a construction permit for the baghouse installation and CHPP renovation (see attached) issued 1 February 2001. The permit defines the type of equipment at the CHPP and contains many conditions related to record keeping, boiler operation, and pollutant monitoring. In the permit, FWA agreed to certain operational and emission limitations order to avoid tougher Prevention of Significant Deterioration (PSD) or New Source Review (NSR) permits. A discussion and simple economic analysis of this issue provided as part of past years OVEST study are attached. The MG Lovelace brief indicates that the demand on the CHPP will be increasing significantly through 2007 and some of the proposed courses of action would have a commensurate increase in demand placed on the existing boilers. Section 12.1 of the permit limits coal consumption for the CHPP to 336,000 tons/year calculating on a 12-month rolling average basis. Section 14.1 of the permit limits the monthly average steam production to 150,000 lb/hr for each of the six boilers.

If any new course of action at the CHPP either changes the type of equipment specified in the permit or causes a violation in the permit conditions, then the permit must be modified or a new permit obtained. This would entail a fair amount of time and trouble and FWA would risk having to obtain a PSD and/or NSR permit.

Changing a coal-fired boiler to an oil-fired boiler would mean modifying the construction permit or getting a new permit as discussed above. Oil-fired boilers have the same requirements as coal-fired boilers as described in Alaska regulation 18 AAC 50.055. "Industrial Processes And Fuel-Burning Equipment." The regulations specify particulate matter restriction of 0.05 grains/dscf for oil-fired boilers as compared to 0.1 grains/dscf for coal-fired. However, the construction permit for the CHPP specifies particulate matter emission level of 0.05 grains/dscf.

Appendix D includes an e-mail from an USEPA list server that indicates the Fairbanks area has attained CO levels lower that the National Ambient Air Quality Standards. However, this does NOT mean that the area has been designated as attainment but it is obviously one of the steps required towards reaching attainment status. The Fairbanks area continues to be designated as a serious non-attainment area for CO.

In considering options for the CHPP, it should be noted that decrease in power production at FWA will result in decreased emissions at the new power generator location. This could improve the air quality in the Tanana Valley, if the power were supplied from Anchorage, or if a more efficient technology/cleaner burning fuel were used by a power plant in the Tanana Valley. However, the air quality in Anchorage or the Tanana Valley could be worsened. This is why a regional study is needed in determining the long-term solution for FWA.

5 Regional Energy Issues

The following issues are relevant to the regional energy situation:

- power distribution network reliability
- network improvements currently on-going and planned
- regional power load issues
- no natural gas available in Fairbanks (for more than 10 years)
- fuel oil is expensive: $7.8 vs. $2.9/MBtu for coal
- one local source of coal
- coal is low sulfur, but easily friable (makes handling difficult, creates fugitive dust).

The electric utility in Fairbanks is Golden Valley Electric Association (GVEA). Table 10 lists the generators in the Fairbanks area. Fort Wainwright, Eielson AFB, and the University of Alaska have cogeneration systems that generate electricity and heat for their own consumption. Aurora Energy sells all of its electricity to GVEA and sells heat on two heating loops in the downtown Fairbanks area. The DOE Clean Coal Plant is a demonstration plant and is not currently on line.

Table 10. Fairbanks area generation summary.

Name	Electrical Generation Capacity (MW)	Primary Fuel	Equipment Description	Cogeneration
(1) Fort Wainwright	**22.0**	Coal	Boiler / Steam Turbine	District Heating
(2) Eielson AFB	**25.0**	Coal	Boiler / Steam Turbine	District Heating
(3) University of Alaska	**13.0**	Coal / Fuel Oil	Boiler / Steam Turbine	District Heating
(4) Aurora Energy (IPP)	**27.0**	Coal	Boiler / Steam Turbine	District Heating
(5) Golden Valley Energy Assoc.	**195**			
A – North Pole	125.0	Fuel Oil	Gas Turbine	No
B – GVEA Facility	40.0	Fuel Oil	Gas Turbine	No
C – John Brown	30.0	Fuel Oil	Gas Turbine	No
(6) Healy	**25.0**	Coal	Boiler / Steam Turbine	No
(7) DOE Clean Coal Plant	**55.0**	Coal	Boiler / Steam Turbine	No
Total	***362.0***			
Total w/o Clean Coal Plant	***307.0***			

The fuels available in Fairbanks are coal and diesel oil. The average cost of coal is approximately $45/ton and the average cost of diesel is $1.05/gal.

GVEA has partial ownership of a hydroelectric plant in the Anchorage area and typically imports 17 MW from that plant through the Railbelt Intertie into the Fairbanks region.

Fairbanks is electrically connected to the Anchorage area through the Railbelt Intertie. The Railbelt Intertie is has two distinct sections, the Southern Intertie and the Northern Intertie. The Southern Intertie runs between Wasilla and Healy and has a capacity of 75 MW. The Northern Intertie runs between Healy and Fairbanks and has a capacity of 100 MW. The Railbelt Intertie (Figure 10) is the only transmission network into the Fairbanks region. However, this intertie runs through an earthquake seismic zone 4 area and the Alaskan Mountain Range.

The Anchorage area has abundant generation resources with most of the generation coming from hydro or natural gas power plants. Table 11 lists the Anchorage generation capacity.

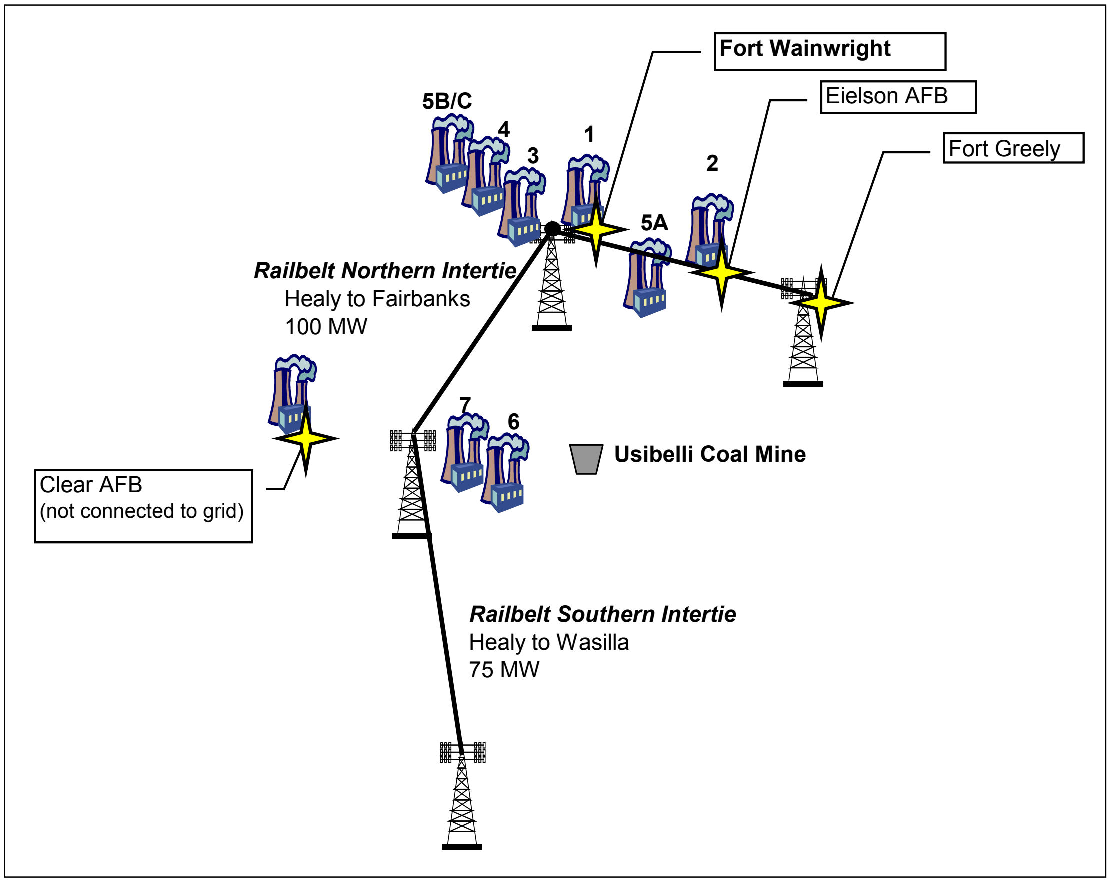

Figure 10. Southern and northern Railbelt intertie.

Table 11. Anchorage area generation summary.

Name	Electrical Generation Capacity (MW)	Primary Fuel	Equipment Description	Cogeneration
(A) Eklutna Power Plant	30.0	Water	Water turbine	No
(B) Municipal Light and Power	297.5			
	260.9	Natural gas	Gas turbine	Combined cycle
	34.0	Natural gas	Boiler/steam turbine	
	2.6	Diesel	I/C diesel engine	
© Chugach Electric Association	465.0			
	397.0	Natural gas	Gas turbine	Combined cycle
	17.0	Water	Water turbine	
	51.0	Natural gas	Boiler/steam turbine	
Total	**792.5**			

Local Utility Total Electrical Capacity

Golden Valley has resources for a total generation capacity of 264 MW (Table 12). The electricity from the Aurora and Healy plants is purchased under contracts from the owners of those facilities. GVEA has partial ownership of a hydro plant in the Anchorage area and imports 17 MW from that facility over the Railbelt Intertie:

- Anchorage to Healy: 75 MW (includes the Hydro Import)
- Healy to Fairbanks: 100 MW
- Current Maximum Import: 75 MW.

GVEA is electrically connected to the Anchorage area through the Railbelt Intertie. The southern portion of the intertie has a transmission capacity of 75 MW and the northern portion has a transmission capacity of 100 MW. Thus, the current maximum import capacity over the intertie is 75 MW. Due to the nature of the fuel mix for the generators in the Anchorage area (hydro and natural gas), the cost of the electricity purchased for import is typically lower than the cost of local generation.

Table 12. Total power available to Golden Valley.

Plant	Capacity
(6)	25.0
(4) Aurora Energy	27.0
GVEA Gas	195.0
Hydro	17.0
Total	***264.0***

GVEA has peak demand of approximately 185 MW, which represents 53 percent of the total electric resources available to GVEA (247 MW of local generation and 100 MW of import capacity).

Local Utility Reliability

Table 13 lists the outages for Golden Valley over the last 4 years. The values represent the average hours of outage in a year the "typical" customer experiences.

The most recent outage history on the distribution line to Fort Wainwright is as follows:

- 7 June 2002: 34 minutes
- 17 March 2002: 3 minutes
- 18 June 2001: 16 minutes
- 11 September 2000: 2 minutes.

Local Utility Largest Loads

GVEA has provided documentation that states they can meet current future power requirements of FWA (Appendix E). The current largest customers of GVEA who purchase all of their electricity from GVEA are as follows:

Fort Knox:	30 MW
Williams:	16 MW
Pogo Mine:	15 MW
Greely:	3.5 MW
Healy:	2 MW
Alaska Pipeline Pumping	~1 MW.

Fort Knox is on an interruptible rate. Should FWA purchase a significant portion of their electricity from GVEA, FWA would be one of GVEA's top five largest customers.

Table 13. Golden Valley outages.

Year	Power (hours)	Storms (hours)	Total Hours
1998	0.31	0.16	0.47
1999	0.65	0.87	1.52
2000	1.354	0.07	1.42
2001	0.54	0.05	0.59
Avg	***0.712***	***0.287***	***1.00***

Local Utility Rate Schedules

Golden Valley has new rate schedules that took affect on 1 July 2002. Fort Wainwright is currently on rate schedule GS-2:

- GS-2: General Service exceeding 25 kW (Current Rate)
  - Customer Charge: $40
    * Demand: $6.25/kW
    * Energy:
      ~ First 500 kWh 11.36 cents/kWh
      ~ Next 4,500 kWh 9.9 cents/kWh
      ~ Next 10,000 kWh 9.3 cents/kWh
      ~ Next 15,000 kWh 7.5 cents/kWh
- GS-2(2): General Service Large Commercial up to 138 kV Serviced (Effective 1 July 2002)
  - Customer Charge: $100
    * Demand: $8.00/kW
    * Energy:
      ~ First 15,000 kWh 6.667 cents/kWh
      ~ Over 15,000 kWh 5.837 cents/kWh
- GS-2(3): General Service High Voltage Industrial (Effective 1 July 2002)
  - Customer Charge: $180
    * Demand: $11.25/kW
    * All Energy: 5.197 cents/kWh

Appendix F includes a summary of the U.S. Army Alaska utility sales rates for both Federal and non-Federal tenants. Table 14 lists utility sales rate for both Federal and non-Federal tenants for Golden Valley and Aurora Energy.

Table 14. Energy rate comparison.

Parameter	Fed Tenants	Tenants
Power	$kWh	$kWh
FWA	0.0642	0.0841
GVEA*	0.089	0.089
Heat	$/Klb	$/Klb
FWA	10.7682	11.1217
Aurora	NA	$10.50
Walden	NA	$10.84

*GVEA electric rate includes demand charge; rate is average cost.

Existing Maximum Power Supply to Fort Wainwright:

FWA is currently interfaced with GVEA through a 7.5 MW substation and a 5.0 MW backdoor intertie. Thus, the total purchase capability of FWA from GVEA is 12.5 MW. FWA is always importing or exporting electricity to GVEA at a minimum rate of 0.5 MW. The distribution line that feeds FWA also feeds additional customers. Occasionally, when GVEA has a problem on this distribution line it asks FWA to export power to the other customers on the distribution line.

Historical Fort Wainwright Electric Use from Golden Valley

Table 15 lists the FWA electrical purchases from GVEA over the past 12 months. This usage is due to turbine rebuild projects, controls upgrade, and CHPP renovation. Note that the peak demand is near the maximum import capacity of 12.24 MW in November 2001 and that the total electric consumption is always less than 2,000,000 kWh. The average electrical demand for GVEA purchases is 9.0 MW and the average energy purchases are 900,000 kWh per month.

The load factor for these purchases is very low. It ranges from less than 0.005 in May 2001 to only as high as 0.31 in September 2001. The average load factor for GVEA electric purchases is 0.14.

Table 15. FWA monthly electrical purchases from GVEA, May 2001 – May 2002.

Golden Valley Electric Association

Month	kWh	kW	Days	Avg Daily Use
May-01	28,800	7,696	33	873
Jun-01	1,953,000	11,262	28	69,750
Jul-01	1,417,800	7,883	33	42,964
Aug-01	1,697,400	7,883	29	58,531
Sep-01	1,764,600	7,883	30	58,820
Oct-01	638,400	7,883	35	18,240
Nov-01	1,256,700	12,240	27	46,544
Dec-01	1,234,200	11,523	29	42,559
Jan-02	230,400	8,568	33	6,982
Feb-02	194,400	8,568	29	6,703
Mar-02	206,400	8,568	28	7,371
Apr-02	732,000	8,566	32	22,875
May-02	420,000	8,568	29	14,483

Golden Valley Planned Infrastructure Additions

GVEA has (either in-process or planned) several infrastructure improvements anticipated to increase the reliability of electric service to their customers. These planned improvements are:

- Battery Storage: 20 MW for 15 minutes *(under construction)*
- Additional tie between Healy and Fairbanks: Increase transmission capacity to 140 MW. Decreases line losses from 12 MW down to 4 MW. *(under construction)*
- Add 138 kV line between Fort Knox and North Pole to establish circular loop (i.e., increased reliability). This is the same distribution trunk that feeds Fort Wainwright. *(planned)*
- Install tie between North Pole and Carney to provide power for Missile Defense of approximately 5 MW. *(planned)*

In addition, the State of Alaska is considering an upgrade to the tie between Wasilla and Willow to increase the reliability of the feed between Anchorage and Healy. When the project is complete, the capacity of the tie will increase from 75 MW to 140 MW.

Interim Solution, Estimated Net Coal Consumption in the Fairbanks Region

The interim solution of converting the CHPP to heating only will reduce coal consumption at FWA, but will provide an overall increase in sales to the region, which would be used for required capitol improvements. Tables 16 and 17 outline these changes in coal consumption and sales in the Fairbanks region. The notes below each table outlines the methodology taken to reach these values and to make comparisons. Note that local power producers will produce (or purchase) power to maximize their profit.

Table 16. Interim solution estimated net coal consumption in Fairbanks region (assuming the Fort Wainwright CHPP goes to heating only).

	Coal Usage (Tons/yr; assumes $50.30/ ton)					
	2002/2003	**2003/2004**	**2004/2005**	**2005/2006**	**2006/2007**	**5-Yr Average**
Option 2b: Conversion to Heating Only [1]	118,756	125,503	125,503	125,503	132,475	125,548
Option 4: Current CHPP Renovation Path (20MW)[1]	204,523	211,030	211,030	211,030	217,538	211,030
Net Result	-85,767	-85,527	-85,527	-85,527	-85,063	-85,482
Decrease Coal $ at FWA	($4,314,065)	($4,302,018)	($4,302,018)	($4,302,018)	($4,278,669)	($4,299,758)
Increased Coal Usage at Other Local Power Producers[2,3,4]	63,499	63,499	63,499	63,499	63,499	63,499
Increase Coal $ at Other Local Producers	$3,194,000	$3,194,000	$3,194,000	$3,194,000	$3,194,000	$3,194,000
Net Regional Affect of Coal Consumption	-22,268	-22,028	-22,028	-22,028	-21,564	-21,983
Net Regional Affect of Coal Purchases ($) [5]	($1,120,065)	($1,108,018)	($1,108,018)	($1,108,018)	($1,084,669)	($1,105,758)

Notes:

[1] Coal usage for both options listed came from the CERL FWA CHPP Technical Report, and based on usage from May 2001 to April 2002. Cost per ton includes delivery. “Old hospital” demo-ed in 05/06.

[2] Both utilities (Aurora, Healy) provided net export values during the selected timeframe.

[3] This assessment assumes that each plant will not increase capacity within the next 5 yrs, and that customers of the two remaining plants do not change power requirements.

[4] This assessment also assumes that both plants run 100% of capacity, all the time, and coal plants are used before other non-coal plants.

[5] Since operating 100% capacity all of the time is unrealistic, these net affect values could be considered a least negative impact.

Table 17. Interim solution estimated net sales in Fairbanks region (assuming the Fort Wainwright CHPP is used for heating only.

	Net Revenue					
	2002/2003	**2003/2004**	**2004/2005**	**2005/2006**	**2006/2007**	**5-Yr Average**
Net Regional Affect of Coal Purchases ($)	($1,120,065)	($1,108,018)	($1,108,018)	($1,108,018)	($1,084,669)	($1,105,758)
Increase in MWh to Aurora Plant	71,378	71,378	71,378	71,378	71,378	71,378
Increase in Sales to Aurora Plant	$4,996,440	$4,996,440	$4,996,440	$4,996,440	$4,996,440	$4,996,440
Increased MWh to Healy Plant	15,668	15,668	15,668	15,668	15,668	15,668
Increased Sales to Healy Plant	$1,096,780	$1,096,780	$1,096,780	$1,096,780	$1,096,780	$1,096,780
Increased Electrical Sales	$6,093,220	$6,093,220	$6,093,220	$6,093,220	$6,093,220	$6,093,220
Net Affect on Total Sales for Healy & Aurora	$4,973,155	$4,985,202	$4,985,202	$4,985,202	$5,008,551	$4,987,462

Assessment limitations and assumptions:

This assessment is a conservative estimate that addresses the best case scenario for the coal industry. Any changes to the following assumptions could detrimentally impact and further decrease coal revenues estimates:

1. Average Energy Cost for Aurora: $70.00 per MWh
2. Average Energy Cost for Healy: $70.00 per MWH
3. This assessment does not address the impact on the Alaska Railroad Corporation or other ancillary businesses.
4. This assessment assumes that GVEA will purchase power from the nearby coal facilities (Healy and Aurora power plants) first, before other power sources are utilized (which is not current practice). Power provided from natural gas facilities will shift the economic base towards Anchorage where those power generation facilities are currently located.
5. This assessment recognizes that the added FWA power requirement will cause the Healy and Aurora facilities to exceed their capacities during certain months. Therefore, GVEA will most likely have to purchase additional power through their tie-in to the Anchorage area.
6. This assessment assumes the Healy and Aurora plants will not increase capacity within the next 5 years and that current customers of the two plants do not change their power requirements.
7. This assessment assumes Healy and Aurora plants are continuously running at 100% capacity (does not include maintenance / down time that would reduce capacity to 90-92% for planning purposes) throughout the evaluation period. Anything less than 100% will further decrease coal consumption and the corresponding revenues.

6 Alternative Technologies

Distributed Generation

Description

Distributed generation (DG) involves the use of individual generators at or near the building or load that is being served. Given the restricted fuel choices at Fort Wainwright, diesel-fired generators or renewable technologies (solar or wind) are the only DG options that could be applicable.

Suitability for FWA

A key consideration in the economic viability of distributed generation, is whether the waste heat from the units can be used to offset thermal loads. In the case of Fort Wainwright, the utilidor distribution system needs to be heated to provide adequate freeze protection. Only a central plant or perhaps two or three smaller satellite heating plants strategically located around the facility could accomplish this. Therefore, capturing waste heat from distributed generators would not be warranted. This reduces the cost effectiveness of distributed generation options, and makes them impractical for Fort Wainwright as sources of primary power.

Gas Turbines

Description

Diesel-fueled gas turbines (combustion turbines) are a potential alternative to the existing coal-fired steam turbine-generators for on-site power production at FWA. To meet the thermal requirements of the facility, heat recovery steam generators (HRSGs) or boilers would need to be included. The electrical efficiency of the gas turbines for this application would be about 33 to 34 percent (heat rates of 10,000-11,000 Btu/kWh), with improved performance at lower ambient temperatures. In terms of thermal output, the HRSGs, with supplementary oil-firing are capable of providing about 15,000 lb/hour of steam per MW of electrical output. Since the peak steam demand for heating ranges from 275,000 lb/hr (current demand) to 320,000 lb/hr (2006/2007 time period) the HRSGs could *theoretically* meet the thermal loads. However, in actual operation there is a question whether HRSGs could reliably achieve this output with oil as the supplementary fuel. The estimated installed costs for this option are about $2000/kW to meet the year 2007 peak electrical demands. The capital costs for the gas turbine and related mechanical and electrical equipment, including HRSGs comprise about $415/kW of this cost. If separate oil-fired boilers for the supplementary heating are used they would add about $132/kW. Other major cost items include building facilities, oil storage tanks, and installation, and mark-ups for overhead and profit. Schmidt Associates, Inc. as part of this project developed detailed cost estimates for this option.

