Arnold Schwarzenegger
Governor

COST AND VALUE OF WATER USE AT COMBINED-CYCLE POWER PLANTS

PIER FINAL PROJECT REPORT

Prepared For:
California Energy Commission
Public Interest Energy Research Program

Prepared By:
John S. Maulbetsch, Consultant
Michael N. DiFilippo Consultant

April 2006
CEC-500-2006-034

Prepared By:
John S. Maulbetsch
Maulbetsch Consulting
Menlo Park, California

and

Michael N. DiFilippo, Consultant
Berkeley, California

Contract No. 500-02-014
Work Authorization No. 104

Prepared For:
California Energy Commission
Public Interest Energy Research (PIER) Program

Joe O'Hagan,
Contract Manager

Kelly Birkinshaw,
Program Area Team Lead

Martha Krebs, Ph.D.,
Deputy Director
ENERGY RESEARCH AND DEVELOPMENT DIVISION

B B. Blevins
Executive Director

DISCLAIMER

This report was prepared as the result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.

Acknowledgements

The authors acknowledge the helpful participation of three individuals.

- Joe O'Hagan of the California Energy Commission and Kent Zammit of EPRI, whose interest in and critical review of the analyses resulted in a much improved report;
- Hal Wightman of ThermoFlow, Inc. whose skill with the cycle analysis and plant design capabilities of the GTPro/PEACE software packages was invaluable to the conduct of the study.

Please cite this report as follows:

Maulbetsch, J. S., and M. N. DiFilippo. 2006. *Cost and Value of Water Use at Combined-Cycle Power Plants.* California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2006-034.

Preface

The Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The PIER Program, managed by the California Energy Commission (Energy Commission) conducts public interest research, development, and demonstration (RD&D) projects to benefit the electricity and natural gas ratepayers in California. The Energy Commission awards up to $62 million annually in electricity-related RD&D, and up to $12 million annually for natural gas RD&D.

The PIER program strives to conduct the most promising public interest energy research by partnering with RD&D organizations, including individuals, businesses, utilities, and public or private research institutions.

PIER funding efforts are focused on the following RD&D program areas:

- Buildings End-Use Energy Efficiency
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Environmentally Preferred Advanced Generation
- Energy-Related Environmental Research
- Energy Systems Integration

What follows is the final report for the Alternative Cooling Technologies and Strategies project, contract number 500-02-014, work authorization 104, conducted by Maulbetsch Consulting and Michael N. DiFilippo, Consultant. The report is entitled *Cost and Value of Water Use at Combined-Cycle Power Plants.* This project contributes to the Energy-Related Environmental Research program.

For more information on the PIER Program, please visit the Energy Commission's Web site at **www.energy.ca.gov/pier** or contact the Energy Commission at (916) 654-5164.

Table of Contents

List of Figures

List of Tables

Abstract

This study compared water requirements, plant and cooling system capital and operating costs, and plant output and efficiency between plants equipped with wet and dry cooling. Comparisons were made for 500 megawatt, gas-fired, combined-cycle power plants at four sites, typical of environmental conditions in California.

A plant design was generated for each site/plant/cooling system combination. The total plant costs and selected individual component costs for each design were determined. Researchers calculated performance characteristics—including net plant output, heat rate, water consumption, and operating power requirements.

Results of the analysis include:

- the use of dry cooling reduces plant water requirements by approximately 2,000 to 2,500 acre-feet per year,
- The associated costs are:
  - increased plant capital cost of approximately $8 million to $27 million, or about 5% to 15% of the total plant cost,
  - potential reduction of energy production by about 13,000–56,000 megawatt hours (MWh) per year (1% to 2% of the total),
  - capacity reduction on hot days of 13 to 23 MW (4% to 6% of total), and
  - potential annual revenue reduction of about $1.5 to $3.0 million (1% to 2% of total).

Executive Summary

Introduction

Water use and conservation at electric power plants are becoming increasingly important siting issues in California and elsewhere. At most plants, the requirement for condensing turbine exhaust steam—generically known as *power plant cooling*—is the major use of water. Alternative cooling systems exist, including once-through cooling, recirculating wet cooling, dry cooling, and hybrid (wet/dry) cooling. Dry and hybrid systems can reduce cooling water consumption significantly compared to the more traditional wet recirculating or once-through cooling systems. These savings, however, come at a price, including increased plant capital and operating costs, reduced plant efficiency and output, increased fuel consumption, and an associated increase in power plant air emissions.

Purpose

The purpose of this study was to determine optimal power plant cooling options in terms of water savings, capital and operating costs, and operational efficiency for California power plants that operate in a variety of climates and with a variety of cooling water supplies.

Project Objectives

This project's objectives were to compare water requirements, plant and cooling system capital and operating costs, and power plant operating penalties for alternative cooling systems over a range of plant and site characteristics and source water types representative of the range of conditions found in California.

Scope

Comparisons of water use, costs, and penalties were made between two commonly chosen cooling systems:

- Wet cooling, which is a recirculating system with a steam surface condenser and a mechanical-draft, counterflow wet cooling tower
- Dry cooling, which uses a mechanical, forced-draft air-cooled condenser

All comparisons were made on the basis of a 500 megawatt (MW) (nominal), gas-fired, combined-cycle (2 x 1) power plant, typical of current construction in California.

Four sites, each representing a different meteorology, were selected:

- Desert (very hot, arid)
- Central Valley (hot, moderately humid)
- Coastal (cool, humid)
- Mountain (variable, elevated)

Table ES-1 lists the design points for the two cooling systems at each site.

Table ES-1. Case study design points

	Elevation	Temp	Rel. Hum	Wet Bulb	Backpressure	Tcond @ Backpressure	ACC ITD
	ft	F	%	F	inHga	F	F
Desert							
Wet	400	96	45	78	2.5	109	
Dry	400	96	23	68	6.0	141	45
Valley							
Wet	500	96	32	72	2.5	109	
Dry	500	86	30	64	3.5	121	35
Coast							
Wet	0	74	55	63	2.5	109	
Dry	0	65	62	57	2.5	109	44
Mountain							
Wet	3,200	96	29	70	2.5	109	
Dry	3,200	78	42	62	4.5	130	52

Several source waters, including fresh, brackish, saline, and reclaimed municipal waste water, were evaluated. Table ES-2 shows the source waters considered at each site.

Table ES-2. Source waters at each site

Water Source	Case Study Site			
	Desert	Valley	Coast	Mountain
Fresh	x	x	x	x
Brackish	x	x		
Saline	x	x		
Reclaimed		x	x	x

A plant design was generated for each site/plant/cooling system combination. In addition, the plant off-design performance was calculated at each of eight ambient conditions covering the annual range of temperatures at the particular site. The total plant costs and selected individual component costs for each design were determined. Researchers calculated performance characteristics, including net plant output, heat rate, water consumption, and operating power requirements. Table ES-3 lists the quantities determined for each case.

Methodology

The approach for comparing water consumption, plant performance, and system cost between wet- and dry-cooled plants is as follows:

- **Comparable plant designs.** For each site, an optimized plant design is determined for two plants: one equipped with wet cooling; the other, with dry cooling. "Optimized," in this context, is defined as that plant with the lowest total evaluated cost. *Total evaluated cost* is the sum of the annualized capital cost and the several continuing costs of fuel, operating cost, and lost potential revenue. The selected designs can the be compared on the basis of capital costs, design capacity, design heat rate, and design water use.
- **Annual performance.** Once the plant design is determined, the off-design performance is calculated at eight operating points covering the range of ambient

temperatures at the site over the course of a year. These performance values are then integrated over a year of operation using temperature duration curves for the site. This determines the annual net plant output, the annual fuel cost, the annual operating costs, the annual water use, and an annual potential revenue.