Suitability for FWA

Gas turbines are a suitable alternative for FWA, but have high operating costs due to the use of costly diesel fuel.

Clean Coal Technologies – Pressurized Fluidized Bed Combustion (PFBC)

Description

Fluidized Bed Combustion (FBC) in boilers can be particularly useful for high ash, low-grade coals, and/or those with variable characteristics, although PFBC has also been used on a commercial scale in Sweden and Japan with traded coals of higher quality. It is used with a combined-cycle system incorporating both steam and gas turbines. Considerable effort has been devoted to the development of PFBC during the 1990s. As with atmospheric FBC, two formats are possible, one with bubbling beds, and the other with a circulating configuration.

Units operate at pressures of 145 to 218 PSI with combustion temperatures of 1470 to 1650 °F. The pressurized coal combustion system heats steam, in conventional heat transfer tubing, and produces a hot gas supplied to a gas turbine. Gas cleaning is a vital aspect of the system, as is the ability of the turbine to cope with some residual solids. The need to pressurize the feed coal, limestone and combustion air, and to depressurize the flue gases and the ash removal system introduces some significant operating complications. The combustion air is pressurized in the compressor section of the gas turbine.

1st and 2nd generation PFBC technology are intended for combined cycle operation — heated, pressurized flue gas from boiler is used to fire a gas turbine.

Since other gaseous and liquid fuels are not readily available, this technology is not really appropriate. The proportion of power coming from the steam: gas turbines is approximately 80:20 percent.

Advanced PFBC, which is not yet commercial, adds a carbonizer to co-produce a syngas that is used to fire the gas turbine. This avoids the need for a second fuel for the turbine. This is not appropriate since it is not available and would probably be cost prohibitive for such a small application.

Unit size

The current PFBC demonstration units are all of about 80 MWe capacity, but two larger units have started up in Japan at Karita and Osaki. These are of 360 and 250 MWe capacity respectively, and the Karita unit uses supercritical steam. (Their size is tied to the capacity of the gas turbine.)

Thermal Efficiency

PFBC units are intended to give an efficiency value of over 40 percent, and low emissions, and developments of the system using more advanced cycles are intended to achieve efficiencies of over 45 percent.

Flue Gas Cleaning/Emissions

Combustion takes place at temperatures from 800 to 900 °C resulting in reduced NO_x formation compared with PCC. N_2O formation is, however, increased. SO_2 emissions can be reduced by the injection of sorbent into the bed, and the subsequent removal of ash together with reacted sorbent. Limestone or dolomite are commonly used for this purpose.

Residues

The residues consist of the original mineral matter, most of which does not melt at the combustion temperatures used. Where sorbent is added for SO_2 removal, there will be additional CaO/MgO, $CaSO_4$ and $CaCO_3$ present. There may be a high free lime content and leachates will be strongly alkaline. Carbon-in-ash levels are higher in FBC residues that in those from PCC.

Suitability for FWA

While PFBC technology holds promise for increased efficiency (e.g., 40+ percent) and lower emissions (both lower SO_2 and NOx), and has the advantage of compactness, as compared to other coal-fired systems, this study finds that Fort Wainwright would not be a good application for the following reasons:

- The technology is developmental and not fully commercialized
  - Hot gas cleanup (particulates) needs additional development
  - Sufficient alkali and sulfur removal is required to prevent gas turbine corrosion problems
  - Gas turbines are still emerging from the DOE Advanced Turbine Systems Program
- The complexity of the technology raises reliability and maintenance concerns.
- Cold climate reliability is uncertain.
- The technology has a high cost — particularly for a small-capacity installation like Fort Wainwright.

An investment in this option would effectively be an investment in a demonstration project. Given the reliability issues, parts/service availability, etc., this makes PFBC a risky choice for Fort Wainwright.

Coal Gasification

Description

Coal gasification involves the creation of a hydrocarbon rich gas from coal feedstock that can be used as a fuel source for heat and power generation. In a typical application the gaseous fuel would be used in a combustion turbine to generate power, or in a combined cycle configuration where a heat recovery steam generator (HSRG) would use the CT's waste heat to produce steam to drive a steam turbine generator Figure 11 shows this system. The advantages of using the process are higher efficiencies (45 to 60 percent) and lower emissions as compared to conventional power plants. Gasification for power generation is still developmental, and a number of projects have been funded by DOE's Clean Coal Program. According to DOE, utility-scale gasification plants are expected to cost about $1200/kW – about 1/3 more than conventional coal plants. For a small scale applications such as Fort Wainwright, costs would be expected to be much higher. Within Alaska, gasification has been explored at several sites located near coal mines. The disadvantages of coal gasification relate primarily to process complexity (gasifier and gas clean-up technologies) and cost.

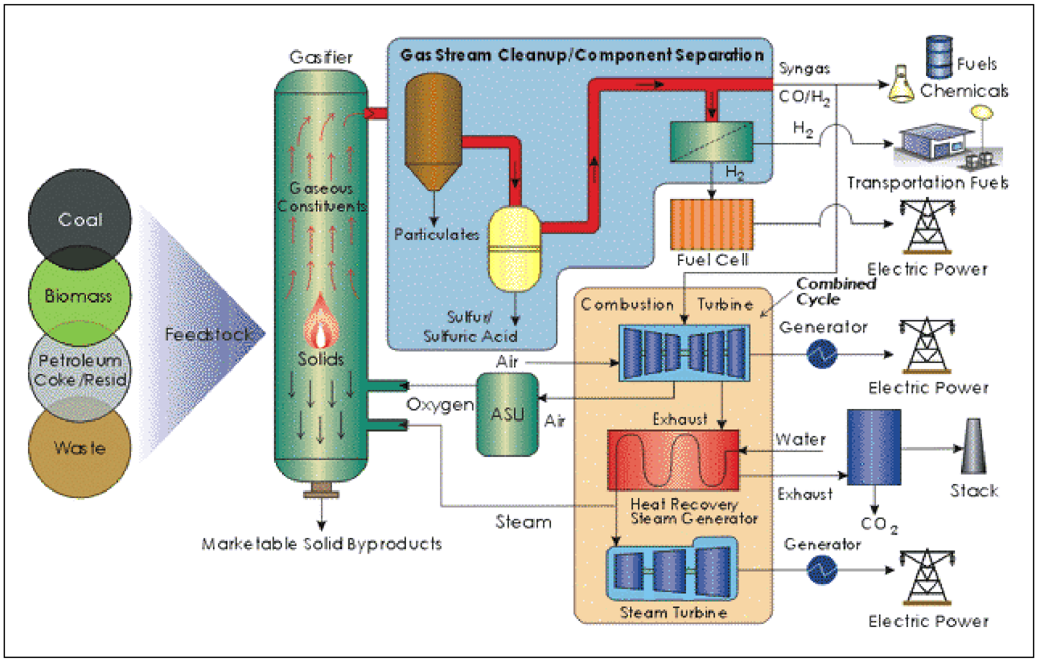

Figure 11. Schematic of coal gasification.

Suitability for FWA

Coal gasification is at the demonstration stage and has high technical and cost risks for Fort Wainwright. Therefore, it is not recommended for this application.

Wind Generation in Alaska

Description

The State of Alaska has regions that are favorable for wind generation. The locations of the State that are most desirable are the Aleutian Islands, islands in the Bering Sea as well as the northern and western coastal areas.

The evaluation of the potential for wind generation is based on wind power classes that are categories for average wind speeds. There are seven wind power classes with Class 1 being the lowest and Class 7 the highest. Table 18 lists the wind power classes.

The application of large-scale wind turbines typically requires a location to be classified as a Class 4 or higher to be technically and economically feasible. DOE reports that Alaska has the largest areas of Class 7 wind power in the United States.

Figures 12 and 13 show wind maps for the region of Alaska near Fairbanks and Fort Wainwright, respectively. The maps indicate that, in the immediate vicinity of Fairbanks, wind power is classified as Class 1. However, potential sites for wind generation are identified southeast of Fairbanks between Delta Junction and the Alaska Ridge where Class 4 through Class 7 have been identified. This region is near the location of Fort Greely. Table 19 lists wind projects in Alaska.

Table 18. Wind power classes (source: www.eren.doe.gov).

Wind Power Class	Avg. Speed (mph)	Wind Power (watts/meter2)
1	12.5	200
2	14.3	300
3	15.7	400
4	16.8	500
5	17.9	600
6	19.7	800
7	26.6	2000

Table 19. Alaskan Wind Projects (source: http://www.eren.doe.gov/state_energy/).

Owner	Project Name	Capacity (Kw)
Alaska Village Electric Cooperative Inc.	Alaskan Village Electric Cooperative	150.0
Kotzebue Electric Association	Kotzebue Wind Project Phase I And Ii	500.0
Tanadgusix Corporation	Saint Paul Island	225.0
Total		775.0

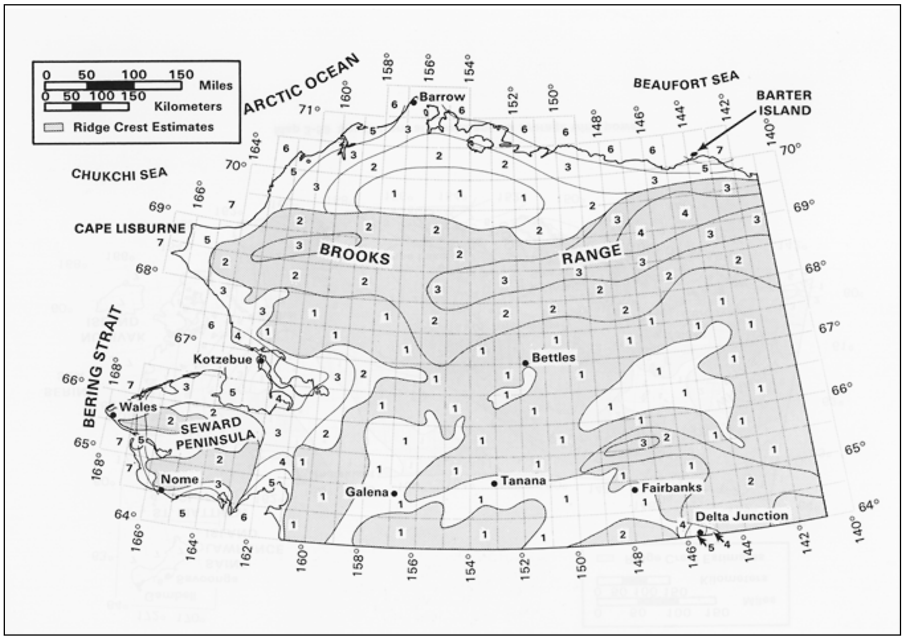

Figure 12. Wind maps of the Fairbanks Region (source: http://rredc.nrel.gov).

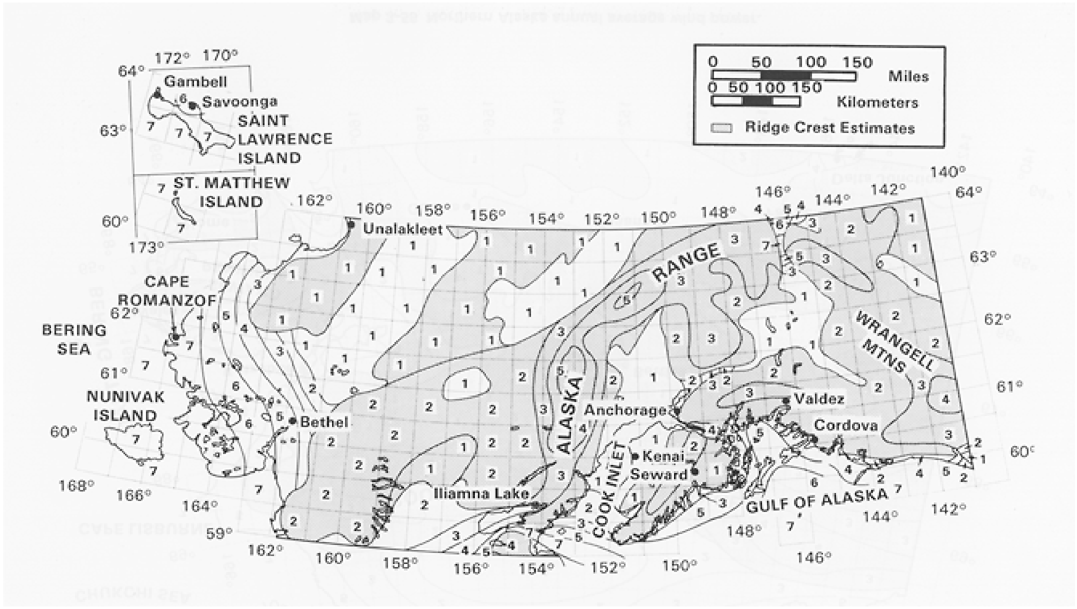

Figure 13. Wind maps of the Anchorage region (source: http://rredc.nrel.gov).

GVEA installed a demonstration wind turbine near Healy that operated from May 1998 to April 2000. The wind turbine had a rated capacity of 10 kW. The turbine required a minimum wind speed of 8 mph to generate electricity. The system was installed at a total cost of $47,400. Results of the demonstration are an availability of 76.8 percent and an average capacity factor of 15.6 percent of 1.56 kW (source: www.gvea.com).

Suitability for FWA

Installation of wind turbines at Fort Wainwright is not feasible due to low wind speeds. The nearest location that has adequate wind speeds is in the vicinity of Fort Greely. However, more detailed wind resource information needs to be developed for this area to determine if a wind-farm makes technical/economic sense. Typically 1 year or more of high-quality windspeed data is needed. Furthermore, while wind technologies have proven reliable in large-scale applications, meeting the cold weather requirements of central Alaska could prove challenging. In any event, the low capacity factors associated with wind turbines, means that wind is more likely to supplement generation resources, than to provide baseload power. Therefore, wind technologies are not considered applicable at this point in time for FWA. However, this is a technology that is making rapid advances, and may become a cost-effective option in the future. Wind generation may become a contributor within the mix of generation technologies that could provide power to the region.

Photovoltaics

Description

A 100 kW photovoltaic (PV) array would provide about 113,608 kWh/year of AC power. This equates to a capacity factor of 13 percent strictly due to solar energy availability. Table 20 summarizes the energy output of a 100kW PV Array.

Batteries would be required to overcome the intermittent nature of the resource, which would add substantially to the costs. Typical installed costs of photovoltaic systems are on the order $10,000/kW, or about $1 Million for a 100 kW system. Photovoltaic system efficiencies are about 10 to 13 percent (sunlight to electricity). The key advantages of PV are low O&M costs due to zero purchased fuel requirements and few moving parts or components requiring service. Since no purchased fuel is needed, photovoltaic systems can serve as a hedge against fuel price variability. More information about PV systems is provided separately.

Table 20. Energy output of a 100 kW photovoltaic array at FWA.

Month	Energy Output (kWh)
January	2,377
February	7,033
March	14,312
April	17,263
May	14,128
June	13,260
July	13,264
August	11,653
September	9,200
October	6,535
November	3,393
December	1,191
Annual	113,608

Reference: PVWatts Version 1, Fairbanks, AK solar data for a 100 kW array (http://rredc.nrel.gov/solar/codes_algs/PVWATTS/version1/code/pvwatts.cgi)

Suitability for FWA

Solar technologies (e.g., photovoltaic systems) are not practical for meeting substantial portions of installation electrical requirements due to limited resources (sunshine) during the winter.

7 Options Analysis

In exploring the options for an interim solution and identifying possible long-term solutions, the amount of rigor in the analysis of each option varied based on the data available during the short duration of the study. Shortcuts were often made in estimating capital costs, energy costs, and fuel/power requirements. The increasing energy requirements for both power and heat over several years added complexity to the analysis. Some options also considered sales of power to the local utility. Some options considered the financing of power substations by the local utility, where others did not. Most long term options considered non-government owned or privately operated plants. Also, back-up power, which is considered a critical issue, was not included in every option because the existing plant does not have back-up power other than the local utility. The intent of this analysis was not to provide a direct comparison of options, but to investigate a range of possibilities for the short term and long term.

Local Partnering Options

There is currently no direct relationship between Aurora Energy and FWA. Aurora is owned by the Usibelli family who also owns the coal mine from which FWA purchases coal. Discussions were held with Aurora Energy to discuss the possibility of FWA purchasing heat from Aurora. The existing Aurora district heating loop operates at 50 psig and the Fort Wainwright heating loop operates at 100 psig. To provide the required heating to FWA, a new dedicated 100 psig loop would need to be run between the Aurora plant and FWA (approximately 3 miles). The estimated cost of the new dedicated 100 psig heating loop for FWA is $1.5 million per mile or $4,500,000.

Without knowing the financing of the new dedicated steam loop to FWA or the contractual arrangement between FWA and Aurora, it is initially estimated that Aurora could provide FWA steam at its current rate of $10.50/1000 lb of steam. Thus, the estimated annual cost of heating based on 1,500,000,000 lb/year would be $15,750,000/year.

The other alternative for purchasing heat from Aurora is for Aurora to install and operate boilers at FWA and sell energy on a BTU basis. The initial question was posed assuming the installation of oil-fired boilers. Aurora suggested that if oil were pursued as a fuel, the cost of heating should be linked to an index that reflects the variability in the cost of oil. They have suggested that the installation of coal-fired boilers would result in a more cost effective and stable price for heating. The cost of heating service could not be estimated at this time. Aurora wanted to know if the operation and maintenance of the utilidors would be included in the delivery of heat. This was not pursued further to avoid issues involving asbestos problems, which are associated with the utilidors.

Explanation of Life-Cycle Costs

Life-cycle costing for the existing operation and options was performed using WinLCCID Version 1.6 Build 58. Energy costs were escalated using the rates in the program that were taken from NIST Handbook 135 Supplement (April 2002). Labor and other operating costs were escalated using an inflation factor of 2.5 percent/year. Future costs were reduced to their present value equivalents using the programs discount rate of 3.2 percent. Appendix G outlines the life-cycle cost analysis for each option. Appendix H includes data supporting the options analyses.

Options Considered

An attempt was made to update the life cycle cost analysis as better cost data was developed from the 1391 preparation for the implementing the interim solution for heating only. For example the O&M upgrade costs of $65M were reduced to $20M based on the requirements needed for a short term solution versus a long term solution.

This study considered the following options:

1. Status Quo (current MCA investment only)
2. Conversion to heating only plant
    a. Coal
    b. Conversion to heating only plant-approved OMA funds, back-up power
3. Heating only plant with oil backup
4. Current CHPP renovation path
5. Standalone CHPP to meet future loads
6. Electricity produced to follow heat load
7. Oil-fired combustion turbines
8. “Clean Coal” technologies:
    a. Pressurized fluid bed combustor
    b. Circulating fluid bed combustor

9. Heating only satellite plants
10. GVEA electricity/Aurora Energy heating

Other areas reviewed were:

- individual boilers at each building
- natural gas technologies
- renewables/wind energy.

Option 1: Status Quo – Current MCA Investment Only

Definition

This option includes CHPP upgrades only to ensure reliable heating/electrical supply for winter FY02/FY03. In other words, this option offers a 1-year solution with no additional OMA. Additional years of operation would incur higher risks of equipment failure.

Major Equipment Changes

- no upgrade of primary power sub-station or secondary distribution
- baghouse ($25M)
- cooling condenser projects ($23M)
- CHPP has 6 -150 kpph coal boilers and 4-5MW STGs.

Advantages:

- No additional OMA capital costs required
- GVEA power purchase limited to 12.5MW.

Disadvantages

- does not meet future power requirements
- no seismic upgrade
- higher risk of equipment failure after FY02/03 in the coal-feed systems and the STGs.

Cost Summary

- Capital cost is $48M (i.e., $23M + $25M)
- LCC is $327M.

Option 2a: Conversion to Heating Only Plant – Coal

Definition

This option includes plant upgrades sufficient to ensure reliable heating for 25 years, with no power generation.

Major Equipment Changes

- refurbish four coal boilers
- no STGs
- four new baghouses (-$5M)
- no air-cooled condenser (-$23M)
- fund $10M substation through GVEA utility bill.

Advantages

- all power is purchased from GVEA
- substation allows 100 percent GVEA power
- revised projects return $28M to the U.S. Treasury
- less air emissions.

Disadvantages

- no back-up power if GVEA goes down
- insufficient back-up boilers
- no seismic upgrade
- must reallocate current OMA $
- Need additional $20M to complete the current OMA upgrade project.

Cost Summary

- capital cost is $20M (i.e., $25M – $5M)
- LCC is $335M.

The reallocation of current OMA funding was completed by keeping only those projects that dealt with the maintenance of the heating only side of the plant, and by adding other necessary projects from the list of the latest requested OMA increase (the additional $60M requested) This list is attached as Appendix I.

Option 2b: Conversion to Heating Only Plant within Approved OMA Funds and Back-Up Power

Definition

This option includes plant upgrades sufficient to ensure reliable heating until FY12. In other words, this is a 10-year solution with no power generation.

Major Equipment Changes

- refurbish four coal boilers
- no STGs
- four new baghouses (–$5M)
- no air-cooled condenser (–$23M)
- fund $10M substation through GVEA utility bill
- fund $18M backup power through an MCA project.

Advantages

- all power purchased from GVEA
- substation allows 100 percent GVEA power
- revised projects return $28M to the U.S. Treasury
- less air emissions.

Disadvantages

- after 10 years, more OMA is needed for next 15 years
- no seismic upgrade
- insufficient back-up boilers
- must reallocate current OMA $
- need an additional $20M to complete the current OMA upgrade project.

Cost Summary

- capital cost is $38M ($25M - $5M + $18M)
- LCC is $367M.
- Table 21 lists funding requirements needed to complete this option.

Option 3: Conversion to Heating Only Plant with Oil Backup

Definition

This option includes plant upgrades sufficient to ensure reliable heating for 25 years, with no power generation.

Table 21. Summary of funding for recommended course of action.

Project	Source	Funds ($M)	Change ($M)	4Q02	4Q03	4Q04
Air-cooled condensers	MCA	$23 FY02	($23)	Cancel		
Baghouses	MCA	$25 FY00	($5)	Modify from 6 to 4 units	Under construction	On-line
Various boiler & plant equipment upgrades	OMA	$45 FY00	$0	Re-focus to heating only	Work complete	
New Substations & FWA line upgrades	MCA		$10	Design	Under construction	On-line
New Back-up power generators	MCA		$18	Design	Under construction	On-line
Overall change in funds to FWA			$0			

Major Equipment Changes

- reduce baghouses to three boilers (-$5M)
- no air-cooled condenser (-$23M)
- one coal boiler is converted to oil ($4.9M)
- no STGs
- fund $10M substation through GVEA utility bill.