- **Cost elements.** The several cost elements are then combined, using an appropriate annualization factor to put the capital cost on an annual basis, to determine the total annual cost of operation. The difference between the two total costs establishes the total annual cost associated with the choice of cooling system.

- **Water use.** Water use is summed over the year to determine the annual water requirements for each power plant and the water savings achievable from the use of dry cooling.

Table ES-3. Calculated quantities for case studies

Design Point Values	Plant net capacity, MW
	Plant capital cost, MM$
	Normalized cost, $/MW
	Gas firing rate, MMBtu/hr
	Heat rate, Btu/kWh
	Operating power, kW
	Water requirements, gpm
	Water treatment equipment cost, MM$
	Water treatment power requirement, kW
Hot Day Performance	Plant net capacity, MW
	Gas firing rate, MMBtu/hr
	Water requirements, gpm
Annual Performance	Plant output, MWh/year
	Annual fuel use, MMBtu/year
	Water requirements, acre-feet/year
	Potential revenue, MM$/yr

Conclusions

The results of the analysis can be summarized in the following conclusions.

- For a 500 MW gas-fired, combined-cycle plant (typical of new plants in California) the use of dry cooling reduces the annual plant water requirements by approximately 2,000 to 2,500 acre-feet per year, depending on the climate at the plant location.

- The associated costs are:
    - Increased plant capital cost of approximately $8 million to $27 million, or about 5% to 15% of the total plant cost
    - Potential reduction of energy production by about 13,000–56,000 megawatthours (MWh) per year (1% to 2% of the total)
    - Capacity reduction on hot days of 13 to 23 MW (4% to 6% of total)
    - Potential annual revenue reduction of about $1.5 to $3.0 million (1% to 2% of total)
- The cost of dry cooling can be expressed as the "effective cost" of water. This is defined as the additional cost of using dry cooling expressed on an annualized basis divided by the annual reduction in water requirement achieved through the use of dry cooling. This "effective cost" of saved water ranges from $3.40 to $6.00 per 1,000 gallons. This cost compares to more typical costs for industrial and residential uses, ranging from $1.00 to $2.50 per 1,000 gallons.

It is important to understand that these costs and penalties are calculated for dry cooling systems which were sized using an optimization criterion of minimum total annualized cost based on current estimates of capital, fuel and electricity costs. Other optimization criteria could have been chosen and would have yielded different results. For example, if a very high value were assigned to meeting peak power demands on the hotter days, a larger and more expensive cooing system would have been selected. While the total annualized cost would have been higher, the "hot day capacity reduction" would have been reduced or eliminated.

Recommendations

The quantitative conclusions of this study are dependent on a number of assumptions and estimates including those for the costs of plant construction, the present and future costs of fuel and electricity, and the value assigned to peak power demand. Therefore, it is recommended that the results of the study be reviewed and updated periodically as conditions, costs, and projections change to ensure a sound basis for future decision making.

Benefits to California

The use of the results of this study and related work referenced in the report should assist power project developers, environmental organizations, and groups entrusted with siting decisions to come to informed conclusions regarding trade-offs between water consumption by a proposed power plant and the cost and capacity of that plant. Over time, these decisions will lead to an appropriately balanced approach to resolving conflicting requirements of water conservation and power supply for the citizens of California.

1.0 Introduction

Water use and conservation at electric power plants have long been important siting issues in California and elsewhere. At most plants, the requirement for condensing exhaust steam from steam turbines—generically known as *power plant cooling*—is the largest use of water at the plant. A number of alternative cooling systems exist and have been used. These systems include once-through cooling, recirculating wet cooling, dry cooling, and hybrid (wet/dry) cooling. A discussion and comparison of these cooling systems are given in a recent EPRI (2004) report. They are summarized here for convenient reference.

Once-through cooling. In once-through cooling, water is withdrawn from a natural waterbody, passed through the tubes of a surface steam condenser and returned to the waterbody at a higher temperature. This was formerly the common form of cooling at U.S. power plants and is currently in use at over 1200 seam-electric generating units. Withdrawal rates are usually 400 to 600 gallons per minute (gpm) per megawatt (MW) of steam-electric generating capacity, and the retuned water is typically 15°F to 20°F (8°C to 12°C) warmer than the source water from which it was withdrawn. It is seldom, if ever, used for new power plants in the United States today.

Recirculating wet cooling. Recirculating wet cooling is the most common choice of cooling system for current plant construction in the United States. Recirculating wet cooling is similar to once-through cooling in that the steam is condensed in a water-cooled, surface condenser; but different in that the heated cooling water is not returned to the source waterbody. Instead it is pumped to a cooling component, typically a mechanical draft cooling tower and then recirculated to the condenser. In the cooling tower a small faction (typically 1% to 2%) is evaporated in order to cool the remainder. Once the system is filled, the only water withdrawn from the environment is make-up water sufficient to replace that lost to evaporation, blowdown, and drift. This amount is typically 10 to 15 gpm per MW of steam generating capacity.

Dry cooling systems. Dry cooling systems, as used in the United States, are typically the type in which turbine exhaust steam is ducted directly to an air-cooled condenser. Heat rejection to the environment takes place in a single step in which steam is condensed in finned tube bundles, which are cooled by air blown across the exterior finned surfaces.

Hybrid cooling systems. Hybrid cooling systems employ a combination of wet and dry cooling technologies. Most systems in the United States are intended for plume abatement and are essentially all-wet systems with a small amount of dry cooling to heat the tower exhaust plume above saturation conditions during cold, high-humidity periods when the wet tower plume is likely to be visible. Hybrid systems intended for water conservation, on the other hand, are primarily dry systems with a small wet capacity to provide additional cooling during the hottest periods of the year to mitigate hot-day capacity loses associated with all-dry systems. These systems are receiving increasing attention in the United States in recent years, but are still rare in practice. Further discussion of these systems is available in the EPRI (2004) report, but is beyond the scope of this study.

Figure 1 shows a schematic of a combined-cycle power plant (typical of current plant construction in California) and indicates the major water uses at the plant.