Advantages

- all power is from GVEA
- substation allows 100 percent GVEA power
- revised projects return $28M to the U.S. Treasury
- less air emissions
- seismic upgrade.

Disadvantages

- after 10 years, more OMA is needed for next 15 years
- no back-up power if GVEA goes down
- must reallocate current OMA $
- need an additional $20M to complete the current OMA upgrade project.

Cost Summary

- capital cost is $25M (i.e., $4.9M for conversion; $20M for modified baghouse project)
- LCC is $349M.

Option 4: Current CHPP Renovation Path

Definition

This option brings all existing equipment up to current standards to ensure reliable heat and power for 25 years.

Major Equipment Changes

- refurbish six coal boilers
- four - 5MW STGs
- six baghouses ($25M)
- air-cooled condenser ($23M)
- black-start generator.
- fund $10M substation through GVEA utility bill

Advantages

- all CHPP systems upgraded to utility standards
- substation allows 100 percent GVEA back-up power
- high power reliability and seismic upgrade
- seismic upgrade.

Disadvantages

- does not meet future power loads without import of GVEA power
- includes excess boiler capacity
- requires an additional $56M to complete the current OMA upgrade project and other items required for 25-yr reliability.

Cost Summary

- capital cost is $104M ($25M for baghouses; $23M for air-cooled condenser; $56M for CHPP renovation)
- LCC is $351M.

Option 5: Standalone CHPP To Meet Future Loads

Definition

Bring all existing equipment up to current standards, CHPP meets future heating and power needs for 25 years.

Major Equipment Changes

- refurbish six coal boilers
- two new 5 MW STGs ($33M) for total of six 5MW
- six baghouses ($25M)

- expanded air-cooled condenser ($36M)
- fund $10M substation through GVEA utility bill
- black-start generator.

Advantages

- self-reliant
- meets future loads - 26 MW, 320,000 lb/hr steam
- addresses OSHA and environmental issues
- can support GVEA distribution network
- reliable heat and power
- allows installation to sell excess power
- includes a seismic upgrade.

Disadvantages

- increases air emissions
- requires a large capital investment
- requires an additional $20M to complete the current OMA project upgrade.

Cost Summary

- capital cost is $137M ($25 for baghouses; $23M for air-cooled condenser; $88M for total upgrade to 30MW)
- LCC is $369M.

Option 6: Electricity Produced To Meet Required Steam Production Only

Definition

This option modifies CHPP operations for power generation to follow heating load, brings most equipment up to current standards to ensure reliable heat and power for 25 years.

Major Equipment Changes

- refurbish five boilers and four 5MW STGs
- reduce scope of air-cooled condenser (-$2M)
- five baghouses (-$2.5M)
- fund $10M substation through GVEA utility bill
- black-start generator.

Advantages

- generates power most efficiently
- provides reliable electricity and heat for 25 years
- includes seismic upgrade.

Disadvantage

- large capital cost.

Cost Summary

- capital cost is $ 63.5M (i.e., $23 + $25M – $2M – $2.5M + $20M)
- LCC is $390M.

Option 7: Oil-Fired Combustion Turbines

Definition

This option includes a new oil-fired combustion turbine plant, abandons the existing CHPP, and will provide reliable heat and power for 25 years.

Major Equipment Changes

- entirely new plant with:
  - three Taurus Solar CT oil-fired turbine generator sets
  - three 100 kpph oil-fired boilers.

Advantages

- low initial cost
- highly reliable
- meets future heat and power loads
- low labor costs
- highly automated
- easy upgrade to future natural gas.

Disadvantages

- high fuel costs ($21M vs. $11M for coal)
- high-tech O&M staff.

Cost Summary

- capital cost is $51M
- LCC is $491M
- does not include cost to upgrade existing CHPP prior to BOD.

Option 8a: Pressurized Fluidized Bed Combustor

Definition

This option includes a new PFBC combined-cycle plant.

Major Equipment Changes

- new bldg with three PFBC units
- requires existing (two) coal boilers and 4-5 MW steam turbines.

Advantages

- very low emissions
- low fuel costs
- low LCC.

Disadvantages

- a demonstration technology
- co-funding would require Congressional add
- would require extensive training for O&M staff
- system reliability is unknown
- true costs are difficult to estimate
- relies on existing plant.

Cost Summary

- capital cost is $174M
- LCC is $341M.

Option 8b: Circulating Fluid Bed Combustor (CFBC)

CFBC Using Existing CHPP

Definition

New CFBC combined cycle plant with partial use of CHPP equipment.

Major Equipment Changes

- two existing coal boilers converted to oil for back-up
- upgrade 4-5 MW STGs.

Advantages

- self-reliant
- meets future loads

- low O&M
- low fuel costs
- very low emissions
- proven technology.

Disadvantage

- requires use of existing CHPP.

Cost Summary

- capital cost is $151M
- LCC is $406M.

CFBC Involving Demolition of Existing Boiler Plant

Definition

This option includes a new CFBC combined-cycle plant with partial use of CHPP equipment.

Major Equipment Changes

- two existing coal boilers converted to oil for back-up
- upgrade 4 -5 MW STGs.

Advantages

- self-reliant
- meets future loads
- low O&M
- low fuel costs
- very low emissions
- proven technology.

Disadvantage

- requires partial use of existing CHPP.

Option 9: Heating Only Using Satellite Plants

Definition

This option includes new satellite plants with packaged oil-fired boilers, in which new plants send steam to existing utilidors.

Major Equipment Changes

- abandon current CHPP
- replace with three smaller plants with packaged boilers.

Advantages

- low labor costs
- no coal air emission issues
- highly automated.

Disadvantages

- oil storage tanks
- high fuel costs
- oil spill potential
- air permitting issues
- increased carbon monoxide.

Cost Summary

- capital cost is $42M
- LCC is $756M
- does not include cost to upgrade existing CHPP prior to BOD.

Cost Summary

- initial cost is $180M
- LCC is $410M.

Option 10: Electricity from GVEA, Heating from Aurora Energy

Definition

In this option, Aurora Energy will provide FWA steam at advertised rate of $10.50,and all power is purchased from GVEA. Aurora Energy has provided documentation (Appendix J) that states they can meet current and future heating requirements of FWA.

Major Equipment Changes

- requires 3 miles of new pipeline, crossing the Chena River
- condensate receivers
- substations ($10M) funded by GVEA.

Advantages

- no capital investment
- WFA is commodity purchaser

- Aurora is interested in taking over Utilidor O&M
- no heating plant
- no FWA air emissions.

Disadvantages

- no back-up power
- relies entirely on Aurora
- utilidor O&M still an issue
- Aurora capacity is currently only 300 kpph.

Cost Summary

- capital cost is $0
- LCC is $449M
- does not include cost to upgrade existing CHPP prior to BOD.

Table 22 summarizes the capital and life-cycle costs of all options considered.

Table 22. Summary of options considered with capital and life-cycle costs.

Options	Capital $M	LCC $M
Cogeneration		
1: Status Quo - Current MCA investment only	$ 48	$327
4: CHPP Current renovation path	$104	$351
5: Stand alone CHPP to meet future loads	$137	$369
6: Electricity produced follows heating load	$ 63.5	$390
7: Oil-fired combustion turbine	$ 51	$491
8a: Pressurized fluid bed combustor	$174	$341
8b: Circulating fluid bed combustor	$151	$406
Heating Only		
2a: Conversion to Heating Only - Coal	$ 20	$335
2b: Conversion to Heating Only - Approved OMA	$ 38	$367
3: CHPP - Conversion of plant with oil backup	$ 25	$349
9: Satellite plants	$ 42	$756
10: Purchase from Aurora Energy/GVEA (w/ GVEA emergency generators)	$ —	$449

8 Summary and Recommendations

This study has assessed the current upgrade projects, analyzed alternatives for an interim solution, and identified possible options for a long-term regional study for the Fort Wainwright Central Heat and Power Plant. The interim solution described in this work is an attempt to reduce the Army's investment in capital assets at the FWA CHPP, and to provide safe and reliable energy while a long-term regional study can be conducted and implemented. This long term solution will provide an optimal strategy for investing Army funds at FWA, and support a regional solution for the Tanana Valley that addresses power, air quality, and economic factors.

This study makes the following recommendations for Fort Wainwright:

1. Implement Option 2b, "Conversion to Heating Only Plant within Approved OMA Funds." This option:
    a. Provides reliable heat and power for 10 years
    b. After 10 years, if the path is continued, would require additional funds to maintain reliability
    c. Meets environmental and safety constraints.
    d. Provides time to develop strategic energy plan.
2. It is recommended that CHPP be configured accordingly:
    a. Heating only with four coal boilers, each with a baghouse
    b. 100% power purchased from GVEA
    c. Back-up power in place for critical loads
    d. No steam turbine generators (STGs) or cooling ponds.
3. The following interim plan is recommended before implementing Option 2b:
    a. Assess reliability of heat and power
    b. Assess emissions permit issues
    c. Determine time for baghouse project to be completed
    d. Determine time for substations/ back-up generators to be installed
    e. Implement other reliability measures
    f. Determine impact on current funded projects. (Table 21 (p 43) summarizes the funding requirements needed to complete the recommended option)
        (1) Invest in substations to allow 100% purchase ($10M)
        (2) Invest in on-site back-up power ($18): reprogram MILCON
        (3) Delay/cancel air-cooled condenser project
        (4) Modify contract to install only four baghouses.

4. It is recommended that a long-term energy plan be adopted to address the following issues:
    a. Private sector heating for new housing
    b. Standalone heating assessment for new construction facilities
    c. Private sector options for heat and power
    d. Third party construction of a new central plant that is on or near FWA
    e. Other energy options: Renewable energy, new technology, etc.
5. It is recommended that Fort Wainwright continue with utilidor upgrades.
6. It is recommended that a Fairbanks Regional Power Study be conducted to focus primarily on the area within a 200-mile radius of Fairbanks, and also to consider power generation and distribution in the Anchorage area.
    a. Many military installations in the Fairbanks area warrant a DoD presence in this power study, including:
        (1) Fort Wainwright
        (2) Eielson AFB
        (3) Clear AFS
        (4) The new Space & Missile Defense Command (SMDC) facilities on or near Fort Greely.
    b. Team members should include:
        (1) ERDC/CERL
        (2) Air Force Civil Engineering Support Agency
        (3) Defense Energy Support Center (DESC).
    c. Non-DOD team members should include:
        (1) Department of Energy
        (2) Alaska Department of Natural Resources
        (3) Alaska Industrial Development and Export Authority (AIDEA)
        (4) University of Alaska – Fairbanks
        (5) Industrial energy research organizations (i.e., American Gas Association, Electric Power Research Institute).
    d. The Department of Energy should be the team leader for this power study.
    e. Some of the goals of this team effort should include:
        (1) Developing a regional solution to regional energy and power needs
        (2) Determining availability of natural gas in the Fairbanks area
        (3) Assessing the long-term coal supplies in the region
        (4) Determining expansion plans of all Independent Power Producers (IPPs) and local utilities in the region
        (5) Determining economic growth in the region
        (6) Assessing reliability and capacity needs of the region.

Appendix A: Contractor Qualifications

Science Applications International Corporation (SAIC)

SAIC is a Fortune 500 company that ranks as the largest employee-owned research and engineering firm in the nation. SAIC and its subsidiaries have more than 40,000 employees with offices in over 150 cities worldwide. The SAIC personnel who conducted the work for this study are part of SAIC's Energy Systems Group.

SAIC's Energy Systems Group is highly experienced and skilled in the assessment and evaluation of advanced and emerging energy technologies, renewable energy systems as well as the latest advances in combined heat and power systems. SAIC has performed numerous technology evaluations, conducted long-term performance monitoring of advanced energy equipment, conducted market assessments and performed feasibility studies. The Group has significant experience in developing, monitoring, and evaluating conventional and advanced energy systems and technologies and has providing overall project coordination on large demonstration projects.

For the Federal government, SAIC's Energy Systems Group provides technical services to the U.S. Department of Energy directly and through the following agencies: the Energy Information Association (EIA), the National Energy Technology Laboratory (NETL), and the National Renewable Energy Laboratory (NREL). In addition, the Energy Systems Group is working with the U.S. Army Construction Engineering Research Laboratory (CERL) in the area of fuel cells, compressed air systems and desiccant space conditioning systems.

For state governments, SAIC's Energy Systems Group provides technical expertise and program management services to the New York State Energy Research and Development Authority (NYSERDA), Wisconsin's Focus on Energy Program, and the California Energy Commission (CEC).

On the local government level, SAIC's Energy Systems Group provides technical services to the County of San Diego, the City of Chula Vista and the San Diego Regional Energy Office.

SAIC's Energy Systems Group has offices in Albany, New York; Syracuse, New York; Madison, Wisconsin; San Diego, California; McLean, Virginia; Oak Ridge, Tennessee; and Pittsburgh, Pennsylvania.

SAIC's Experience with the DOE National Energy Technology Laboratory:

SAIC is part of a joint venture called Energy and Environmental Solutions (E2S) that provides technical services to the National Energy Technology Laboratory (NETL). Approximately 80 SAIC staff work on-site at NETL's Pittsburgh facility and work closely with NETL personnel in the areas of coal, oil, gas, global climate change, and international programs, as well as providing information technology (IT) support. SAIC engineers, scientists, economists, and IT specialists perform studies in clean coal technologies, environmental control systems, distributed generation, and carbon sequestration. The work ranges from detailed engineering analyses using system simulation tools such as Aspen, to policy analyses related to the introduction of NETL-supported energy technologies. SAIC technical experts are also engaged in technology transfer activities internationally with NETL, specifically in India. SAIC has worked with NETL and its predecessor organizations, the Federal Energy Technology Center (FETC) and the Pittsburgh Energy Technology Center (PETC) for nearly 20 years. SAIC also supports DOE's Office of Fossil Energy in Alaska through our NETL contract and has a dedicated staff member in Anchorage.

John Westerman; Program Manager

Mr. Westerman is a Program Manager at SAIC in the Energy Systems Group. He has more than 15 years of experience in the evaluation and application of new energy technologies. Mr. Westerman has conducted feasibility studies for the application of fuel cells for the U.S. Department of Defense, the U.S. Coast Guard, the Kennedy Space Center and the Wildlife Conservation Society. He has conducted performance and environmental monitoring on eight fuel cells. He is a co-author of the Phosphoric Acid Fuel Cell Technical Instruction Guide published by the Army Corp of Engineers. Mr. Westerman is currently developing a distributed generation software analysis tool for the U.S. Department of Energy. Mr. Westerman has conducted energy analysis, rate studies and application assessments at numerous DoD facilities to evaluate the application of fuel cells, engine-driven air compressors, and desiccant cooling systems. Mr. Westerman has an MBA from the University of San Diego and a BS in Physics from the University of California, San Diego.

Robert Lorand, P.E.; Program Manager

Mr. Lorand is a senior program manager at SAIC, with nearly 30 years experience with advanced energy systems. Mr. Lorand has conducted technology assessments and feasibility studies of central heating and power plants and cogeneration systems. He led a U.S. Trade and Development Agency (TDA) sponsored study to upgrade coal-fired central heating and power plants in the Czech Republic. This involved managing a team of subcontractors including Babcock and Wilcox, Sargent and Lundy Engineers, and Czech engineering firms. For Consolidated Edison Company of New York, Mr. Lorand was responsible for evaluating opportunities to reduce energy and conserve water from Con Ed's steam distribution network. Mr. Lorand has also been involved with alternative energy systems, including renewable energy technologies and fuel cells. He served as the U.S. technical representative to the International Energy Agency (IEA) task on solar energy in building renovation. Mr. Lorand began his career at Pratt and Whitney Aircraft as a compressor analytical engineer and also served as a performance engineer, including work with the United Technologies Research Center (UTRC). Mr. Lorand holds a Bachelor in Engineering Science degree and is a professional engineer.

Schmidt Associates, Inc.

Schmidt Associates, Inc. (SAI) is a professional engineering design firm with a national reputation specializing in the production and distribution of energy. With over 30 years of experience in energy production and distribution, SAI has acquired valuable expertise in many areas. Those areas include maintenance and repair of energy production equipment, planning and design of systems to produce energy in the most economical manner, innovative alternate energy production, monitoring and control of energy production and use, and incineration and environmental control. Our client list includes many Fortune 100 companies, Federal Agencies, U.S. Armed Forces, and public utilities.

Schmidt and Associates was formed in 1965 as mechanical and electrical consulting engineers. During the years of 1966 to 1967, Schmidt and Associates merged with Noble W. Herzberg and Associates. After the death of Mr. Herzberg in 1968, Schmidt and Associates came into its own and emerged as the firm of Schmidt Associates, Inc., mechanical, electrical, and structural engineers.

Since that time, Schmidt Associates, Inc. has specialized in central utilities services, heating, ventilation, air conditioning and power for industrial, institutional, and governmental plants including studies, tests, application, and installation of new technologies in industry today.

Most of our clients return to Schmidt Associates, Inc. many times for additional projects and, in most other cases, referrals by satisfied previous clients become the groundwork for our new clients.

Each project, whether it be a study (feasibility, new technology), retrofitting of small or large installation, or ultimately an entire new installation from ground up, all are handled with the same care and consideration of the client in his needs for an economically, environmentally clean, and efficient end operation.

Project engineers are assigned as needed in their areas of expertise, with a backup of designers, draftsmen, computer personnel, etc. for a refined, successful end operation.

Schmidt Associates, Inc. are registered engineers in the following states:

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- Illuminating Engineering Society
- American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- American Concrete Institute
- Instrument Society of America
- Construction Specifications Institute.

Charlie Schmidt

PRESIDENT	**B.S. Mechanical Engineering, State University of Iowa**
1968-Present	Organized Schmidt Associates, Inc., following the dissolution of the Noble W. Herzberg partnership. Experienced in the design of boiler plants and air pollution control. Responsible for negotiations with prospective clients, project coordination, contractual negotiations, budget preparation, construction supervision and studies.
1966-1967	Schmidt Associates merged with the firm of Noble W. Herzberg and Associates. Over 50% of his time was devoted to the design of large steam generators.
1965	Formed Schmidt Associates as principal in mechanical and electrical consulting engineering firm. The basic service was to other consultants and owners in central utilities services. The group consisted of seven engineers.
1962-1964	Employed by Carl R. Rohrer Associates as Assistant Chief Mechanical Engineer. Supervised an engineering group and directly responsible for all heating, ventilating, air conditioning and piping design.
1960-1962	Employed as an Operational Engineer by Pittsburgh Plate Glass Company, Barberton, Ohio. Responsible for the maintenance and operation of 1,400,000 PPH steam generating plant at 900 PSIG and 900 °F for 150,000 KW capacity, including supervision of coal handling and laboratory testing. Supervised construction and placed into operation an additional 600,000 PPH Babcock and Wilcox cyclone-fired 900 PSIG and 900^{o} boiler and 60,000 KW turbine/generator.
	Registered Professional Engineer in Ohio, Pennsylvania, Michigan, Indiana, Iowa, Illinois and Kentucky.
	Member of American Society of Mechanical Engineers, National Society of Professional Engineers, Ohio So-

ciety of Professional Engineers, and Akron Society of Professional Engineers.

The following is a list of special consulting work:

1972-Present	Presentation of technical papers: Cleveland Engineering Society, University of Kentucky, Cleveland Energy Conference, Cleveland State University, Penn State University, University of Wisconsin, Ohio State University, United States Environmental Protection Agency.
1995-1997	United States Agency for International Development (USAID) - Combustion and air pollution expert for Kamerovo Region (Siberia), Russia. Reduced particulate emissions 50% and decreased coal usage 15% without any capital investment.
1975-1978	Judge in Energy Conservation Project, Northeast Ohio, Mr. Robert Shepard, Department of Commerce
1971-1978	Special consultant to State of Ohio, Department of Public Works, to work out agreements with Ohio E.P.A. on state institutions.
1970-1972	Technical Boiler Specialist in public utilities case for the cities of Akron and Youngstown, and in a successful case against Ohio Edison in proposed central heating plant closing.
1968-1970	Energy consultant to National Iran Gas Company, Division of National Iran Oil Company; conversion of Iran industry to natural gas from oil.
1967-1974	Pennsylvania State University - Developed dry SO_X, NO_X and particulate removal system with Nuclear Engineering Department.

Appendix B: New Developments Since Team Assessment and Analysis in June/July 2002

The CERL FWA CHPP assessment and analysis team conducted its 8-day site visit in late June 2002. From that time until approximately 10 July (when the recommendation was briefed to senior Army leadership, CERL compiled the data, and developed the courses of action and recommendation.

From July to December 2002, some of the facts and assumptions of this study changed, and the Office of the Assistant Chief of Staff for Installation Management (ACSIM) made a final decision.

Changes During the Course of the Study

Changes in facts and assumptions during the course of this study were:

1. A decision was made to complete the original construction scope of all six baghouses on the CHPP, and not reduce it to the recommended four baghouses. Therefore, we will not have an estimated $5M savings.
2. A decision has not been made to cancel the air-cooled condenser project. A decision is needed by December 2002 to meet 2003 construction season; it is currently scheduled for completion in May 2005.
3. During the June site visit, the team developed a project list (Appendix G) that would reallocate the remaining unobligated OMA funds to upgrade the heating only systems and ensure its reliability for 10 years. This non-binding list has not been implemented; the remaining OMA funds have already been obligated. Therefore, the estimated savings of $16M were not realized.
4. The air quality issues of the heating only option has been analyzed with the following results:
    a. The backup generator component of the heating only plant would introduce new air pollution (AP) sources at FWA
    b. Emissions from generators for heating only option, new hospital, and SBCT threaten to exceed Prevention of Significant Deterioration (PSD) level of significance for NOx

   c. The FWA AP source that trips the PSD level of significance must:
      (1) Apply Best Available Control Technology (BACT)
      (2) Conduct ambient air quality analysis
      (3) Not adversely impact Class I area (Denali NP)
      (4) Undergo public review
   d. Estimated NOx emission levels from new generators will depend on:
      (1) Size of backup generation capability
      (2) Mixture of combustion turbine and reciprocating engine generators
      (3) Level of emission performance that generator manufacturers can guarantee
      (4) Limit on hours of operation (including testing) that FWA can accept
      (5) Attempting to meet future electrical and heating requirements by modifying CHPP will likely trip NOx significance level

5. The assessment team's original estimate for future load growth totaled approximately 26.2 MW by 2007. The interim studies team, which conducted a more detailed analysis, forecasted the growth to approximately 32 MW by 2007.
6. The initial heating load requirement increased as well, from 320 kph to 440 kph. Therefore, the plant would require five boilers (instead of four).
7. Listed below are current cost estimates for the major systems listed in the report for the heating only option:

	Estimate	
System	**Original**	**Current**
Substation for 100% power purchase	$10M	$14M
Back-up Power (critical load vs. 100% backup)	$18M	$16.5M/$20M

Final ACSIM Decision, January 2003

In January 2003, ACSIM issued its decision on how Fort Wainwright will meet its future power and heating requirements. In summary, the decision instructed:

1. The Alaska District Corps of Engineers to proceed with the air-cooled condenser project.
2. The FWA DPW, USARAK DPW, and the Pacific Regional Office – Installation Management Agency to obtain the $20M to complete the CHPP OMA upgrade project.
3. The USARAK and FWA DPW to proceed with the long-range energy study.