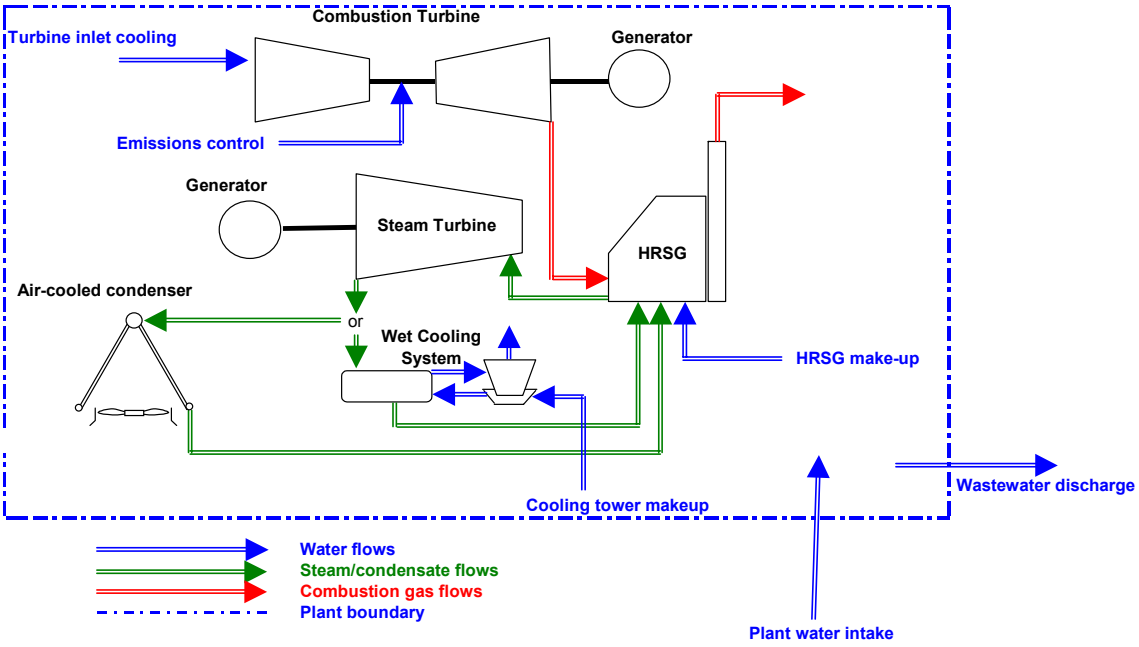


Figure 1. Schematic of water uses in a combined-cycle plant

Table 1 lists typical flow rate requirements for the various uses for a 500 MW plant. Note that for plants with wet cooling systems, the cooling tower make-up represents approximately 95% of the total power plant water requirements. Through the use of dry cooling, the plant's cooling water requirements can be eliminated (with the exception of small, intermittent use for cleaning the finned tube bundles).

Table 1. Average water use at combined-cycle plants

Plant Water Use	Annual Water Use, acre-feet/year	
	Wet Cooled Plant	Dry Cooled Plant
Cooling System Make-up	2,250 to 2,800	0
Auxiliary Cooling[1]	0	0
Turbine Inlet Cooling	30 to 45	30 to 35
HRSG Make-up	40 to 45	40 to 45
Environmental Control[2]	0	0
Hotel Load	40	40
Plant Total	2,360 to 2,930	110 to 120
% Savings with Dry Cooling	95 to 96	

[1] Included in tower make-up for wet plant; assume dry cooler for dry plant

[2] Assume dry technologies for NO_x control

Two related items are noteworthy. First, the other common type of plant installed in California is the simple-cycle gas turbine plant. At these plants only combustion turbines are used to generate power, so no condenser cooling water is required. The plants are characterized as having a low initial cost but very high heat rates compared to combined-cycle plants. As a result they are used only for peaking service and have a typical capacity factor of approximately 10%, as contrasted to a capacity factor of 80% normally achieved by combined-cycle plants. As a result, simple-cycle plants are not an important factor in a water conservation strategy for statewide energy production and will not be considered further in this study.

Second, the third largest use of water at many combined-cycle plants is for combustion turbine inlet cooling. During the hottest hours of the year, the mass flow of air to the combustion turbines, which are constant volume flow devices, is reduced as the air density decreases with increasing ambient temperature. The evaporation of water to cool the inlet air during these periods of high ambient temperature partially maintains the mass flow of air to the turbines and restores much of the capacity that would otherwise be lost. Since this approach is nearly always used at combined-cycle plants in California, the case study designs and off-design performance calculations assume the presence and use of inlet cooling as part of routine plant operation. The value of water in this application is discussed and quantified in a later section of this report.

2.0 Purpose

Although significant amounts of water can be saved by the use of dry cooling, the savings come at a price in the form of higher plant cost, reduced power production, increased fuel consumption as a result of lower plant efficiency, higher plant operating power requirements, and hence, higher operating costs—all resulting in a reduction in potential revenue from the power generation operation. Conversely, the use of water for wet cooling at the power plant avoids these costs and thus provides value to the plant and its operation. The purpose of this study is to estimate the value of water use at power plants at a variety of sites and using a variety of source waters representative of conditions in California.

3.0 Methodology and Scope

To achieve this purpose, the study calculates the costs and benefits of water use at four sites with four source water types. The sites and plant types are those developed in a previous study funded by the California Energy Commission's Public Interest Energy Research (PIER) Program (DiFilippo 2003; Maulbetsch 2002).

The primary emphasis of this study is on the comparative cost, performance, and water use of gas-fired, combined-cycle power plants with dry and wet cooling systems.