Appendix C: Description of Climate in Fairbanks, AK

Alaska Science Forum, July 24, 1981, Ice Fog Article #497, by T. Neil Davis

This column is provided as a public service by the Geophysical Institute, University of Alaska Fairbanks, in cooperation with the UAF research community. T. Neil Davis is a seismologist at the institute. Permission to reproduce this information was granted by: Alaska State Climate Center, Environmental and Natural Resources Institute, University of Alaska Anchorage.

An important characteristic of the arctic and subarctic environment, especially in winter, is the stillness of the air. Aircraft pilots in particular notice the change that winter brings as their craft speed steadily along, instead of bouncing around through summer's turbulent air.

As the sun retreats to near or below the horizon, less heating of the ground surface and the near-surface air occurs. If the sky is clear, the earth radiates its heat energy to the frigid reaches of space and then cools the air in contact with it. Cold, stagnant air near the ground results, often inverting the normal trend for decreasing air temperature with increasing altitude. Sometimes extreme inversions develop. At Fairbanks, where hills surround the city to further hamper air movement, the near-ground inversions are among the world's most extreme, as much as 16°F (9°C) each 100 feet (30 meters) of altitude.

The stagnation and horizontal layering of the air creates spectacular mirages and some effects that are less pleasing. Industrial pollution from urban areas of the northern hemisphere finds its way into the arctic where it hangs suspended in multiple reddish-brown layers to signal the passersby that they have not entirely escaped civilization.

Of immediate concern to residents of northern cities is the trapping of man-made pollutants by the steep inversions such as occur at Fairbanks. Most are concerned with one particular pollutant, ice fog, because they can see it, or more precisely, because of it they cannot see vehicles on the streets, or land at the local airport.

Ice fog forms from water vapor expelled into the air by people breathing, but mostly from water vapor ejected into the air from automobiles and smokestacks. Compared to warm air, cold air is able to hold very little water vapor. Air at room temperature, if saturated, can contain about 20 grams of water vapor per cubic meter, but air at -40°C can hold a maximum of only 0.1 grams, 200 times less. When air is cooled to the point of saturation, excess water condenses into either liquid or ice crystals, depending on the temperature and also on the presence of other particles that help supercooled water droplets to turn into ice crystals. [Supercooled water is that remaining liquid even though its temperature is below 32°F (0°C)]. In clean air the resulting ice fog may not form until the temperature falls to –40 °C, but if the air is dirty, the fog of tiny spherical, block-like or platelet ice crystals can start to develop at temperatures as warm as – 20 °C.

In a way, ice fog is but a warning of conditions that also trap more lethal urban pollutants. The stagnant air within the near-ground inversion also traps carbon monoxide, nitrogen and sulfur oxides, lead and hydrocarbons. Even tiny amounts of carbon monoxide are bad, especially for young children, since prolonged exposure can permanently retard their mental processes. However, the ice fog particles perhaps combine, as do liquid water droplets, with other pollutants to create obnoxious or dangerous acid compounds.

The air in a place such as Fairbanks can be so stagnant and the inversions so severe (inversions of at least some degree occur here approximately 240 days each year) that the city's pollution becomes trapped in a comparatively tight box of small volume. It is for this reason that scientists say that this particular city is so susceptible to pollution and that control of pollution sources is essential. They point out that though Fairbanks has a population two hundred times less than Los Angeles, the levels of the pollution in the two cities is sometimes comparable

Fairbanks, Alaska, Erbfc - Boreal (Subarctic) Continental*

Fairbanks is located in the Tanana Valley of interior Alaska, and is well sheltered from maritime influences by mountain ranges on practically all sides. The area, consequently, has a definite continental climate, conditioned in large measure by the ready response of the land mass to variations in solar heat received by the area throughout the year. The sun is above the horizon from 18 to 21 hours each day during the months of June and July; and during this period daily average maximum temperatures reach the lower seventies, and extreme highs of 90 °F or more have occurred in May, June, and July. Conversely, during the period from November to March, when the sunshine period ranges from 10 to less than 4 hours per day, the lowest temperature readings normally fall below zero quite regularly and extremes of near or below - 60 have occurred in three midwinter months. The surrounding upland areas tend to aid the drainage or settling of cold air into the Tanana Valley lowlands.

The persistent snow cover during the winter months is a major contributing factor to the development of extreme cold, since the white surface prevents the absorption of heat from the rather limited amount of sunshine realized during the winter season. During December and January maximum temperatures are usually below zero.

Ice fog and smoke conditions frequently occur with the extremely low temperatures during anticyclonic conditions and these tend to persist for periods of a few days to one or two weeks. During such periods most, if not all, aircraft operations are suspended. Amounts of cloudiness are low, on the average, the year around, and are particularly low during the period February through April. Wind speeds are particularly light during the winter months. These facts, together with the relative scarcity of heavy fog during March and April, indicate that flying conditions are quite favorable during the early spring months when the daylight hours are rapidly increasing.

Precipitation normally follows a fairly regular pattern. By stateside standards the total annual precipitation of about 12 inches is relatively light, being a little less than is received at Denver and a little more than is received at San Diego. Growing season precipitation, which begins with the occurrence of light rain

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* From *THE WEATHER* ALMANAC, by James A. Ruffner and Frank E. Bair (eds.), The Gale Group, 1999. Reprinted by permission of The Gale Group.

showers in May, builds up through the summer months to a maximum in August. There is a noticeable decline in precipitation from September on through December. April, which averages the lightest monthly precipitation during the year, realizes the greatest percentage of possible sunshine.

The average last date of freezing temperatures in the spring is May 21; and the average first occurrence of freezing temperatures in the fall is August 30, resulting in a growing season averaging around 100 days. The dairy industry and potato and vegetable farming represent the primary agricultural pursuits in the area, potatoes being the chief money crop. Summers are not sufficiently warm to mature corn, peppers, and tomatoes. However, cabbage, turnips, and the leafy vegetables grow luxuriantly, and there is a better chance of maturing grain crops in the Tanana Valley than in other agricultural areas of Alaska.

Ice begins running in the Chena Slough at Fairbanks during October, varying in time from the freeze-up, which averages about the first week in the month, to the date when ice will support a man's weight, averaging October 27. The Chena remains frozen and safe for man until the middle of April. Break-up usually occurs about the first week in May.

Fairbanks Weather Service Office, Fairbanks, Alaska (PAFA / FAI)

Fairbanks is located in the Tanana Valley, in the interior of Alaska. It has a distinctly continental climate, with large variation of temperature from winter to summer.

The climate in Fairbanks is conditioned mainly by the response of the land mass to large changes in solar heat received by the area during the year. The sun is above the horizon from 18 to 21 hours during June and July. During this period, daily average maximum temperatures reach the lower 70s. Temperatures of 80 degrees or higher occur on about 10 days each summer. In contrast, from November to early March, when the period of daylight ranges from 10 to less than 4 hours per day, the lowest temperature readings normally fall below zero quite regularly. Low temperatures of -40 degrees or colder occur each winter. The range of temperatures in summer is comparatively low, from the lower 30s to the mid 90s. In winter, this range is larger, from about 65 below to 45 degrees above. This large winter range of temperature reflects the great difference between frigid weather associated with dry northerly airflow from the Arctic to mild temperatures associated with southerly airflow from the Gulf of Alaska, accompanied by Chinook winds off the Alaska Range, 80 miles to the south of Fairbanks.

Snow cover is persistent in Fairbanks, without interruption, from October through April. Snowfalls of 4 inches or more in a day occur only three times during winter. Blizzard conditions are almost never seen, as winds in Fairbanks are above 20 miles an hour less than 1 percent of the time. Precipitation normally reaches a minimum in spring, and a maximum in August, when rainfall is common. During summer, thunderstorms occur in Fairbanks on an average of about eight days. Thunderstorms are about three times more frequent over the hills to the north and east of Fairbanks. Damaging hail or wind rarely accompany thunderstorms around Fairbanks.

There are rolling hills reaching elevations up to 2,000 feet above Fairbanks to the north and east of the city. During winter, the uplands are often warmer than Fairbanks, as cold air settles into the valley. In some months, temperatures in the uplands will average more than 10 degrees warmer than Fairbanks. During summer, the uplands are a few degrees cooler than the city. Precipitation in the uplands around Fairbanks is heavier than it is in the city by roughly 20 to 50 percent. Fairbanks exhibits an urban heat island especially during winter. Low lying areas nearby such as the community of North Pole, are often colder than the city, sometimes by as much as 15 degrees.

During winter, with temperatures of -20 degrees or colder, ice fog frequently forms in the city. Cold snaps accompanied by ice fog generally last about a week, but can last three weeks in unusual situations. The fog is almost always less than 300 feet deep, so that the surrounding uplands are usually in the clear, with warmer temperatures. Visibility in the ice fog is sometimes quite low, and this can hinder aircraft operations for as much as a day in severe cases. Aside from the low visibility in winter ice fog, flying weather in Fairbanks is quite favorable, especially from February through May, when crystal clear weather is common and the length of daylight is rapidly increasing.

Hardy vegetables and grains grow luxuriantly. Freezing of local rivers normally begins in the first week of October. The date when ice will normally support a persons weight is October 27. Rivers remain frozen and safe for travel until early April. Breakup of the river ice usually occurs in the first week of May.

Appendix D: Air Emissions Documents

Construction Permit

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: D-1 PAGE NO: 1 OF 3

DESCRIPTION: Remove the Voluntary PM Emission Limitation from the Air Quality Construction Permit

ORIGINAL DESIGN:

The U.S Army Alaska (USARK) has finalized an air quality construction permit that applies to the upgrade of the boilers, the construction and installation of baghouses at the Fort Wainwright central heating and power plant (CHPP), and two other non-related modifications. Alaska regulation 18 AAC 50.305(a)(4) allows owners of air pollution sources to request operational limitations in exchange for a more lenient construction permit classification. USARK requested this type of limitation to avoid a construction permit classification that would have triggered both New Source Review (NSR) and Prevention of Significant Deterioration (PSD) requirements. The construction permit specifies that the particulate matter (PM) emissions from each of the boilers not exceed 0.05 grains/dry standard cubic foot (dscf) averaged over three hours.

PROPOSED DESIGN:

Remove the voluntary PM emission limitation of 0.05 grains/dscf from the air quality construction permit. The PM emission concentration for the CHPP would then be specified in 18 AAC 50.055(b)(2), which requires that the PM emissions from each of the boilers not exceed 0.1 grains/dscf averaged over three hours.

ADVANTAGES:

Instituting the proposed design would not set a more stringent emission limit precedent for other Alaska coal burning facilities. The current air quality construction permit probably does set this type of precedent.

However, it is important to understand that acceptance of an emission limit of 0.05 grains/dscf does not affect the design of the baghouse. A properly designed baghouse achieves very high PM reduction efficiencies (~99%) throughout a wide range of particle sizes. Sizing baghouses is different from most air pollution control devices in that the emission reduction requirement is not a concern of the designer. Instead, designers size baghouses by considering the worst-case flue gas flow rate and a design factor called the air to cloth ratio. A designer will try to balance capital costs (baghouse size) versus operating costs (pressure drop). Baghouses designed in this way can easily achieve 0.01 grains/dscf during normal operation. The acceptance of the 0.05 grains/dscf emission limitation is analogous to a car dealer at first being required to provide vehicles with gas mileage of 2 mpg and then later the requirement is changed to 4 mpg when every one of the vehicles on the lot can achieve at least 20 mpg.

DISADVANTAGES:

Eliminating the limitation from the air quality construction permit would trigger both PSD and NSR. USARK agreed to the emission limitation in the air quality construction permit so that the baghouse construction and boiler upgrade project would avoid being classified as a significant modification that would institute PSD and NSR requirements.

NSR is a pre-construction permitting process for non-attainment and unclassifiable areas. The Fairbanks area is a non-attainment area for carbon monoxide (CO) and an increase in emissions of CO from the boilers could trigger NSR. PSD is a similar pre-construction permitting process for attainment areas. NSR and PSD would at a minimum require:

4. A Best Available Control Technology (BACT) analysis
5. A dispersion model study to determine exceedances of National Ambient Air Quality Standards (NAAQS) or PSD increments,
6. Ambient air monitoring at the CHPP site for criteria air pollutants, for a period of up to 1 year
7. Complex documentation in the construction permit showing the results of 1, 2, and 3 above, calculations of changes in emissions, and onsite or nearby meteorological data.

Other potential requirements include the need to find offsets for CO emissions or the need to reduce other criteria air pollutant emissions to prevent exceedances of NAAQS or PSD increments. Both the offset and PSD emission reduction requirements would likely necessitate the installation of high cost air pollution control equipment at the CCHPP or other sources at Fort Wainwright.

The modifications at the CHPP (the Upgrade Project) could also trigger the application of NSPS. As a minimum, these regulations would require the installation of continuous emission monitors (CEMs) for nitrogen oxides (NOx) and sulfur oxides (SOx). These monitors are expensive and significant labor would be required to maintain the CEMS, provide quality assurance and quality control services and documentation, and provide regulatory required reports.

JUSTIFICATION:
The proposed design avoids setting a more stringent PM emission precedent that other Alaska coal burning facilities may be forced to achieve. [Federal Register: July 5, 2002 (Volume 67, Number 129)] [Rules and Regulations]
[Page 44769-44770]
>From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr05jy02-4]

Carbon Monoxide Attainment Status

ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 81
[Docket <greek-i> AK-02-003; FRL-7240-8]

Determination of Attainment for the Carbon Monoxide National Ambient Air Quality Standard for Fairbanks Carbon Monoxide Nonattainment Area, Alaska

AGENCY: Environmental Protection Agency (EPA).
ACTION: Final rule.

SUMMARY: EPA is determining that the Fairbanks Carbon Monoxide (CO) nonattainment area in Alaska has attained the National Ambient Air Quality Standards (NAAQS) for CO by the deadline required by the Clean Air Act Amendments of 1990 (CAAA), December 31, 2001.

EFFECTIVE DATE: August 5, 2002.

FOR FURTHER INFORMATION CONTACT: Connie Robinson, EPA, Region 10, Office of Air Quality, Mail Code: OAQ-107, 1200 Sixth Avenue, Seattle Washington, 98101, (206) 553-1086.

SUPPLEMENTARY INFORMATION: Throughout this document wherever “we,” “us,” or “our” is used we mean EPA.

I. Background

EPA has the responsibility for determining whether a non-attainment area has attained the CO NAAQS by the applicable attainment date. In this case the EPA was required to make a determination concerning whether the Fairbanks serious CO non-attainment area attained the NAAQS by its December 31, 2001, attainment date. Pursuant to the CAAA, the EPA is required to make an attainment determination for this area by June 30, 2002, no later than 6 months following the attainment date for the area. This final rule was based on all available, quality-assured data collected from the CO monitoring sites, which has been entered into the Aerometric Information

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Retrieval System (AIRS). This data was reviewed to determine the area's air quality status in accordance with EPA guidance at 40 CFR 50.8, and in accordance with EPA policy and guidance as stated in a memorandum from William G. Laxton, Director Technical Support Division, entitled "Ozone and Carbon Monoxide Design Value Calculations," dated 18 June 1990.

On May 23, 2002 (67 FR 36135), EPA proposed to determine that the Fairbanks CO non-attainment area in Alaska has attained the National Ambient Air Quality Standards (NAAQS) for CO as of December 31, 2001. A detailed discussion of EPA's proposal is contained in the May 23, 2002, proposed rule and will not be restated here. The reader is referred to the proposed rule for more details.

II. Public Comments

We received no comments in response to EPA's proposed action to determine that the Fairbanks CO non-attainment area in Alaska has attained the National Ambient Air Quality Standards (NAAQS) for carbon monoxide as of December 31, 2001.

III. Attainment Determination

EPA has determined that the Fairbanks serious CO non-attainment area has attained the CO NAAQS by its attainment date of December 31, 2001. Consistent with CAAA section 188, the area will remain a serious CO non-attainment area with the additional planning requirements that apply to serious CO non-attainment areas. This finding of attainment should not be confused with a redesignation to attainment under CAAA section 107(d). Alaska has not submitted a maintenance plan as required under section 175A(a) of the CAAA for redesignation to attainment. The designation status in 40 CFR part 81 will remain serious non-attainment for the Fairbanks CO non-attainment area until such time as EPA finds that Alaska has met the CAAA requirements for redesignation to attainment.

IV. Administrative Requirements

Under Executive Order 12866 (58 FR 51735, October 4, 1993), this action is not a “significant regulatory action” and therefore is not subject to review by the Office of Management and Budget. For this reason, this action is also not subject to Executive Order 13211, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use” (66 FR 28355, May 22, 2001). This action merely approves state law as meeting Federal requirements and imposes no additional requirements beyond those imposed by state law. Accordingly, the Administrator certifies that this rule will not have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 et seq.). Because this rule approves pre-existing requirements under state law and does not impose any additional enforceable duty beyond that required by state law, it does not contain any unfunded mandate or significantly or uniquely affect small governments, as described in the Unfunded Mandates Reform Act of 1995 (Public Law 104-4).

This rule also does not have tribal implications because it will not have a substantial direct effect on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes, as specified by Executive Order 13175 (65 FR 67249, November 9, 2000). This action also does not have Federalism implications because it does not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132 (64 FR 43255, August 10, 1999). This action merely approves a state rule implementing a Federal standard, and does not alter the relationship or the distribution of power and responsibilities established in the Clean Air Act. This rule also is not subject to Executive Order 13045 “Protection of Children from Environmental Health Risks and Safety Risks” (62 FR 19885, April 23, 1997), because it is not economically significant.

In reviewing SIP submissions, EPA’s role is to approve state choices, provided that they meet the criteria of the Clean Air Act. In this context, in the absence of a prior existing requirement for the State to use voluntary consensus standards (VCS), EPA has no authority to disapprove a SIP submission for failure to use VCS. It would thus be inconsistent with applicable law for EPA, when it reviews a SIP submission, to use VCS in place of a SIP submission that otherwise satisfies the provisions of the Clean Air Act. Thus, the requirements of section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note) do not apply. This rule does not impose an information collection burden under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

The Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the Federal Register. A major rule cannot take effect until 60 days after it is published in the Federal Register.

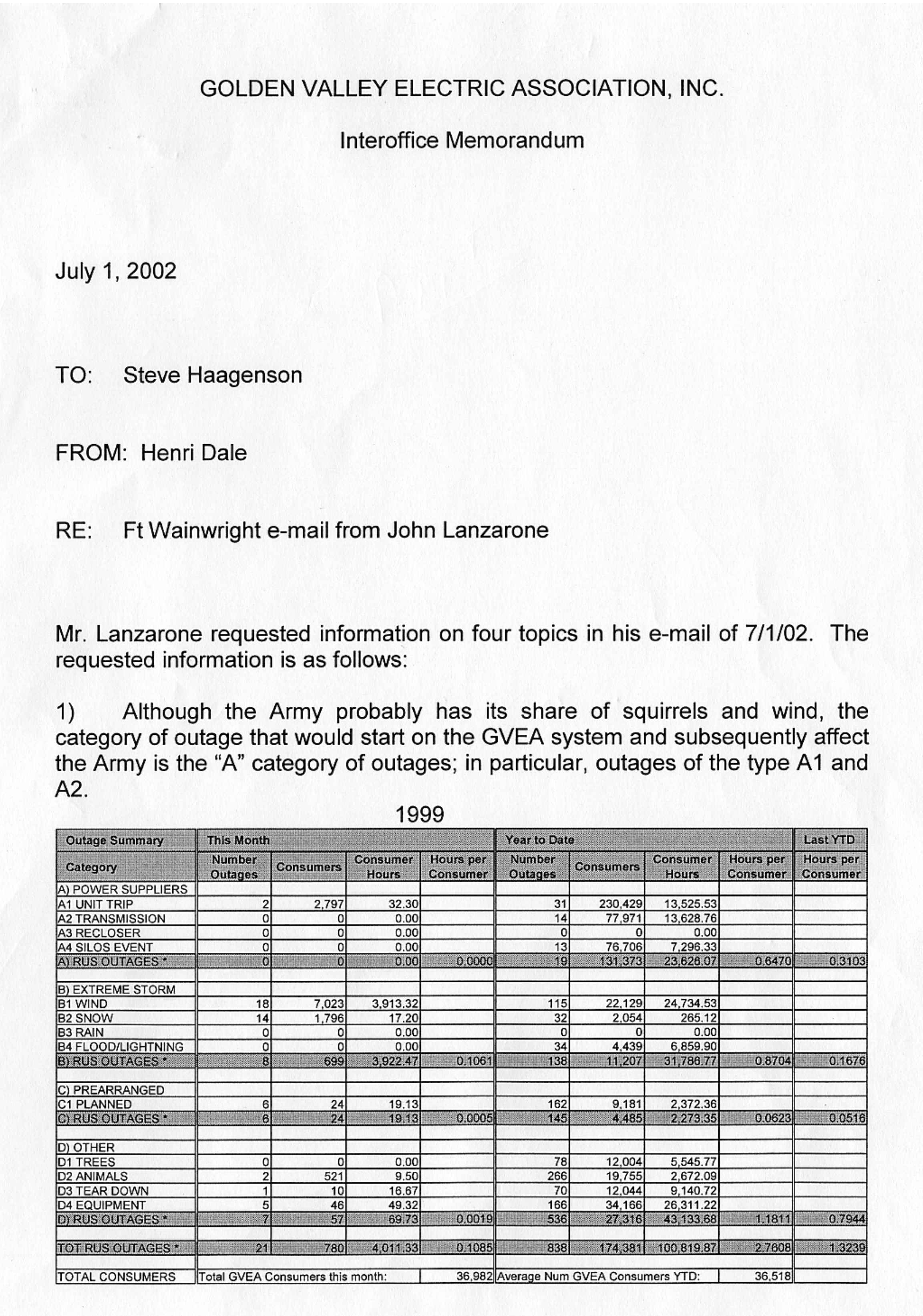
This action is not a “major rule” as defined by 5 U.S.C. 804(2). Under section 307(b)(1) of the Clean Air Act, petitions for judicial review of this action must be filed in the United States Court of Appeals for the appropriate circuit by September 3, 2002. Filing a petition for reconsideration by the Administrator of this final rule does not affect the finality of this rule for the purposes of judicial review nor does it extend the time within which a petition for judicial review may be filed, and shall not postpone the effectiveness of such rule or action. This action may not be challenged later in proceedings to enforce its requirements. (See section 307(b)(2).) List of Subjects in 40 CFR Part 81

Environmental protection, Air pollution control, Carbon monoxide National parks, Reporting and recordkeeping requirements, Wilderness areas.

Dated: June 26, 2002.
Ronald A. Kreizenbeck
Acting Regional Administrator, Region 10.
[FR Doc. 02-16854 Filed 7-3-02; 8:45 am]

BILLING CODE 6560-50-P

Appendix E: Memo From GVEA Regarding Ability To Meet Current and Future Power Requirements of FWA



GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

Interoffice Memorandum

July 1, 2002

TO: Steve Haagenson

FROM: Henri Dale

RE: Ft Wainwright e-mail from John Lanzarone

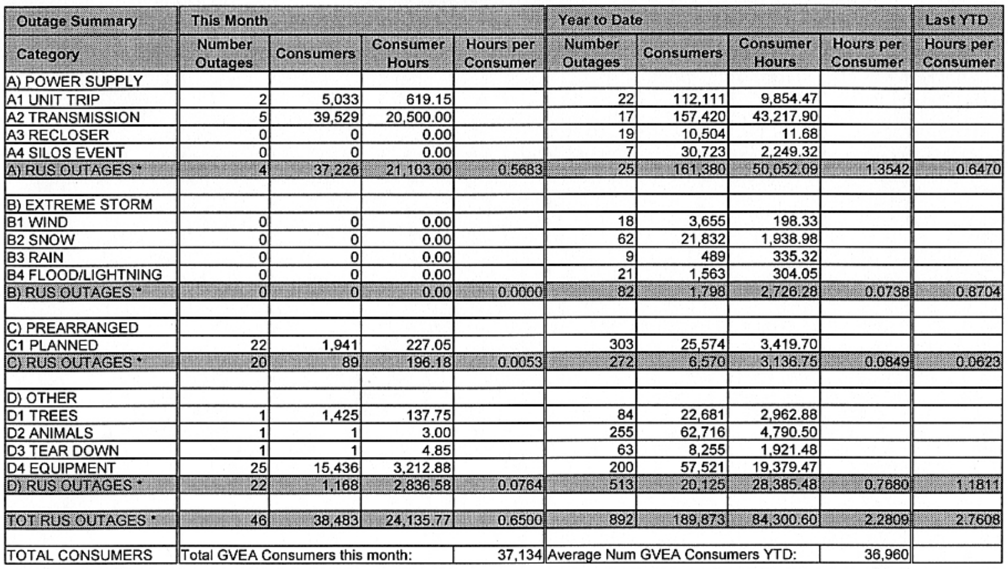
Mr. Lanzarone requested information on four topics in his e-mail of 7/1/02. The requested information is as follows:

1) Although the Army probably has its share of squirrels and wind, the category of outage that would start on the GVEA system and subsequently affect the Army is the "A" category of outages; in particular, outages of the type A1 and A2.

1999

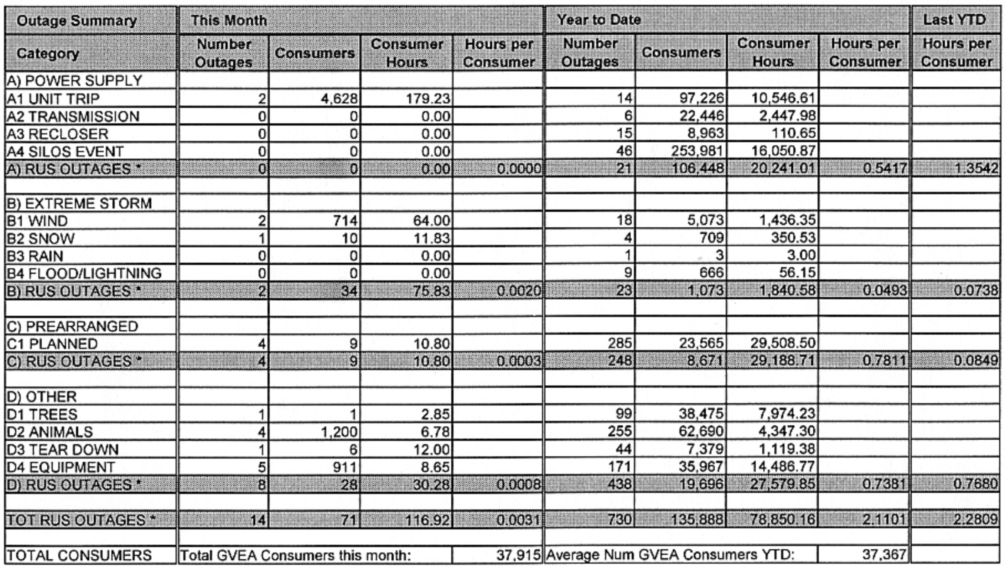
Outage Summary	This Month				Year to Date				Last YTD
Category	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Hours per Consumer
A) POWER SUPPLIERS									
A1 UNIT TRIP	2	2,797	32.30		31	230,429	13,525.53		
A2 TRANSMISSION	0	0	0.00		14	77,971	13,628.76		
A3 RECLOSER	0	0	0.00		0	0	0.00		
A4 SILOS EVENT	0	0	0.00		13	76,706	7,296.33		
A) RUS OUTAGES *	0	0	0.00	0.0000	19	131,373	23,626.07	0.6470	0.3103
B) EXTREME STORM									
B1 WIND	18	7,023	3,913.32		115	22,129	24,734.53		
B2 SNOW	14	1,796	17.20		32	2,054	265.12		
B3 RAIN	0	0	0.00		0	0	0.00		
B4 FLOOD/LIGHTNING	0	0	0.00		34	4,439	6,859.90		
B) RUS OUTAGES *	8	699	3,922.47	0.1061	138	11,207	31,786.77	0.8704	0.1676
C) PREARRANGED									
C1 PLANNED	6	24	19.13		162	9,181	2,372.36		
C) RUS OUTAGES *	6	24	19.13	0.0005	145	4,485	2,273.35	0.0623	0.0516
D) OTHER									
D1 TREES	0	0	0.00		78	12,004	5,545.77		
D2 ANIMALS	2	521	9.50		266	19,755	2,672.09		
D3 TEAR DOWN	1	10	16.67		70	12,044	9,140.72		
D4 EQUIPMENT	5	46	49.32		166	34,166	26,311.22		
D) RUS OUTAGES *	7	57	69.73	0.0019	536	27,316	43,133.68	1.1811	0.7944
TOT RUS OUTAGES *	21	780	4,011.33	0.1085	838	174,381	100,819.87	2.7608	1.3239
TOTAL CONSUMERS	Total GVEA Consumers this month:			36,982	Average Num GVEA Consumers YTD:			36,518	

2000

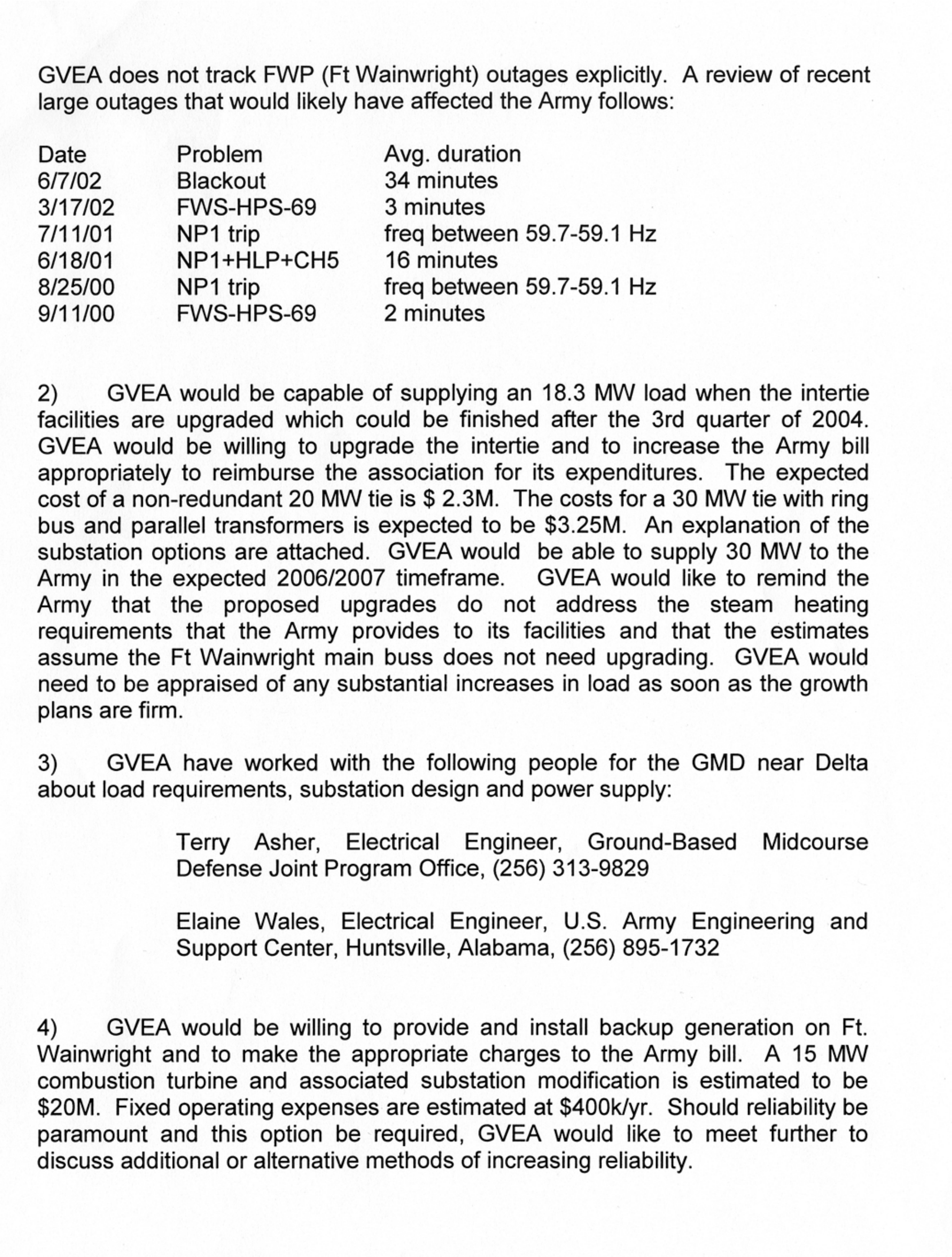


Outage Summary	This Month				Year to Date				Last YTD
Category	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Hours per Consumer
A) POWER SUPPLY									
A1 UNIT TRIP	2	5,033	619.15		22	112,111	9,854.47		
A2 TRANSMISSION	5	39,529	20,500.00		17	157,420	43,217.90		
A3 RECLOSER	0	0	0.00		19	10,504	11.68		
A4 SILOS EVENT	0	0	0.00		7	30,723	2,249.32		
A) RUS OUTAGES *	4	37,226	21,103.00	0.5683	25	161,380	50,052.09	1.3542	0.6470
B) EXTREME STORM									
B1 WIND	0	0	0.00		18	3,655	198.33		
B2 SNOW	0	0	0.00		62	21,832	1,938.98		
B3 RAIN	0	0	0.00		9	489	335.32		
B4 FLOOD/LIGHTNING	0	0	0.00		21	1,563	304.05		
B) RUS OUTAGES *	0	0	0.00	0.0000	82	1,798	2,726.28	0.0738	0.8704
C) PREARRANGED									
C1 PLANNED	22	1,941	227.05		303	25,574	3,419.70		
C) RUS OUTAGES *	20	89	196.18	0.0053	272	6,570	3,136.75	0.0849	0.0623
D) OTHER									
D1 TREES	1	1,425	137.75		84	22,681	2,962.88		
D2 ANIMALS	1	1	3.00		255	62,716	4,790.50		
D3 TEAR DOWN	1	1	4.85		63	8,255	1,921.48		
D4 EQUIPMENT	25	15,436	3,212.88		200	57,521	19,379.47		
D) RUS OUTAGES *	22	1,168	2,836.58	0.0764	513	20,125	28,385.48	0.7680	1.1811
TOT RUS OUTAGES *	46	38,483	24,135.77	0.6500	892	189,873	84,300.60	2.2809	2.7608
TOTAL CONSUMERS	Total GVEA Consumers this month:			37,134	Average Num GVEA Consumers YTD:			36,960	

2001



Outage Summary	This Month				Year to Date				Last YTD
Category	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Number Outages	Consumers	Consumer Hours	Hours per Consumer	Hours per Consumer
A) POWER SUPPLY									
A1 UNIT TRIP	2	4,628	179.23		14	97,226	10,546.61		
A2 TRANSMISSION	0	0	0.00		6	22,446	2,447.98		
A3 RECLOSER	0	0	0.00		15	8,963	110.65		
A4 SILOS EVENT	0	0	0.00		46	253,981	16,050.87		
A) RUS OUTAGES *	0	0	0.00	0.0000	21	106,448	20,241.01	0.5417	1.3542
B) EXTREME STORM									
B1 WIND	2	714	64.00		18	5,073	1,436.35		
B2 SNOW	1	10	11.83		4	709	350.53		
B3 RAIN	0	0	0.00		1	3	3.00		
B4 FLOOD/LIGHTNING	0	0	0.00		9	666	56.15		
B) RUS OUTAGES *	2	34	75.83	0.0020	23	1,073	1,840.58	0.0493	0.0738
C) PREARRANGED									
C1 PLANNED	4	9	10.80		285	23,565	29,508.50		
C) RUS OUTAGES *	4	9	10.80	0.0003	248	8,671	29,188.71	0.7811	0.0849
D) OTHER									
D1 TREES	1	1	2.85		99	38,475	7,974.23		
D2 ANIMALS	4	1,200	6.78		255	62,690	4,347.30		
D3 TEAR DOWN	1	6	12.00		44	7,379	1,119.38		
D4 EQUIPMENT	5	911	8.65		171	35,967	14,486.77		
D) RUS OUTAGES *	8	28	30.28	0.0008	438	19,696	27,579.85	0.7381	0.7680
TOT RUS OUTAGES *	14	71	116.92	0.0031	730	135,888	78,850.16	2.1101	2.2809
TOTAL CONSUMERS	Total GVEA Consumers this month:			37,915	Average Num GVEA Consumers YTD:			37,367	



GVEA does not track FWP (Ft Wainwright) outages explicitly. A review of recent large outages that would likely have affected the Army follows:

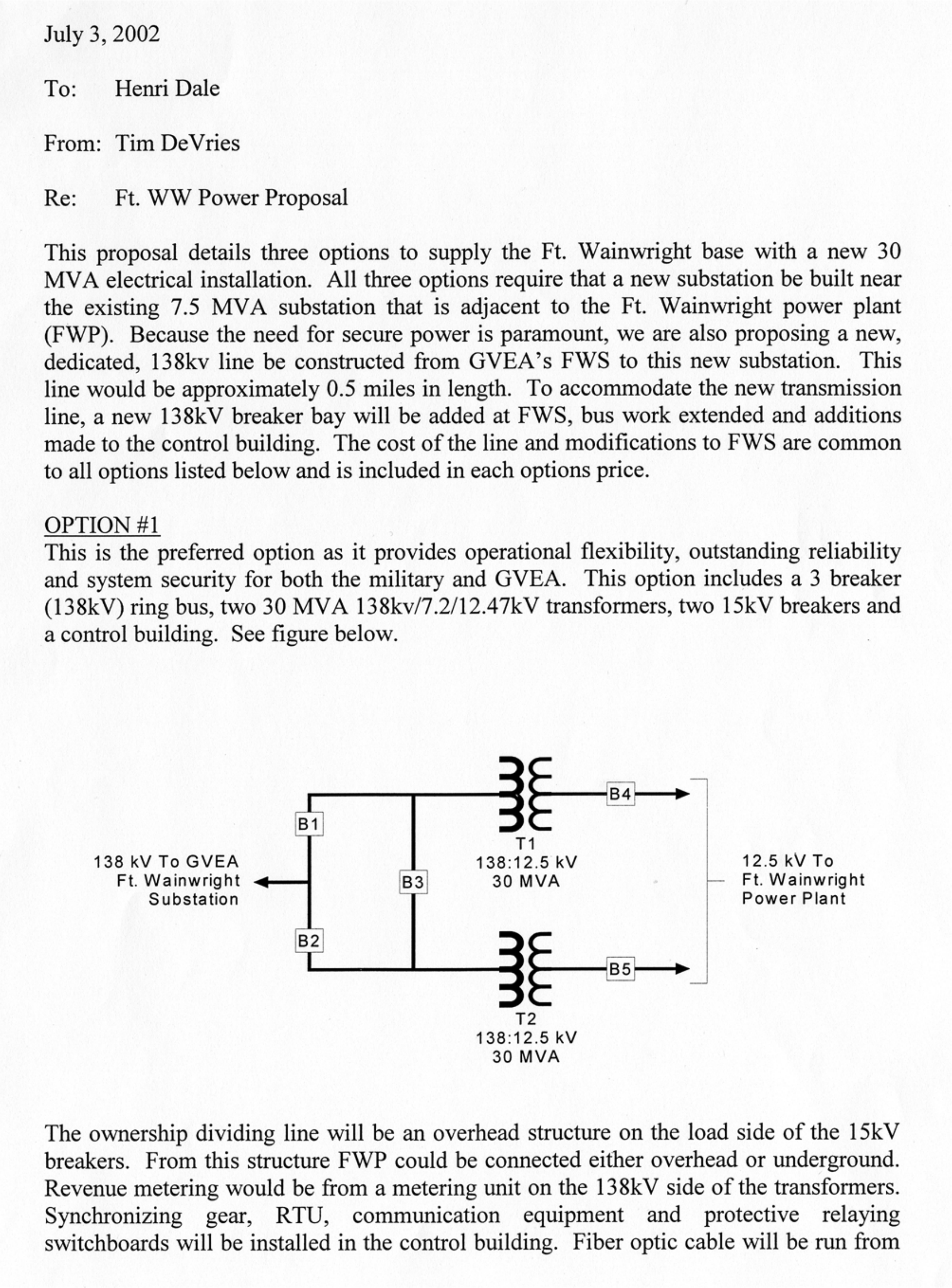
Date	Problem	Avg. duration
6/7/02	Blackout	34 minutes
3/17/02	FWS-HPS-69	3 minutes
7/11/01	NP1 trip	freq between 59.7-59.1 Hz
6/18/01	NP1+HLP+CH5	16 minutes
8/25/00	NP1 trip	freq between 59.7-59.1 Hz
9/11/00	FWS-HPS-69	2 minutes

2) GVEA would be capable of supplying an 18.3 MW load when the intertie facilities are upgraded which could be finished after the 3rd quarter of 2004. GVEA would be willing to upgrade the intertie and to increase the Army bill appropriately to reimburse the association for its expenditures. The expected cost of a non-redundant 20 MW tie is $ 2.3M. The costs for a 30 MW tie with ring bus and parallel transformers is expected to be $3.25M. An explanation of the substation options are attached. GVEA would be able to supply 30 MW to the Army in the expected 2006/2007 timeframe. GVEA would like to remind the Army that the proposed upgrades do not address the steam heating requirements that the Army provides to its facilities and that the estimates assume the Ft Wainwright main buss does not need upgrading. GVEA would need to be appraised of any substantial increases in load as soon as the growth plans are firm.

3) GVEA have worked with the following people for the GMD near Delta about load requirements, substation design and power supply:

> Terry Asher, Electrical Engineer, Ground-Based Midcourse Defense Joint Program Office, (256) 313-9829
>
> Elaine Wales, Electrical Engineer, U.S. Army Engineering and Support Center, Huntsville, Alabama, (256) 895-1732

4) GVEA would be willing to provide and install backup generation on Ft. Wainwright and to make the appropriate charges to the Army bill. A 15 MW combustion turbine and associated substation modification is estimated to be $20M. Fixed operating expenses are estimated at $400k/yr. Should reliability be paramount and this option be required, GVEA would like to meet further to discuss additional or alternative methods of increasing reliability.



July 3, 2002

To: Henri Dale

From: Tim DeVries

Re: Ft. WW Power Proposal

This proposal details three options to supply the Ft. Wainwright base with a new 30 MVA electrical installation. All three options require that a new substation be built near the existing 7.5 MVA substation that is adjacent to the Ft. Wainwright power plant (FWP). Because the need for secure power is paramount, we are also proposing a new, dedicated, 138kv line be constructed from GVEA's FWS to this new substation. This line would be approximately 0.5 miles in length. To accommodate the new transmission line, a new 138kV breaker bay will be added at FWS, bus work extended and additions made to the control building. The cost of the line and modifications to FWS are common to all options listed below and is included in each options price.

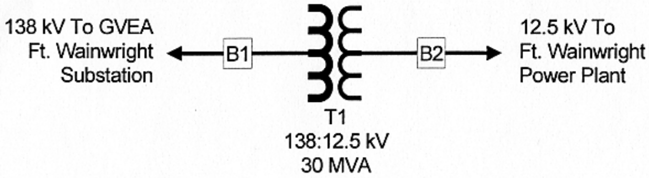
OPTION #1

This is the preferred option as it provides operational flexibility, outstanding reliability and system security for both the military and GVEA. This option includes a 3 breaker (138kV) ring bus, two 30 MVA 138kv/7.2/12.47kV transformers, two 15kV breakers and a control building. See figure below.

The ownership dividing line will be an overhead structure on the load side of the 15kV breakers. From this structure FWP could be connected either overhead or underground. Revenue metering would be from a metering unit on the 138kV side of the transformers. Synchronizing gear, RTU, communication equipment and protective relaying switchboards will be installed in the control building. Fiber optic cable will be run from the new substation back to FWS. Part of this fiber is used for protective relaying and part for the RTU and telephone communication. We believe this proposal could be constructed for $3.25 million. This estimate includes all engineering, material, construction, installation and checkout necessary to provide a functional facility by October 1, 2004.