In order to develop the costs required for the comparisons, the following quantities are determined for two optimized plants at each site; one using wet cooling, and the other using dry cooling.

- Plant capital cost
- Plant efficiency and fuel cost
- Plant output capacity at summer peak conditions (MW)
- Plant annual output (MWh per year)
- Water used by the plant (acre-feet/year)

A variety of source waters, including saline water, brackish groundwater, and reclaimed municipal waste water (in addition to fresh water) were considered at each site.

All plants were assumed to use water (in addition to cooling tower make-up, at the wet-cooled plants) for inlet air-cooling of the combustion turbines, for steam cycle make-up and for a plant "hotel" load (e.g., water used for cleaning, drinking, sanitary uses). The gas turbine inlet cooling will be done with evaporative cooling ("fogging" of the inlet air). The amount varies from case to case as a function of the site meteorology but ranged from 20 to 60 gpm for both of the two combustion turbines at each 500 MW plant. The hotel load and steam cycle make-up were set at 30 gpm for each case study plant. Although some plants also use water for NO_x control and auxiliary cooling, this analysis assumed that those functions are performed with dry technologies, with zero water requirements.

Once the plant design was determined, the off-design performance was calculated at eight operating points covering the range of ambient temperatures at the site over the course of a year. These performance values were then integrated over a year of operation using temperature duration curves for the site. This process determined the annual net plant output, the annual fuel cost, the annual operating costs, the annual water use, and an annual potential revenue.

The several cost elements were then combined, using an appropriate annualization factor to put the capital cost on an annual basis, to determine the total annual cost of operation. The difference between the two total costs establishes the total annual cost associated with the choice of cooling system. Water use was summed over the year to determine the annual water requirements for each power plant and the water savings achievable from the use of dry cooling.

For completeness and convenience of reference, a few special comparisons are presented at the end of the report. These are:

- Simple-cycle versus combined-cycle power plants
- Combined-cycle plants with and without combustion turbine inlet cooling
- Combined-cycle plants using different design optimization criteria.

4.0 Base Cases

4.1. Sites

Four sites were chosen to cover a range of climates representative of conditions in California. These were a desert site, a valley site, a mountain site, and a coastal site.

1. The **desert site,** with a very hot, arid climate, represents a particularly challenging set of conditions for air-cooled equipment, but also represents the condition under which water is the most scarce.

2. The **valley site,** while still having high summertime temperatures, represents a more moderate climate than the desert site. At this location, fresh water is highly valued by the agricultural community, but saline groundwater, which is unsuitable for irrigation, is available.

3. The **coastal site** has much cooler summertime temperatures. Fresh and reclaimed municipal water is available at coastal locations; groundwater in sufficient quantities is usually not. Wet, recirculating cooling using seawater for cooling water make-up is not considered in this analysis.

4. The **mountain site** has low annual average temperatures, but high summertime temperatures comparable to the desert site. Probable water sources are fresh surface or groundwater or, in some locations near larger cities, reclaimed water. The higher elevation (3,200 feet (975 meters) above sea level) has some effect on the performance of both wet and dry cooling systems.

4.2. Site Meteorology

Meteorological design conditions for the four sites are:

1. **Desert site** (data from Blythe, California)
   Elevation: 400 ft. (122 meters) (14.5 psia; 28.5 in Hga)
   Summer average temperature:[1] 96°F (36°C); coincident wet bulb: 69°F (21°C) (rh = 25.1%)
   1% dry-bulb temperature:[2] 109°F (43°C); coincident wet bulb: 73°F (23°C) (rh = 17.5%)
   1% wet-bulb temperature:[3] 78°F (26°C); coincident dry bulb: 96°F (36°C) (rh = 45.4%)

[1] Average temperature during months of June through September
[2] Dry-bulb temperature exceeded for 1% of the hours during the year (~90 hours)
[3] Wet-bulb temperature exceeded for 1% of the hours during the year (~90 hours)