OPTION #2

This option drops one of the 30 MVA transformers and eliminates the 138kV ring bus. It has less flexibility and security than option #1, but it also costs less. See figure below. We believe this option could be constructed for $2.40 million. This estimate includes all engineering, material, construction, installation and checkout necessary to provide a functional facility by October 1, 2004.



OPTION#3

A variation of option #2 that drops the transformer size to 20 MVA. The only difference is in the cost of the transformer and a slightly smaller transformer foundation. We believe this option could be constructed for $2.30 million. This estimate includes all engineering, material, construction, installation and checkout necessary to provide a functional facility by October 1, 2004.

Appendix F: U.S. Army Alaska Utility Sales Rates

Table C1. Energy cost summary, Walden Housing Energy.

Month*	Diesel Fuel		Electricity		
	Gallons	**Cost**	**kWh**	**Cost**	**$/kWh**
June-02			226459	20289.72	0.089595556
July-01			198105	18117.89	0.091455996
August-01			185793	17469.67	0.094027601
September-01			213524	19158.95	0.089727384
October-01			232076	20577.85	0.088668583
November-01			250661	22140.84	0.088329816
December-01			343264	30505.42	0.088868684
January-02	24638	$25,771	382721	33131.54	0.086568388
February-02	23862	$24,960	309360	27086.56	0.087556762
March-02	21020.1	$21,987	253538	22391.67	0.08831682
April-02	17610	$18,420	238987	21245.96	0.088900066
May-02	24304	$25,422	215385	19725.55	0.091582747
June-02	$-				
July-02	$-				
August-02	$-				
September-02	$-				
October-02	$-				
November-02	$-				
December-02	$-				
Average					$0.089

*Assumptions:

Btu/gal = 134000 Diesel Fuel Artic (DFA)
Price/gal = $1.05 Petro Star
Cost/MBtu = $7.81
At an assumed fuel efficiency of 72%, the cost of delivered heat is $10.84
Cost/kWh = $0.089 Golden Valley Electric Association, Inc.

Table C2. Summary of FY02 USARAK utility rates (DPW utility customer rate by location, meter type, and organization type).

	Fort Richardson				Fort Wainwright				Fort Greely			
	Metered		Non-Metered		Metered		Non-Metered		Metered		Non-Metered	
	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract	Federal "A" Rate MOU/ISSA	Other "B" Rate Contract
Power	***$/kWh***	***$/kWh***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kWh***	***$/kWh***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kWh***	***$/kWh***	***$/sq ft/yr***	***$/sq ft/yr***
Distributed Power	$0.0740	$0.0884	$0.6688	$0.7990	$0.0642	$0.0841	$0.6711	$0.8791	$0.2178	$0.2344	$1.4486	$1.5590
Distributed BRTS Power (Alyeska)									$0.1768	$0.2033		
Heat	***$/klb***	***$/klb***	***$/sq ft/yr***	***$/sq ft/yr***	***$/klb***	***$/klb***	***$/sq ft/yr***	***$/sq ft/yr***	***$/klb***	***$/klb***	***$/sq ft/yr***	***$/sq ft/yr***
Distributed Steam	$6.6616	$7.3768	$0.5852	$0.6481	$10.7682	$11.1217	$1.3629	$1.4076	$11.7054	$12.6234	$1.7990	1.9400
Air Force Hospital	$4.2467											
Gas Heat			$0.1657									
Electric Heat			$1.5774				$1.3685					
Oil Heat							$0.5300				$0.5300	
Water	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***
Distributed Treated Water	$0.6461	$1.0296	$0.1386	$0.2209	$1.6861	$4.2731	$0.0854	$0.2165	$0.9683	$1.3561	$0.0659	$0.0922
Treated Water (EAFB)	$0.5750											
Untreated Dam Water (AWWU)		0.0384										
Untreated Well Water (ADFG)		$0.2307										
Sewer:	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***	***$/kgal***	***$/kgal***	***$/sq ft/yr***	***$/sq ft/yr***
Sewage Collection/Disposal	$1.4323	$1.6497	$0.0774	$0.0892	$5.7100	$7.0551	$0.2069	$0.2557	$2.2944	$3.6508	$0.0812	$0.1290
Refuse	***$/ton***	***$/ton***	***$/sq ft/yr***	***$/sq ft/yr***	***$/ton***	***$/ton***	***$/sq ft/yr***	***$/sq ft/yr***	***$/ton***	***$/ton***	***$/sq ft/yr***	***$/sq ft/yr***
Refuse Collection/Disposal	$93.64	$110.08	$0.0495	$0.0582	$179.19	$192.02	$0.1185	$0.1270	$333.26	$449.91	$0.1309	$0.1767
*includes distribution costs.												

Table C3. Fort Wainwright FY01 utility rates (metered utilities).

Army Utility Service	Units	Rate "A" (Federal Tenant Rate)	Rate "B" (Non-Federal Tenant Rate)	Ration of Rate B to Rate A
Electrical Power				
Production	$/kWh	0.0591	0.0682	1.1540
Power & Distribution	$/kWh	0.0636	0.0855	1.3443
Heating Steam				
Production	$/klb	8.2087	8.7716	1.0686
Production & Distribution	$/klb	11.9826	12.9295	1.0790
Potable Water	$/kgal	2.0434	3.6111	3.4609
Sewerage				
Water & Disposal	$/kgal	3.0840	4.3503	1.4106
Refuse				
Collection	$/cu yd	3.4122	3.8838	1.1382
Disposal	$/cu yd	3.5604	3.6849	1.0350
Collection & Disposal	$/cu yd	6.9726	7.5687	1.0855

Table C4. Fort Wainwright FY01 utility rates (nonmetered utilities).

Utility Service	FY99 O&M Cost* ($/yr)	Facilities Serviced (sq ft)	Federal Rate "A"* ($/sq ft/yr)	Ration of B to A	Non-Federal Rate "B"* ($/sq ft/yr)
Electrical Power	$5,884,943	8,760,501	0.6718	1.3443	0.9031
Steam Heat	$14,136,610	8,760,501	1.6137	1.0790	1.7412
Water	$453,073	8,760,501	0.0529	3.4609	0.1831
Sewer	$1,027,639	8,760,501	0.1173	1.4106	0.1655
Refuse	$802,328	8,760,501	0.0916	1.0855	0.0994
Total			2.5473		3.0923

* Calculated August 2000 using FY99 operating data.

Appendix G: Life-Cycle Costs

Option 1

```
Life Cycle Cost Analysis      Study: FWA1.LC
WinLCCID  FY99                            07/08/02 13:58:07
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 1: Status Quo
Alternative: Alternative 1
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description   |  Cost in  | Equivalent |Time(s) Cost |
|                            |   DOS $   |  Uniform   |  Incurred   |
|                            |           |Differential|             |
|                            |           | Escalation |             |
|                            |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$48,000,000|       0.00%|    Jan03    |
|Electricity                | $2,877,990|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       |$10,165,918|      -0.91%| Jan04-Jan28 |
|OM&R Remaining             | $4,967,300|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,940,000|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,949,100|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,949,100|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,958,200|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,967,300|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.09 /KW-hrs|      32989.339843 MW-hrs| Jan04-
Jan28 |
```

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|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|            6305775 MBtus| Jan04-
Jan28 |
============================================================================
===

   Life Cycle Cost Analysis      Study: FWA1.LC
WinLCCID  FY99                           07/08/02 13:58:07
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 1: Status Quo
Alternative: Alternative 1
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $47,249,960

     Energy Costs                                              $193,281,700

          Electricity                                 $40,437,740
          Coal                                       $152,843,900

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $86,721,850

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                    $0
          Net Disposal Costs or Retention Value                 $0
          Other Capital Costs/Benefits                          $0
          Other Operational Costs/Benefits                      $0

     LCC of all Costs/Benefits (Net PW)                        $327,253,500


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 2a

```
Life Cycle Cost Analysis      Study: FWA2.LC
WinLCCID  FY99                            07/08/02 14:01:56
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2: Conversion to Heating Only
Alternative: Alternative 2
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$20,000,000|       0.00%|    Jan03    |
|Electricity                |$10,175,292|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       | $6,284,924|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,447,449|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,397,619|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,413,866|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,413,866|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,430,658|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,447,449|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      127113.29687 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|            3898449 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA2.LC
WinLCCID  FY99                            07/08/02 14:01:56
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2: Conversion to Heating Only
Alternative: Alternative 2
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs ...............................19,687,480

     Energy Costs ................................................237,463,300

          Electricity ..................................142,969,900
          Coal ..........................................94,493,430

     Water Costs ...........................................................0

     Routine M&R/Custodial Costs ..................................77,581,820

     Major Repair/Replacement Costs ........................................0

     Other Costs & Monetary Benefits .......................................0

          Other Pre-occupancy Costs/Benefits .....................0
          Net Disposal Costs or Retention Value ..................0
          Other Capital Costs/Benefits ...........................0
          Other Operational Costs/Benefits .......................0

     LCC of all Costs/Benefits (Net PW) .........................$334,732,600


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 2agen (Backup Generator Only)

```
Life Cycle Cost Analysis      Study: FWA2agen.LC
WinLCCID  FY99                            07/09/02 11:23:30
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2a: Backup Generator Only
Alternative: Alternative 2a
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |         $0|       0.00%|    Jan03    |
|Electricity                |    $36,000|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Backup Gen                 |   $942,833|N/A         | Jul04-Jul28 |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      448.14001464 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA2A.LC
WinLCCID  FY99                            07/09/02 11:23:30
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2a: Backup Generator Only
Alternative: Alternative 2a
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                                       $0

     Energy Costs                                                $505,825

          Electricity                                    $505,825

     Water Costs                                                          $0

     Routine M&R/Custodial Costs                                          $0

     Major Repair/Replacement Costs                                       $0

     Other Costs & Monetary Benefits                             $15,559,820

          Other Pre-occupancy Costs/Benefits                     $0
          Net Disposal Costs or Retention Value                  $0
          Other Capital Costs/Benefits                  $15,559,820
          Other Operational Costs/Benefits                       $0

     LCC of all Costs/Benefits (Net PW)                          $16,065,645

*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 2b

```
Life Cycle Cost Analysis      Study: FWA2A.LC
WinLCCID  FY99                            07/09/02 10:47:41
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2b: Conv to Htg Only w Backup Gen
Alternative: Alternative 2b
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$19,600,000|       0.00%|    Jan03    |
|Electricity                |$10,211,266|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       | $6,284,924|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $5,390,282|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $5,340,452|       0.00%|    Jul03    |
|Year 2 OM&R                | $5,356,699|       0.00%|    Jul04    |
|Year 3 OM&R                | $5,356,699|       0.00%|    Jul05    |
|Year 4 OM&R                | $5,373,491|       0.00%|    Jul06    |
|Year 5 OM&R                | $5,390,282|       0.00%|    Jul07    |
|Backup Gen                 |   $942,833|N/A         | Jul04-Jul28 |
====================================================================

        Other Key Input Data

    Location - ALASKA                      Census Region: 4
    Rates for Industrial Sector            Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      127113.29687 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           3898449 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA2A.LC
WinLCCID  FY99                            07/09/02 10:47:41
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 2b: Conv to Htg Only w Backup Gen
Alternative: Alternative 2b
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $19,293,730

     Energy Costs                                              $237,968,700

          Electricity                                $143,475,300
          Coal                                        $94,493,430

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $94,055,260

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                            $15,559,820

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                $15,559,820
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $366,877,600


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 3

```
Life Cycle Cost Analysis      Study: FWA3.LC
WinLCCID  FY99                            07/08/02 14:10:17
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 3: Conv to Htg with Oil Backup
Alternative: Alternative 3
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$45,000,000|       0.00%|    Jan03    |
|Electricity                |$10,175,292|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Distillate Oil             |   $803,326|       0.49%| Jan04-Jan28 |
|Coal                       | $5,982,784|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,447,449|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,397,619|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,413,866|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,413,866|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,430,658|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,447,449|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

=============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption        |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      127113.29687 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Distillate Oil    |    $1.05 /Gallons|          106518.5 MBtus| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           3711036 MBtus| Jan04-
Jan28 |
=============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA3.LC
WinLCCID  FY99                            07/08/02 14:10:17
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 3: Conv to Htg with Oil Backup
Alternative: Alternative 3
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $44,296,830

     Energy Costs                                              $247,002,100

          Electricity                                $142,969,900
          Distillate Oil                              $14,081,490
          Coal                                        $89,950,790

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $77,581,820

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $368,880,800


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 4

```
Life Cycle Cost Analysis      Study: FWA4.LC
WinLCCID  FY99                            07/08/02 14:14:13
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 4: Current CHPP Renovation Path
Alternative: Alternative 4
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$ 68,000,00|       0.00%|    Jan03    |
|Electricity                | $3,198,020|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       |$10,165,918|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,967,300|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,940,000|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,949,100|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,949,100|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,958,200|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,967,300|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.10 /KW-hrs|      32989.339843 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           6305775 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA4.LC
WinLCCID  FY99                            07/08/02 14:14:13
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 4: Current CHPP Renovation Path
Alternative: Alternative 4
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $66,937,440

     Energy Costs                                              $197,778,300

          Electricity                                 $44,934,390
          Coal                                       $152,843,900

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $86,721,850

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $351,437,600


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 5

```
Life Cycle Cost Analysis      Study: FWA5.LC
WinLCCID  FY99                            07/08/02 14:16:56
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 5: Stand Alone CHPP
Alternative: Alternative 5
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$114,000,00|       0.00%|    Jan03    |
|Electricity                |  -$123,156|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       |$11,365,439|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $5,008,906|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,940,000|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,954,887|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,954,887|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,988,497|       0.00%|    Jul06    |
|Year 5 OM&R                | $5,008,906|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |     $1.00 /KW-hrs|     -123.33999633 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           7049821 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA5.LC
WinLCCID  FY99                            07/08/02 14:16:57
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 5: Stand Alone CHPP
Alternative: Alternative 5
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                            $112,218,600

     Energy Costs                                              $169,148,200

          Electricity                                 -$1,730,430
          Coal                                       $170,878,700

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $87,332,300

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $368,699,200


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 6

```
Life Cycle Cost Analysis      Study: FWA6.LC
WinLCCID  FY99                            07/08/02 14:19:14
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 6: Elec Prodn to Meet Stm Prodn
Alternative: Alternative 6
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           | $63,500,00|       0.00%|    Jan03    |
|Electricity                | $5,961,222|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       |$10,551,384|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,886,116|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,857,340|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,866,932|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,866,932|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,876,537|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,886,116|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.10 /KW-hrs|      61495.710937 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|          6544874 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA6.LC
WinLCCID  FY99                            07/08/02 14:19:14
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 6: Elec Prodn to Meet Stm Prodn
Alternative: Alternative 6
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                         $62,507,750

     Energy Costs                                          $242,398,700

          Electricity                             $83,759,280
          Coal                                   $158,639,400

     Water Costs                                                     $0

     Routine M&R/Custodial Costs                            $85,299,700

     Major Repair/Replacement Costs                                  $0

     Other Costs & Monetary Benefits                                 $0

          Other Pre-occupancy Costs/Benefits             $0
          Net Disposal Costs or Retention Value          $0
          Other Capital Costs/Benefits                   $0
          Other Operational Costs/Benefits               $0

     LCC of all Costs/Benefits (Net PW)                    $390,206,100


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 7

```
Life Cycle Cost Analysis      Study: FWA7.LC
WinLCCID  FY99                            07/08/02 14:25:05
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 7: Cogen Combustion Turbine
Alternative: Alternative 7
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$51,428,000|       0.00%|    Jan03    |
|Distillate Oil             |$21,549,205|       0.49%| Jan04-Jan28 |
|                         Re| $2,940,500|N/A         | Jul08-Jul28 |
|                         Ye| $2,940,500|       0.00%|    Jul03    |
|                         Ye| $2,940,500|       0.00%|    Jul04    |
|                         Ye| $2,940,500|       0.00%|    Jul05    |
|                         Ye| $2,940,500|       0.00%|    Jul06    |
|                         Ye| $2,940,500|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Distillate Oil    |    $1.05 /Gallons|         2857355.75 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA7.LC
WinLCCID  FY99                            07/08/02 14:25:05
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 7: Cogen Combustion Turbine
Alternative: Alternative 7
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $50,624,390

     Energy Costs                                              $388,872,400

          Distillate Oil                             $377,735,600

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $51,377,180

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $490,874,000

*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 8a

```
Life Cycle Cost Analysis      Study: FWA7A.LC
WinLCCID  FY99                            07/09/02 12:41:39
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 8a: PFBC
Alternative: Alternative 8a
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$174,000,00|       0.00%|    Jan03    |
|Electricity                |-$1,511,376|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       | $8,104,871|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,200,000|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $2,800,000|       0.00%|    Jul03    |
|Year 2 OM&R                | $2,800,000|       0.00%|    Jul04    |
|Year 3 OM&R                | $2,800,000|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,200,000|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,200,000|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|========================|===========
==|
|Electricity       |      $.06 /KW-hrs|     -25893.029296 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|            5027337 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA7A.LC
WinLCCID  FY99                            07/09/02 12:41:40
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 7a: PFBC
Alternative: Alternative 7a
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                            $171,281,100

     Energy Costs                                         $100,620,320

          Electricity                                -$21,235,880
          Coal                                       $121,856,200

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $69,438,630

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                   $341,340,050


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 8

```
Life Cycle Cost Analysis      Study: FWA8.LC
WinLCCID  FY99                            07/08/02 14:31:02
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 8: CFB  Combustor
Alternative: Alternative 8
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$150,670,00|       0.00%|    Jan03    |
|Electricity                | $2,878,006|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       | $9,667,850|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,093,501|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,066,201|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,075,301|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,075,301|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,084,401|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,093,501|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption        |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.06 /KW-hrs|      49306.261718 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           5996830 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA8A.LC
WinLCCID  FY99                            07/08/02 14:31:02
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 8a: CFB  Combustor
Alternative: Alternative 8a
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                            $148,315,600

     Energy Costs                                              $185,793,500

          Electricity                                 $40,437,960
          Coal                                       $145,355,500

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $71,454,610

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $405,563,700


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 8b

```
Life Cycle Cost Analysis      Study: FWA8B.LC
WinLCCID  FY99                            07/08/02 14:33:53
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 8b: Circ Fluid Bed Combustor
Alternative: Alternative 8b
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$180,090,00|       0.00%|    Jan03    |
|Electricity                |  -$123,160|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Coal                       |$10,808,601|      -0.91%| Jan04-Jan28 |
|Remaining OM&R             | $4,135,107|N/A         | Jul08-Jul28 |
|Year 1 OM&R                | $4,066,201|       0.00%|    Jul03    |
|Year 2 OM&R                | $4,081,088|       0.00%|    Jul04    |
|Year 3 OM&R                | $4,081,088|       0.00%|    Jul05    |
|Year 4 OM&R                | $4,114,698|       0.00%|    Jul06    |
|Year 5 OM&R                | $4,135,107|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.06 /KW-hrs|     -2109.9899902 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                        0| Jan04-
Jan28 |
|Coal              |$45.80 /Short Tons|           6704422 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA8B.LC
WinLCCID  FY99                            07/08/02 14:33:53
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 8b: Circ Fluid Bed Combustor
Alternative: Alternative 8b
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                            $177,275,900

     Energy Costs                                              $160,776,100

          Electricity                                 -$1,730,485
          Coal                                       $162,506,600

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                                $72,065,050

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $410,117,100


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 9

```
Life Cycle Cost Analysis      Study: FWA9.LC
WinLCCID  FY99                            07/08/02 14:36:17
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 9: Satellite Plants
Alternative: Alternative 9
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |$42,074,000|       0.00%|    Jan03    |
|Electricity                | $9,855,323|      -1.30%| Jan04-Jan28 |
|Electric Demand            |   $792,624|      -1.30%| Jan04-Jan28 |
|Distillate Oil             |$15,057,957|       0.49%| Jan04-Jan28 |
|Remaining OM&R             |$17,520,020|N/A         | Jul08-Jul28 |
|Year 1 OM&R                |$15,337,510|       0.00%|    Jul03    |
|Year 2 OM&R                |$16,065,020|       0.00%|    Jul04    |
|Year 3 OM&R                |$16,065,020|       0.00%|    Jul05    |
|Year 4 OM&R                |$16,792,520|       0.00%|    Jul06    |
|Year 5 OM&R                |$17,520,020|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      127113.29687 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |                   792624| Jan04-
Jan28 |
|Distillate Oil    |    $1.05 /Gallons|            1996637 MBtus| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA9.LC
WinLCCID  FY99                            07/08/02 14:36:17
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 9: Satellite Plants
Alternative: Alternative 9
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                             $41,416,550

     Energy Costs                                              $413,561,600

          Electricity                               $149,611,000
          Distillate Oil                            $263,950,600

     Water Costs                                                        $0

     Routine M&R/Custodial Costs                               $300,668,200

     Major Repair/Replacement Costs                                     $0

     Other Costs & Monetary Benefits                                    $0

          Other Pre-occupancy Costs/Benefits                  $0
          Net Disposal Costs or Retention Value               $0
          Other Capital Costs/Benefits                        $0
          Other Operational Costs/Benefits                    $0

     LCC of all Costs/Benefits (Net PW)                        $755,646,300


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Option 10

```
Life Cycle Cost Analysis      Study: FWA10.LC
WinLCCID  FY99                            07/08/02 14:38:29
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 10: Buy all heat & power
Alternative: Alternative 10
Name of Designer: John Vavrin

                           Basic Input Data Summary

Criteria Reference: Tri-Service MOA for Econ Anal/LCC (Energy)

                 Discount Rate:  3.2 %

        Key Project-Calendar Information

        Date of Study (DOS)              Jul-02
        Midpoint of Construction (MPC)   Jan-03
        Beneficial Occupancy (BOD)       Jul-03
        Analysis End Date (AED)          Jul-28

====================================================================
| Cost/Benefit Description  |  Cost in  | Equivalent |Time(s) Cost |
|                           |   DOS $   |  Uniform   |  Incurred   |
|                           |           |Differential|             |
|                           |           | Escalation |             |
|                           |           |    Rate    |             |
|===========================|===========|============|=============|
|Investment Costs           |         $0|       0.00%|    Jan03    |
|Electricity                |$10,175,318|      -1.30%| Jan04-Jan28 |
|Electric Demand            |         $0|      -1.30%| Jan04-Jan28 |
|Remaining OM&R             |$17,855,020|N/A         | Jul08-Jul28 |
|Year 1 OM&R                |$15,344,160|       0.00%|    Jul03    |
|Year 2 OM&R                |$16,181,110|       0.00%|    Jul04    |
|Year 3 OM&R                |$16,181,110|       0.00%|    Jul05    |
|Year 4 OM&R                |$17,018,070|       0.00%|    Jul06    |
|Year 5 OM&R                |$17,855,020|       0.00%|    Jul07    |
====================================================================

        Other Key Input Data

    Location - ALASKA                     Census Region: 4
    Rates for Industrial Sector           Tables From:  Apr-02

============================================================================
===
|   Energy Type    |    Unit Cost     |       Consumption       |  Projected
|
|==================|==================|=========================|===========
==|
|Electricity       |      $.08 /KW-hrs|      127113.29687 MW-hrs| Jan04-
Jan28 |
|Electric Demand   |N/A               |               $0.00E+00K| Jan04-
Jan28 |
============================================================================
===
```

```
   Life Cycle Cost Analysis      Study: FWA10.LC
WinLCCID  FY99                            07/08/02 14:38:29
Project no. FY & Title:  FY02 CHPP FWA
Installation & Location: Fort Wainwright ALASKA
Design Feature: Option 10: Buy all heat & power
Alternative: Alternative 10
Name of Designer: John Vavrin

                            Life Cycle Cost Totals

     Construction/Acquisition Costs                                      $0

     Energy Costs                                              $142,970,200

          Electricity                                $142,970,200

     Water Costs                                                         $0

     Routine M&R/Custodial Costs                               $305,702,000

     Major Repair/Replacement Costs                                      $0

     Other Costs & Monetary Benefits                                     $0

          Other Pre-occupancy Costs/Benefits                   $0
          Net Disposal Costs or Retention Value                $0
          Other Capital Costs/Benefits                         $0
          Other Operational Costs/Benefits                     $0

     LCC of all Costs/Benefits (Net PW)                        $448,672,300


*Net PW Equivalents on Jul 02; in Single Dollars; in Constant Jul 02 Dollars
*Energy Escalation Rates from NIST Handbook 135 Supplement dated Apr 02
```

Appendix H: Options Analysis Data

Status Quo Option 1

Plant upgrades sufficient to ensure reliable heating/electrical supply for FY02/FY03

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	2,214,835.6	2,285,307.64	2,355,779.68	2,426,251.73
Peak		M pph	440	454	468	482
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	101,609.0	101,609.0	101,609.0	101,609.0
Fuel						
Coal		Tons/Yr	204,523.0	211,030.6	217,538.1	224,045.7
Coal Cost	$45.80	/Ton	$9,367,153	$9,665,199	$9,963,245	$10,261,291
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Operating Labor, Water, Chemicals, Parasite Power			$3,214,000	$3,223,100	$3,232,200	$3,241,300
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$1,726,000	$1,726,000
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	7.5	9.5	13.3	15.3
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$720,000	$912,000	$1,276,800	$1,468,800
Energy (GVEA)		MWh	3,083.6	6,587.6	26,663.1	37,229.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$169,483	$374,012	$1,545,818	$2,162,557
Total Energy Cost		/Yr	$181,484	$386,012	$1,557,818	$2,174,558
Total Purchased Power		/Yr	$902,684	$1,299,212	$2,835,818	$3,644,558
Export Power (Ft. Greely)		MWh	(7,485.0)	(7,485.0)	(7,485.0)	(7,485.0)
Sales	$0.05837	/kWh	-$436,899	-$436,899	-$436,899	-$436,899
Total Operating Costs			$14,772,938	$15,476,612	$17,320,364	$18,436,249
Additional Construction Cost			$0	$0	$0	$0

Conversion to mostly Heating Plant with electrical generation and 7.5 MW GVEA. Option 2a
Eliminate air cooled condenser project (-$23M). Plant upgrades sufficient to ensure reliable heating until FY05. Power substation costs ($8M) funded thru GVEA. Electricity produced to only meet required steam production. Generate power most efficiently. Reduce scope of baghouse project to 5 boilers.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	1,547,616.7	1,632,190.20	0.00	0.00
Peak		M pph	288	304	0	0
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	0.0	0.0
Peak		M pph	275	290	0	0
Power Generated		MWh/Yr	58,113.0	61,274.4	0.0	0.0
Fuel						
Coal		Tons/Yr	142,910.5	150,720.2	0.0	0.0
Coal Cost	$45.80	/Ton	$6,545,300	$6,902,985	$0	$0
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Operating Labor, Water, Chemicals, Parasite Power			$3,127,843	$3,138,763	$0	$0
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$0	$0
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$0.00	$0.00
Customer Charge		/Yr	$1,200	$1,200	$0	$0
Demand (GVEA)		MW	7.5	7.5	0.0	0.0
Demand Cost		/kW	$8.00	$8.00	$0.00	$0.00
Demand Cost		/Yr	$720,000	$720,000	$0	$0
Energy (GVEA)		MWh	39,094.0	39,437.2	0.0	0.0
1st 15000	$0.06667	/kWh	$12,001	$12,001	$0	$0
over 15000	$0.05837	/kWh	$2,271,410	$2,291,443	$0	$0
Total Energy Cost		/Yr	$2,283,411	$2,303,443	$0	$0
Total Purchased Power		/Yr	$3,004,611	$3,024,643	$0	$0
Export Power (Ft. Greely)		MWh	0.0	0.0	0.0	0.0
Sales	$0.05837	/kWh	$0	$0	$0	$0
Total Operating Costs			$14,403,753	$14,792,391	$0	$0
Additional Construction Cost			$0	$0	$0	$0

2002-2003
Purchase GVEA, 7.5 MW tie, average 5.0 MW purchase for 7 months and 3.72 MW purchase for 5 months.
2003-2005
Purchase GVEA, 7.5 MW tie, average 5.0 MW purchase for 7 months and 3.81 MW purchase for 5 months.

Conversion to Heating Only Plant within approved OMA funds Option 2b
All electric power from GVEA. 4 coal boilers. Reduce scope of baghouse project to 4 boilers (-$4M).
Eliminate air cooled condenser project (-$23M). Plant upgrades sufficient to ensure reliable heating
until FY10. Power substation costs ($8M) funded thru GVEA.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam Heating		M Lbs/Yr	1,286,044.6	1,359,103.7	1,434,609.4	1,510,115.2
Peak		M pph	255	270	285	300
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Fuel						
Coal		Tons/Yr	118,756.3	125,502.8	132,475.1	139,447.5
Coal Cost	$45.80	/Ton	$5,439,039	$5,748,026	$6,067,361	$6,386,696
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Operating Labor, Water, Chemicals, Parasite Power			$2,762,016	$2,778,263	$2,795,055	$2,811,846
Maintenance Cost (11 men + material)			$1,635,603	$1,635,603	$1,635,603	$1,635,603
Purchased Power GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand		MW	18.4	20.4	24.2	26.2
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$1,766,400	$1,958,400	$2,323,200	$2,515,200
Energy		MWh	97,207.6	100,711.6	120,787.1	131,353.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$5,663,501	$5,868,029	$7,039,835	$7,656,575
Total Energy Cost		/Yr	$5,675,502	$5,880,030	$7,051,836	$7,668,576
Total Purchased Power		/Yr	$7,443,102	$7,839,630	$9,376,236	$10,184,976
Total Operating Costs			$17,279,759	$18,001,522	$19,874,255	$21,019,121
Additional Construction Cost			$0	$0	$0	$0

Note: RIF - less 5 turbine operators, 1 electrician and 1 maintenance mechanic at $43.46/hour.

Coversion to Heating Only Plant with oil backup Option 3
All electric power from GVEA. Reduce scope of baghouse project to 3 boilers (-$8M). Eliminate air cooled condenser project (-$23M). We will have 3 coal boilers, 1 oil backup converted boiler. Power substation costs ($8M) funded thru GVEA.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam Heating		M Lbs/Yr	1,286,044.6	1,359,103.7	1,434,609.4	1,510,115.2
Peak		M pph	255	270	285	300
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Fuel						
Coal		Tons/Yr	112,159.4	118,905.8	125,878.2	132,850.6
Coal Cost	$45.80	/Ton	$5,136,900	$5,445,887	$5,765,222	$6,084,556
Oil		M Gallons/Yr	768,000	768,000	768,000	768,000
Oil Cost	$1.046	/Gallon	$803,328	$803,328	$803,328	$803,328
Operating Labor, Water, Chemicals, Parasite Power			$2,762,016	$2,778,263	$2,795,055	$2,811,846
Maintenance Cost (11 men + material)			$1,635,603	$1,635,603	$1,635,603	$1,635,603
Purchased Power GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand		MW	18.4	20.4	24.2	26.2
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$1,766,400	$1,958,400	$2,323,200	$2,515,200
Energy		MWh	97,207.6	100,711.6	120,787.1	131,353.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$5,663,501	$5,868,029	$7,039,835	$7,656,575
Total Energy Cost		/Yr	$5,675,502	$5,880,030	$7,051,836	$7,668,576
Total Purchased Power		/Yr	$7,443,102	$7,839,630	$9,376,236	$10,184,976
Total Operating Costs			$17,780,948	$18,502,711	$20,375,444	$21,520,310
Additional Construction Cost			$4,892,000	$0	$0	$0

Note: RIF - less 5 turbine operators, 1 electrician and 1 maintenance mechanic at $43.46/hour.
Oil usage is 20 days at 150,000 lbs/hr per year or 768,000 gallons per year and coal reduction o
6,596.9 tons per year.

Stand Alone CHPP to meet future loads Option 5
Upgrade plant to provide full electric load for future (30 MW). Provide reliable heat & power for 25 years.
Six coal boilers, 6 - 5MW generators.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	2,214,835.6	2,330,122.0	2,590,403.2	2,748,457.9
Peak		M pph	440	454	468	482
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	101,609.0	101,609.0	101,609.0	101,609.0
Additional Power From Extraction (Heating)			0.0	2,418.8	4,837.6	7,256.5
Additional Power From Condensers			0.0	4,168.8	21,825.4	29,972.7
Fuel						
Coal		Tons/Yr	204,523.0	215,168.8	239,203.8	253,798.9
Coal Cost	$45.80	/Ton	$9,367,153	$9,854,732	$10,955,533	$11,623,990
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Operating Labor, Water, Chemicals, Parasite Power			$3,214,000	$3,228,887	$3,262,497	$3,282,906
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$1,726,000	$1,726,000
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	7.5	3.0	3.0	3.0
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$720,000	$288,000	$288,000	$288,000
Energy (GVEA)		MWh	3,083.60	0.00	0.00	0.00
1st 15000	$0.06667	/kWh	$12,001	$0	$0	$0
over 15000	$0.05837	/kWh	$169,483	$0	$0	$0
Total Energy Cost		/Yr	$181,484	$0	$0	$0
Total Purchased Power		/Yr	$902,684	$289,200	$289,200	$289,200
Export Power (Ft. Greely)		MWh	(7,485.0)	(7,485.0)	(7,485.0)	(7,485.0)
Sales	$0.05837	/kWh	-$436,899	-$436,899	-$436,899	-$436,899
Total Operating Costs			$14,772,938	$14,661,919	$15,796,330	$16,485,197
Additional Construction Cost			$0	$29,416,000	$0	$0

Note: Of $29,461,000 construction cost, $17,720,000 is the additional air cooled condenser.

Electricity Produced to Only Meet Required Steam Production Option 6
Generate power most efficiently. Reduce scope of baghouse project to 5 boilers.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	1,574,703.8	1,648,985.80	1,723,367.70	1,797,549.70
Peak		M pph	288	302	315	329
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	59,129.0	61,555.2	63,973.0	66,391.8
Fuel						
Coal		Tons/Yr	204,523.0	214,170.8	223,831.5	233,466.3
Coal Cost	$45.80	/Ton	$9,367,153	$9,809,021	$10,251,483	$10,692,756
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Operating Labor, Water, Chemicals, Parasite Power			$3,131,340	$3,140,932	$3,150,537	$3,160,116
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$1,726,000	$1,726,000
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	14.4	16.4	20.2	22.2
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$1,382,400	$1,574,400	$1,939,200	$2,131,200
Energy (GVEA)		MWh	38,078.6	39,156.4	56,814.1	64,961.3
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$2,212,141	$2,275,052	$3,305,732	$3,781,284
Total Energy Cost		/Yr	$2,224,142	$2,287,053	$3,317,733	$3,793,285
Total Purchased Power		/Yr	$3,607,742	$3,862,653	$5,258,133	$5,925,685
Export Power (Ft. Greely)		MWh	0.0	0.0	0.0	0.0
Sales	$0.05837	/kWh	$0	$0	$0	$0
Total Operating Costs			$17,832,236	$18,538,607	$20,386,153	$21,504,557
Additional Construction Cost			$0	$0	$0	$0

Co-generation Oil-Fired Combustion Turbines Option 7
Private sector funded. Demolition of existing boiler plant.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	0.0	0.00	0.00	0.00
Peak		M pph	0	0	0	0
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	97,207.6	100,711.9	120,787.5	131,353.1
Fuel						
Coal		Tons/Yr	0.0	0.0	0.0	0.0
Coal Cost	$45.80	/Ton	$0	$0	$0	$0
Oil		M Gallons/Yr	17,601.9	18,468.7	20,195.1	20,966.9
Oil Cost	$1.046	/Gallon	$18,411,587	$19,318,260	$21,124,075	$21,931,377
Operating Labor, Water, Chemicals, Parasite Power			$1,664,000	$1,674,909	$1,685,818	$1,696,727
Maintenance Cost (5 men + material)			$536,000	$536,000	$536,000	$536,000
Maintenance Cost (combustion turbine contract)			$740,500	$740,500	$740,500	$740,500
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	1.3	3.3	7.1	9.1
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$124,800	$316,800	$681,600	$873,600
Energy (GVEA)		MWh	0.0	0.0	0.0	0.0
1st 15000	$0.06667	/kWh	$0	$0	$0	$0
over 15000	$0.05837	/kWh	$0	$0	$0	$0
Total Energy Cost		/Yr	$0	$0	$0	$0
Total Purchased Power		/Yr	$126,000	$318,000	$682,800	$874,800
Export Power (Ft. Greely)		MWh	0.0	0.0	0.0	0.0
Sales	$0.05837	/kWh	$0	$0	$0	$0
Total Operating Costs			$20,737,587	$21,847,169	$24,028,693	$25,038,905
Additional Construction Cost			$0	$51,428,800	$0	$0

Circulating Fluid Bed Combustor Option 8A
Private sector funded. Demolition of existing boiler plant.
Two existing 150,000 #/hr stoker boilers converted to oil for backup

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	2,214,835.6	2,285,307.6	2,355,779.7	2,426,251.7
Peak		M pph	440	454	468	482
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	101,609.0	101,609.0	101,609.0	101,609.0
Fuel						
Coal		Tons/Yr	190,876.0	196,949.3	203,022.6	209,095.9
Coal Cost	$45.80	/Ton	$8,742,119	$9,020,277	$9,298,436	$9,576,594
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Limestone (38#/ton of coal)		Tons/Yr	3,626.6	3,742.0	3,857.4	3,972.8
Limestone	$45.80	/Ton	$166,100	$171,385	$176,670	$181,955
Operating Labor, Water, Chemicals, Parasite Powe			$3,214,000	$3,223,100	$3,232,200	$3,241,300
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$1,726,000	$1,726,000
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	7.5	9.5	13.3	15.3
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$720,000	$912,000	$1,276,800	$1,468,800
Energy (GVEA)		MWh	3,083.6	6,587.6	26,663.1	37,229.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$169,483	$374,012	$1,545,818	$2,162,557
Total Energy Cost		/Yr	$181,484	$386,012	$1,557,818	$2,174,558
Total Purchased Power		/Yr	$902,684	$1,299,212	$2,835,818	$3,644,558
Export Power (Ft. Greely)		MWh	(7,485.0)	(7,485.0)	(7,485.0)	(7,485.0)
Sales	$0.05837	/kWh	-$436,899	-$436,899	-$436,899	-$436,899
Total Operating Costs			$14,314,003	$15,003,075	$16,832,225	$17,933,508
Additional Construction Cost			$0	$150,670,000	$0	$0

Circulating Fluid Bed Combustor Option 8B

Private sector funded. Demolition of existing boiler plant. Upgrade plant to provide full electric load for future (30 MW). Provide reliable heat & power for 25 years. Two existing 150,000 #/hr stoker boilers converted to oil for backup.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam		M Lbs/Yr	2,214,835.6	2,330,122.0	2,590,403.2	2,748,457.9
Peak		M pph	440	454	468	482
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Power Generated		MWh/Yr	101,609.0	101,609.0	101,609.0	101,609.0
Additional Power From Extraction (Heating)			0.0	2,418.8	4,837.6	7,256.5
Additional Power From Condensers			0.0	4,168.8	21,825.4	29,972.7
Fuel						
Coal		Tons/Yr	190,876.0	200,811.4	223,242.6	236,863.9
Coal Cost	$45.80	/Ton	$8,742,119	$9,197,163	$10,224,512	$10,848,365
Oil		M Gallons/Yr				
Oil Cost	$1.046	/Gallon				
Limestone (38#/ton of coal)		Tons/Yr	3,626.6	3,815.4	4,241.6	4,500.4
Limestone	$45.80	/Ton	$166,100	$174,746	$194,266	$206,119
Operating Labor, Water, Chemicals, Parasite Power			$3,214,000	$3,228,887	$3,262,497	$3,282,906
Maintenance Cost (12 men + material)			$1,726,000	$1,726,000	$1,726,000	$1,726,000
Purchased Power GVEA GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand (GVEA)		MW	7.5	3.0	3.0	3.0
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$720,000	$288,000	$288,000	$288,000
Energy (GVEA)		MWh	3,083.6	0.0	0.0	0.0
1st 15000	$0.06667	/kWh	$12,001	$0	$0	$0
over 15000	$0.05837	/kWh	$169,483	$0	$0	$0
Total Energy Cost		/Yr	$181,484	$0	$0	$0
Total Purchased Power		/Yr	$902,684	$289,200	$289,200	$289,200
Export Power (Ft. Greely)		MWh	(7,485.0)	(7,485.0)	(7,485.0)	(7,485.0)
Sales	$0.05837	/kWh	-$436,899	-$436,899	-$436,899	-$436,899
Total Operating Costs			$14,314,003	$14,179,096	$15,259,575	$15,915,691
Additional Construction Cost			$0	$180,090,000	$0	$0

Note: Of $180,090,000 construction cost, $17,720,000 is the additional air cooled condenser.

Heading only - satellite plants Option 9

Abandon CHPP. 3 satellite plants with package oil-fired boilers. Plants will feed steam to existing Utilidors.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam Heating		M Lbs/Yr	0.0	0.0	0.0	0.0
Peak		M pph	0	0	0	0
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Fuel						
Coal		Tons/Yr	0.0	0.0	0.0	0.0
Coal Cost	$45.80	/Ton	$0	$0	$0	$0
Oil		M Gallons/Yr	12,559.8	13,244.8	13,929.9	14,615.0
Oil Cost	$1.046	/Gallon	$13,137,515	$13,854,107	$14,570,699	$15,287,290
Operating Labor, Water, Chemicals, Parasite Power			$1,664,000	$1,674,909	$1,685,818	$1,696,727
Maintenance Cost (5 men + material)			$536,000	$536,000	$536,000	$536,000
Purchased Power GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand		MW	18.4	20.4	24.2	26.2
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$1,766,400	$1,958,400	$2,323,200	$2,515,200
Energy		MWh	97,207.6	100,711.6	120,787.1	131,353.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$5,663,501	$5,868,029	$7,039,835	$7,656,575
Total Energy Cost		/Yr	$5,675,502	$5,880,030	$7,051,836	$7,668,576
Total Purchased Power		/Yr	$7,443,102	$7,839,630	$9,376,236	$10,184,976
Total Operating Costs			$22,780,617	$23,904,646	$26,168,753	$27,704,994
Additional Construction Cost			$0	$42,074,000	$0	$0

Heating only - Purchase from Aurora Energy Option 10
Abandon CHPP. Partial solution based on existing surplus capacity at Aurora.

			2002-2003	2003-2005	2005-2006	2006-2007
HP Steam Heating		M Lbs/Yr	0.0	0.0	0.0	0.0
Peak		M pph	0	0	0	0
Steam Heating		M Lbs/Yr	1,361,835.8	1,436,117.8	1,510,399.7	1,584,681.7
Peak		M pph	275	290	305	320
Purchased Steam		M Lbs/Yr	1,455,802.5	1,535,209.9	1,614,617.3	1,694,024.7
Purchased Steam	$10.54	/MBtu	$15,344,158	$16,181,112	$17,018,066	$17,855,020
Fuel						
Coal		Tons/Yr	0.0	0.0	0.0	0.0
Coal Cost	$45.80	/Ton	$0	$0	$0	$0
Oil		M Gallons/Yr	0.0	0.0	0.0	0.0
Oil Cost	$1.046	/Gallon	$0	$0	$0	$0
Operating Labor, Water, Chemicals, Parasite Power			$0	$0.00	$0.00	$0.00
Maintenance Cost (5 men + material)			$0	$0	$0	$0
Purchased Power GS-2(2) Rate Schedule						
Customer Charge		/Month	$100.00	$100.00	$100.00	$100.00
Customer Charge		/Yr	$1,200	$1,200	$1,200	$1,200
Demand		MW	18.4	20.4	24.2	26.2
Demand Cost		/kW	$8.00	$8.00	$8.00	$8.00
Demand Cost		/Yr	$1,766,400	$1,958,400	$2,323,200	$2,515,200
Energy		MWh	97,207.6	100,711.6	120,787.1	131,353.1
1st 15000	$0.06667	/kWh	$12,001	$12,001	$12,001	$12,001
over 15000	$0.05837	/kWh	$5,663,501	$5,868,029	$7,039,835	$7,656,575
Total Energy Cost		/Yr	$5,675,502	$5,880,030	$7,051,836	$7,668,576
Total Purchased Power		/Yr	$7,443,102	$7,839,630	$9,376,236	$10,184,976
Total Operating Costs			$22,787,260	$24,020,742	$26,394,302	$28,039,996
Additional Construction Cost			$0	$0	$0	$0

Note: Steam heating is 1,069 Btu/#, NOT 1,000 Btu/#.