2. **Valley site** (data from Bakersfield, California)
   Elevation: 500 ft. (26 meters) (14.4 psia; 28.4 in Hga)
   Summer average temperature: 86°F (30°C); coincident wet bulb: 65°F (18°C) (rh = 32.1%)
   1% dry-bulb temperature: 102°F (39°C); coincident wet bulb: 70°F (21°C) (rh = 19.7%)
   1% wet-bulb temperature: 72°F (22°C); coincident dry bulb: 96°F (36°C) (rh = 31.1%)

3. **Coastal site** (data from San Francisco, California)
   Elevation: Sea level (14.7 psia; 29.9 in Hga)
   Summer average temperature: 65°F (18°C); coincident wet bulb: 57°F (14°C) (rh = 61.6%)
   1% dry-bulb temperature: 79°F (26°C); coincident wet bulb: 62°F (17°C) (rh = 37.9%)
   1% wet-bulb temperature: 63°F (17°C); coincident dry bulb: 74°F (23°C) (rh = 54.7%)

4. **Mountain site** (data from Redding, California)
   Elevation: 3,200 ft. (975 meters) (13.1 psia; 26.9 in Hga)
   Summer average temperature: 78°F (26°C); coincident wet bulb: 62°F (17°C) (rh = 42.2%)
   1% dry-bulb temperature: 103°F (39°C); coincident wet bulb: 69°F (21°C) (rh = 18.6%)
   1% wet-bulb temperature: 70°F (21°C); coincident dry bulb: 96°F (36°C) (rh = 28.8%)

4.3. Power Plant Types

The case study plants are all gas-fired, combined-cycle plants in a two combustion turbines and a single steam turbine (2 x 1) configuration, representative of the plants currently being constructed in California. At each site, two plant designs were analyzed; one with dry cooling; the other with wet cooling.

4.4. Water Sources

Although the primary comparisons were conducted assuming that an adequate supply of good quality freshwater was available, comparisons were also made for the case where degraded water supplies were used for makeup to the plants. As will be described in a later section, saline, brackish, and reclaimed water supplies were also considered.

5.0 Design and Calculations

5.1. Plant Design Points

The design points are as follows:

Plant capacity (nominal):	500 MW
Configuration:	Combined-cycle; 2 x 1
Combustion turbines:	GE 7241 FA 175 MW (nominal) @ ISO conditions[4]
NO_x control:	Dry low-NO_x combustor

The gas turbines are equipped with an inlet fogging system sized to provide sufficient water flow to reduce the inlet air temperature by 75% of the wet-bulb depression (defined as $T_{amb\ dry\text{-}bulb} - T_{amb\ wet\text{-}bulb}$) on the 1% dry-bulb day (the temperature exceeded for 1% of the hours annually).

The base cases assume no duct burning.

The plants were designed and their performance determined with both a wet cooling (a mechanical-draft wet tower) and dry cooling (an air-cooled condenser).

1. **Combined-cycle plant with a wet cooling tower.** The Heat Recovery Steam Generator (HRSG) and cooling system were designed for a 2.5 in Hga turbine backpressure at the 1% wet-bulb condition and the corresponding mean coincident dry-bulb. In previous studies (Maulbetsch 2002; EPRI 2004) a distinction was made in the selection of wet cooling systems between "lowest capital cost designs" and "lowest evaluated cost designs." This distinction results from the fact that a prescribed cooling design point can be achieved with a small, less-expensive tower using increased amounts of fan power or a larger, more costly tower using less fan power. The "low capital cost" design has a higher lifetime cost when properly accounting for the increased power requirements for the life of the plant. In this study, the "lowest evaluated cost design" approach is chosen as the correct comparison to an optimized dry cooling system.