HEATING ONLY - GVEA EMERGENCY GENERATORS

FT. WAINWRIGHT, ALASKA

COST ESTIMATE; SIX (6) 2MW ENGINE GENERATORS

EQUIPMENT		
GENERATORS		
Six (6) 2MW "Alaska Diesel" Engine Generators @ $550,000 each	$ 3,300,000	
12,470V Specification - Six (6) Generators @ $17,500 each	$ 105,000	
Freight - Six (6) Generators @ $25,000 each	$ 150,000	
SWITCHGEAR		
Eight (8) Circuit Breaker Modules and Relaying @ $105,500 each	$ 844,000	
Freight - Eight (8) @ $10,000 each	$ 80,000	
Relaying Modifications	$ 15,000	
		$ 4,494,000
FIELD INSTALLATION AND CONSTRUCTION		
Six Generators @ $190,000	$ 1,140,000	
AF plus 52% of $1,140,000	$ 592,800	
Eight (8) Switchgear Modules @ $40,000 each	$ 320,000	
AF plus 52% of $320,000	$ 166,400	
Relay Modifications	$ 8,000	
AF plus 52% of $8,000	$ 4,160	
Fuel Oil Storage[1]		
(80gph/MW x 10MW x 24hr = 19,200 Gallon Storage; use 20,000)		
20,000 Gallon x $4.00/Gallon (AF Included)	$ 80,000	
Tank Monitor System	$ 10,000	
Heating System	$ 20,000	
Generator Building - 45' x 100'		
4500 sq. ft. x $250/sq. ft. (AF Included)	$ 1,125,000	
Power Feeders		
$250/ft x 100' x 2 Feeders (AF Included)	$ 50,000	
		$ 3,516,360
STARTUP		
Generators (6 Weeks)	$ 85,000	
Swtichgear and Relaying (1 Week)	$ 14,000	
		$ 99,000
	SUBTOTAL	$ 8,109,360
PROFIT & OVERHEAD 15%		$ 1,216,404
ENGINEERING (COE & CONSULTANTS) 15%		$ 1,398,865
	TOTAL	$ 10,724,629

[1] *Engines should be load tested once each month for two hours each, minimum estimated yearly fuel cost for testing is: 12 mo x 1test/mo x 2hr/test x 160 gal/hr x $1.046/gal x 6 engines = $24,099.84*

(AF) Alaska Factor

Option 3: CONVERSION TO HEATING ONLY PLANT - OIL BACKUP

FT. WAINWRIGHT, ALASKA

STAND ALONE CHPP TO MEET FUTURE NEEDS

EQUIPMENT TWO (2) 5MW EXTRACTION AND CONDENSING TURBINES

Two (2) 5MW each Turbine Generator (T/G, Switchgear, 100PSIG Extraction and Condensing)	$ 3,600,000	
		$ 3,600,000

FIELD INSTALLATION

Air Cooled Condenser $\$6.7x10^{6}$/each	$ 13,400,000	
Foundations T/G $60,000/each	$ 120,000	
AF at Plus 52%	$ 62,000	
Piping $550,000/each	$ 1,100,000	
AF at Plus 52%	$ 572,000	
Erection $350,000/each	$ 700,000	
AF at Plus 52%	$ 364,000	
Electrical $150,000/each	$ 300,000	
AF at Plus 52%	$ 156,000	
Crane 30 Ton and Support Steel	$ 150,000	
AF at Plus 52% ($75,000)	$ 39,000	
Building 80' x 70' x 42' High at $\$300/\text{Ft}^{2}$	$ 1,680,000	
		$ 18,643,000
	SUBTOTAL	$ 22,243,000
PROFIT & OVERHEAD 15%		$ 3,336,000
ENGINEERING (COE & CONSULTANT) 15%		$ 3,837,000
	TOTAL	$ 29,416,000

(AF) Alaska Factor

OPTION 7

FT. WAINWRIGHT, ALASKA

THREE (3) CO-GENERATION COMBUSTION TURBINE AND BOILERS

EQUIPMENT

1. Solar Combustion Turbines		
Gas Turbine Equipment		
(3) Taurus 70 (T-10301)S Turbine Generator Sets - 25.7 MW Total	$ 7,542,300	
Commissioning Parts, Startup and Site Testing	$ 243,100	
Freight	$ 120,000	
		$ 7,905,400
Electrical Equipment		
Basic Power Management System	$ 242,900	
Cost of Power Management System Options	$ 16,600	
Switchgear and MCC (design description below)	$ 417,300	
Switchgear, motor control center, auxiliary power transformer and generator grounding resistor		
Switchgear and MCC are shipped loose		
Freight	$ 20,000	
		$ 696,800
Mechanical Equipment		
Air Compressor	$ 248,400	
Three(3) Heat Recovery Steam Generators (HRSG)	$ 1,356,600	
Diverter Valves (By-pass HRSG)	$ 317,400	
Freight to Fairbanks	$ 150,000	
		$ 2,072,400
$10,674,600		
2. Steam Boilers		
Three (3) 100,000 #/hr @ $965,000 each	$ 2,895,000	
Design 250psig		
Operate 100psig at 499°F		
Boiler, Burner, Economizer, Trimmed		
Freight (Mississippi to Fairbanks)	$ 150,000	
Deaerator and Feedwater (use existing)	$ 0	
Condensate Storage and Pumps (use existing)	$ 0	
Combustion Control and Meters (Equipment)		
Three (3) Boilers	$ 360,000	
	$ 3,405,000	
3. CEMS (Equipment)		
Two (2) Stacks; one (1) per Stack		
Opacity, CO and No_x plus Data Loger	$ 350,000	
	$ 350,000	

4. FIELD INSTALLATION

Electrical Tie In for Combustion Turbine/ Generator	$ 476,000
AF Plus 52%	$ 248,000
Erection of Combustion Turbines, Generators, Controls, Diverter Valves Silancers, Air Compressors and Heat Recovery Steam Generators	$ 3,379,900
AF Plus 52%	$ 1,757,500
Foundation Equipment	$ 300,000
AF at Plus 52%	$ 156,000
Steam Boilers	$ 2,895,000
AF at Plus 52%	$ 1,505,400
Combustion Controls	$ 360,000
AF at Plus 52%	$ 187,200
Two (2) 11' dia. Stacks at 120'	$ 1,546,000
AF at Plus 52%	$ 804,000
CEMS Heated Enclosure on Stack	$ 120,000
Building 3-Combustion Turbine/Generator 120' x 145' x $250/ft	$ 4,350,000
3- Steam Boiler. 113' x'84' x $250/ft	$ 2,373,000
Oil Storage 20 days of 20,966,900 gal/yr 1,150,000 gallons x $3.50/gal	$ 4,000,000

$ 24,458,000

SUBTOTAL

$ 38,887,600

PROFIT & OVERHEAD 15%

$ 5,833,100

ENGINEERING (COE & CONSULTANT) 15%

$ 6,708,100

TOTAL

$ 51,428,800

(AF) Alaska Factor

Option 9: HEATING ONLY THREE (3) SATELLITE PLANTS

FT. WAINWRIGHT, ALASKA

TWO (2) 65,000 LB/HR - EACH BOILER PLANT

EQUIPMENT

Two (2) 65,000 lb/hr @ $700,000 each	$ 1,400,000	
Design 250 psig		
Operate 100 psig at 499 ^{0}F		
Boiler, Burner, Economizer, Trimmed		
Freight (Missippi to Fairbanks)	$ 80,000	
Deaerator & Three (3) Feedwater Pumps (150 GPM/ea)	$ 100,000	
Freight	$ 20,000	
Makeup Water Treatment	$ 40,000	
Freight	$ 10,000	
Condensate Storage / Transfer Tank / Pumps	$ 75,000	
Tank - 10,000 gallons		
Pumps - (3) 150 GPM/ea		
Controls		
Transfer Pumps - (3) 150 GPM/ea		
Freight	$ 20,000	
CEM (Equipment)		
One (1) in Common Stack; Opacity, CO & NO_X w/Data Logger	$ 175,000	
RATA Test	$ 10,000	
Combustion Control & Meters (Equipment)		
Two (2) Boilers	$ 240,000	
Remote Monitoring at One (1) Plant	$ 20,000	
		$
2,190,000		

FIELD INSTALLATION

Lower 48 states (electrical, mechanical, catwalks, etc.)	$ 2,190,000	
AF plus 52% ($2,190,000)	$ 1,139,000	
Building 90' x 71' w/AF	$ 1,600,000	
Stack 6' diameter by 120' high w/foundation	$ 400,000	
CEMS Enclosure (Heater)	$ 60,000	
AF plus 52% of $460,000	$ 240,000	
Oil Storage (2 Boilers) w/AF (350,000 gallons)	$ 1,225,000	
		$
6,854,000		

STARTUP

Makeup Water Treatment	$ 10,000	
Deaerator & Feedwater Pumps	$ 10,000	
Burner (4 weeks)	$ 55,000	
Combustion Controls	$ 55,000	
		$
130,000		
		$
9,174,000		

CONTRACTOR PROFIT & OVERHEAD 15%		$
1,376,000		

Option 9: HEATING ONLY THREE (3) SATELLITE PLANTS, cont.

FT. WAINWRIGHT, ALASKA

SPECIAL PLANT FOR THIRD BOILER

EQUIPMENT		
One (1) Boiler 65,000 lbs/hr	$ 700,000	
Freight	$ 40,000	
Combustion Control	$ 120,000	
Increase Deaerator, Water Treatment, Feedwater Pumps	$ 290,000	
		$ 1,150,000
FIELD INSTALLATION		
Lower 48 states (electrical, mechanical, catwalks, etc.)	$ 1,150,000	
AF plus 52% ($700,000)	$ 598,000	
Increase Building 24' x 71' w/AF (25' high)	$ 426,000	
Increase Stack for 3rd Boiler to 7' 6" diameter	$ 200,000	
AF plus 52% of $200,000	$ 104,000	
Increase Oil Storage of 175,000 gallons	$ 613,000	
		$ 3,091,000
STARTUP		
Burner	$ 25,000	
Combustion Controls	$ 25,000	
		$ 50,000
SUBTOTAL		$ 4,291,000
CONTRACTOR PROFIT & OVERHEAD 15%		$ 644,000
ENGINEERING (COE & CONSULTANT) 15%		$ 740,000
		$ 5,675,000

Option 9: HEATING ONLY THREE (3) SATELLITE PLANTS, cont.

FT. WAINWRIGHT, ALASKA

ONE (1) PLANT: TWO (2) 65,000 LB/HR BOILERS
$12,133,000

ONE (1) PLANT: TWO (2) 65,000 LB/HR BOILERS
$12,133,000

ONE (1) PLANT: THREE (3) 65,000 LB/HR BOILERS
$17,808,000

TOTAL THIS SYSTEM
$42,074,000

Appendix I: Reallocation of OMA Funds

Re-allocation of OMA Funds for Heating Only Option

		Legend		
		Modify	Delete	Add
Case	Status	Adjustment	Program Level ROM	Comments
Force Draft Fans	scope/PDC	26,000	$ 52,003	Increase temp of combustion air for baghouse
Boilers Casing ACM	need rfp asap	100,000	$ 300,000	Asbestos removal to tie-in not covered in covered in contract
Contract options 5, 7, 8, & 9 FY01	scope/PDC	$ 2,500,000	$ 5,314,253	N/A
Replace Super Heater Tubes FY01	scope/PDC	2,000,000	$ 4,856,341	N/A
Coal Conveyor Support		150,000	$ 150,000	N/A
Super Heater Header for all boilers	need inspect	750,000	$ 1,500,000	Excessive corrosion due to non return valve leakage
Automatic Boiler Vents	new case	$ (250,000)	$ 250,000	Main boiler vents been maintained, superheater
Boiler #3,4,5 &6 Tube Alignment	item 4/1391	100,000	$ 150,000	Needs to be done
Corroded Water Pipe Replacement	needs replacement	$ (500,000.00)	$ 500,000	Domestic feedwater backup
Process Water Treatment Chemical Injection	OSHA Issue - repair or replace	$ (150,000)	$ 150,000	For injection of chemical additives
Soot Blower Bushings and bearings	item 3/1391	$ 100,000	$ 200,000	For old soot blowers supports that became elliptical
Structural Steel for Grates and Drives	item 1/1391	$ 400,000	$ 600,000	Replace due to corrosion
EPA Ash Unloading Requirement	Environmental - item 19/1391	$ (250,000)	$ 500,000	New enclosed trucks for fly ash transportation to dump
Coal Unloading Dust Collector System	Environmental - item 19/1391	$ (150,000)	$ 150,000	Capital Equipment: Super sack
New Blowdown Valves	repair or replace	$ (300,000)	$ 600,000	Hanger, valves for 6 boilers
Dust collector (DC-1) barrel removal	OSHA issue	$ (50,000)	$ 50,000	Handling system for the barrels of fugitive dust
CHPP condensate pipe, pump, motors replacement	repair or replace	$ (500,000)	$ 800,000	Thin-walled, years of corrosion, pumps and motors end of life expectancy
Industrial Sewage Upgrade	Environmental - H2O emisions	$ (250,000)	$ -	Capacity issue for new equipment, mod for condensor project
Level 85 oil water separator	Environmental - H2O emisions	$ (250,000)	$ 500,000	EPA requirement
Additional 4160V Panels	item 23/1391	$ (200,000)	$ 500,000	Stepdown to 4160 volt, see #54 also. Downgraded later
Repair latrine and breakroom	EEO & OSHA Issue	$ (100,000)	$ 500,000	Health Issue
Repair Spalled Concrete	OSHA Issue	(100,000)	$ 100,000	Structural issue as well
North Coal System Upgrade	coal sop backup	(1,000,000)	$ 4,000,000	Complete overhaul
Exterior Boiler Tube Cleaning	new case	(50,000)	$ 75,000	Equitable adjustment due to actual conditions
Replace 12470 V Switch Gear	follow on	(300,000)	$ 2,500,000	Parts are unavailable for switchgear
Add-ons June 21, 2002				
Balance of stoker grate foundation beam repairs	covered by cont. 00 & 01	$ 200,000	$ 500,000	
Hand hole grinding, 6 boilers	covered by cont. 00 & 01	$ 80,000	$ 180,000	
Blow down pipe flange repairs, 5 boilers	covered by cont. 00 & 01	$ 40,000	$ 90,000	
Coal elevator wall repairs & misc	covered by cont. 00 & 01	$ 100,000	$ 100,000	
Acid Cleaning	covered by cont. 00 & 01	$ 50,000	$ 100,000	
Replace auto feedwater valves and controls	covered by cont. 00 & 01	$ 300,000	$ 780,000	
Delete boiler #3 work (no rehab, not a decommission)	pending	$ (500,000)	$ (500,000)	Needs funding for rehab completion before 2003
Add-on subtotal			$ 1,250,000	
	Alaska Contractor Reality	$ (1,000,000)		
	Total Svaings	$ 996,000		

Appendix J: Memo From Aurora Energy Regarding Ability To Meet Current and Future Power Requirements of FWA

An Employee-Owned Company

MEMORANDUM

Date: July 2, 2002
To: Marty Savoie, ERDC-CERL
From: John Westerman, SAIC
Subject: Summary of Discussions with Buki Wright, General Manager of Aurora Energy 7/02/02

I discussed the possibility of Aurora Energy providing heat to meet the requirements of Fort Wainwright. Note that the estimated central plant output (pounds of steam) to meet Fort Wainwright's thermal requirements, based on calendar year 2001 data, are:

Annual Usage: 1,500,000,000 lbs/year
Winter Peak: 275,000 lbs/hour
Summer Peak: 150,000 lbs/hour

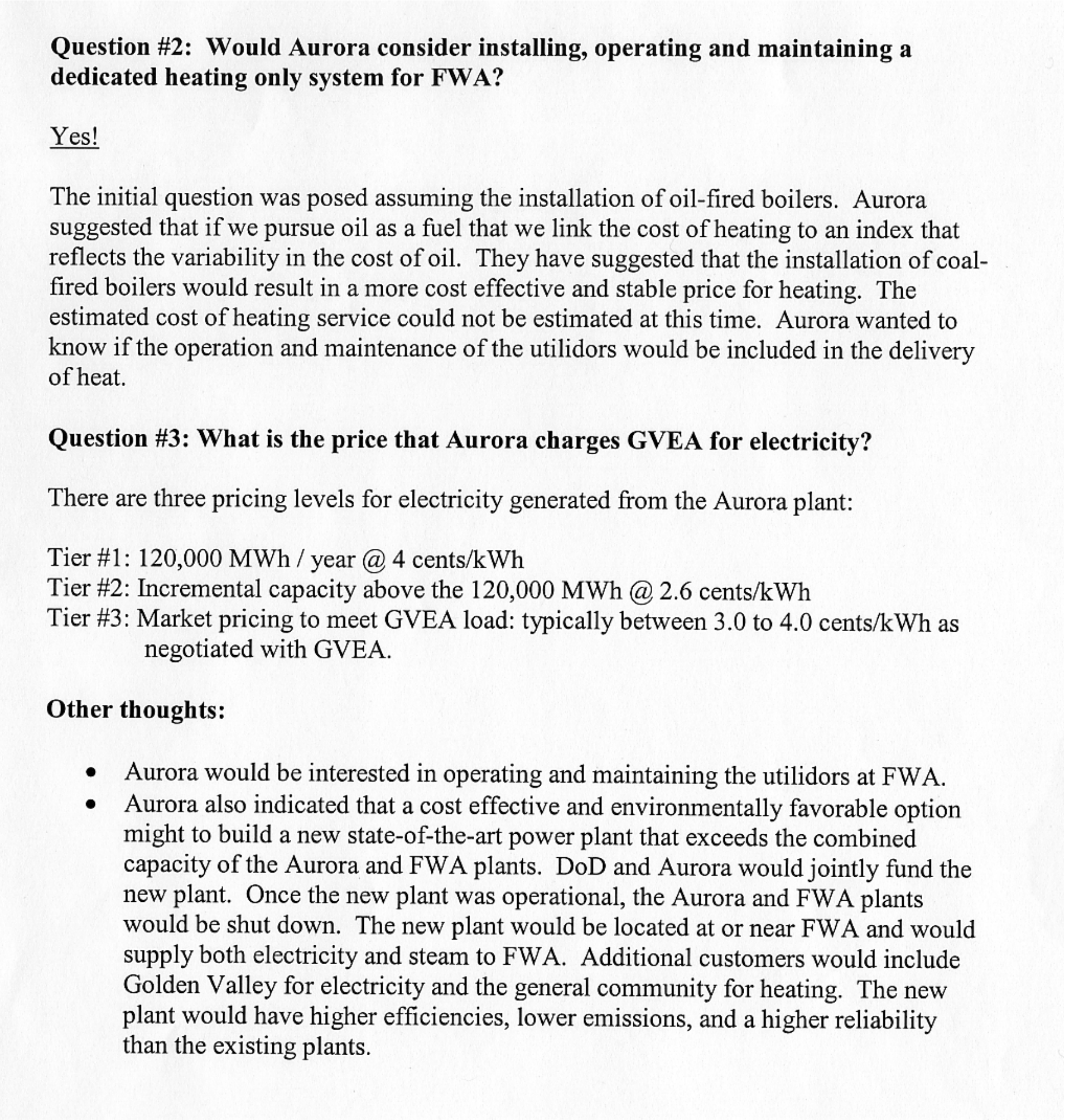
The questions posed to Bucky Wright and his responses follow:

Question #1: Can Aurora Energy provide the heating requirements of Fort Wainwright?

Yes! With the current coal plant and district heating loop, Aurora can supply approximately an additional 300,000 lbs/hour during the winter.

The existing Aurora district heating loop operates at 50 psig and the Fort Wainwright heating loop operates at 100 psig. In order to provide the required heating to FWA a new dedicated 100 psig loop would need to be run between the Aurora plant and FWA (approximately 3 miles). The estimated cost of the new dedicated 100 psig heating loop for FWA is $1.5 million per mile or $4,500,000.

Without knowing the financing of the new dedicated steam loop to FWA or the contractual arrangement between FWA and Aurora, it is initially estimated that Aurora could provide FWA steam at its current rate of $10.50/1000 lbs of steam. Thus, the estimated annual cost of heating based on 1,500,000,000 lbs/year would be $15,750,000/year.



Question #2: Would Aurora consider installing, operating and maintaining a dedicated heating only system for FWA?

Yes!

The initial question was posed assuming the installation of oil-fired boilers. Aurora suggested that if we pursue oil as a fuel that we link the cost of heating to an index that reflects the variability in the cost of oil. They have suggested that the installation of coal-fired boilers would result in a more cost effective and stable price for heating. The estimated cost of heating service could not be estimated at this time. Aurora wanted to know if the operation and maintenance of the utilidors would be included in the delivery of heat.

Question #3: What is the price that Aurora charges GVEA for electricity?

There are three pricing levels for electricity generated from the Aurora plant:

Tier #1: 120,000 MWh / year @ 4 cents/kWh
Tier #2: Incremental capacity above the 120,000 MWh @ 2.6 cents/kWh
Tier #3: Market pricing to meet GVEA load: typically between 3.0 to 4.0 cents/kWh as negotiated with GVEA.

Other thoughts:

- Aurora would be interested in operating and maintaining the utilidors at FWA.
- Aurora also indicated that a cost effective and environmentally favorable option might to build a new state-of-the-art power plant that exceeds the combined capacity of the Aurora and FWA plants. DoD and Aurora would jointly fund the new plant. Once the new plant was operational, the Aurora and FWA plants would be shut down. The new plant would be located at or near FWA and would supply both electricity and steam to FWA. Additional customers would include Golden Valley for electricity and the general community for heating. The new plant would have higher efficiencies, lower emissions, and a higher reliability than the existing plants.

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Assistant Chief of staff for Installation Management (ACSIM)
7701 Telegraph Road
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14. ABSTRACT

The Fort Wainwright (FWA) military community has a critical need to establish its power and heating requirements to successfully complete a series of planned capital improvements. The CHPP upgrade coincides with an expansion of FWA's mission within the next 5 years. To help the installation successfully complete these changes within the specified time frame, the Construction Engineering Research Laboratory (CERL) conducted an independent technical assessment of the FWA CHPP in which: (1) the current condition, capabilities, and maintenance status of the FWA CHPP were evaluated; (2) recent performance tests and supporting combustion data were evaluated to determine baseline-operating conditions and efficiencies; (3) regional private sector opportunities were investigated; (4) current heating and power loads and projected loads were reviewed based on master plans; and (5) alternatives to the current CHPP were developed and recommendations made to implement the most cost effective combinations of technologies that would meet required heating and power loads.

15. SUBJECT TERMS

energy conservation	cost analysis	Ft. Wainwright, AK
central heating plants (CHPs)	heat distribution systems	power plants

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
					John L. Vavrin
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