2. **Combined-cycle plant with an air-cooled condenser.** The rigorous establishment of an optimized design point for each site was beyond the scope of this study. Therefore, the design point for the air-cooled condenser (ACC) was set at the summer average temperature and the corresponding mean coincident wet-bulb. The condenser backpressure at the design

[4] 59°F (15°C); 60% relative humidity; sea level

ambient temperature was selected to provide an ITD of around 45°F (25°C). This choice was determined to be close to optimum based on the results of optimization studies conducted as part of a cooling system study performed for the Electric Power Research Institute (2004).

Table 2 lists the resulting design points.

Table 2. Base case design points

	Elevation (ft.)	Temp (F)	Rel. Hum. (%)	Wet Bulb (F)	Backpressure (in HgA)	Tcond @ Backpressure (F)	ACC ITD (F)
Desert							
Wet	400	96	45	78	2.5	109	
Dry	400	96	23	68	6.0	141	45
Valley							
Wet	500	96	32	72	2.5	109	
Dry	500	86	30	64	3.5	121	35
Coast							
Wet	0	74	55	63	2.5	109	
Dry	0	65	62	57	2.5	109	44
Mountain							
Wet	3,200	96	29	70	2.5	109	
Dry	3,200	78	42	62	4.5	130	52

Annual temperature duration curves for each site are provided in Appendix A.

6.0 Scope of Analysis

The researchers generated a plant design for each site/plant/cooling system combination. The plant off-design performance was then run for each of eight ambient temperatures covering the annual range of temperatures at the particular site. Researchers calculated the total plant costs (along with costs of numerous individual components) for each design. The design, performance, and cost information was developed through the use of software from the Thermoflow Software Suite, including GTPro and PEACE (Thermoflow 2004).

The researchers generated performance characteristics—including net plant output, heat rate, water consumption, and peripheral power requirements from the model. Finally, a variety of source waters were assumed for each plant, and the effect of source water quality on plant cost was determined.

Complete tables of the design and performance results are included in the appendices to the report as follows:

Appendix A: Site Meteorological Data

Appendix B: Design Cost and Performance Data

Appendix C: Off-Design Performance Data

Appendix D: Hourly Operating Data for All Sites, Plants, and Water Sources

Appendix E: Waste Water Treatment Options Summary

The following sections review the highlights of the case study results excerpted from tables in the appendices.

6.1. Plant Designs

Figures 2 and 3 are schematics of the plant design layouts for both the wet and dry cooling systems at the desert site. These figures illustrate the plant flow sheets and the level of detail of design information generated by the Thermoflow program (Thermoflow 2004). Appendix B contains the schematics for the base design cases at all four sites. The values for flows, pressures, temperatures, and other variables in Figures 2 and 3 are specifically for the desert site, but the general plant configurations are identical for all sites.

Table 3 lists the following design values for both the wet- and dry-cooled plants at each of the four sites.

- Plant capital cost, $ millions
- Water system costs, $ millions
- Net output, MW
- Normalized cost, $/kW
- Gas firing rate, MMBtu/hr
- Heat rate, Btu/kWh
- Water requirements, gpm

Table 3. Summary of base case results at design conditions

Design Results						
Site/Plant Cooling System	Net Output	Firing Rate	Heat Rate	Plant Capital Cost	Normalized Cost	Water Requirements (Fresh)
	MW	MMBtu/hr	Btu/kWh	$ (millions)	$/kW	gpm
Desert						
ACC	445.5	3,027	6,795	213.6	479.5	119
Wet cooling	457.8	3,020	6,596	195.6	427.3	2,817
Valley						
ACC	458.0	3,062	6,686	223.7	488.4	106
Wet cooling	457.8	3,016	6,588	197.0	430.3	2,693
Coast						
ACC	486.3	3,208	6,596	222.0	456.5	75
Wet cooling	481.8	3,167	6,573	197.9	410.8	2,391
Mountain						
ACC	416.1	2,799	6,722	210.2	505.2	82
Wet cooling	412.4	2,720	6,597	202.0	489.8	2,451

6.2. Capital Cost and Plant Capacity

The comparisons of plant cost and net output capacity at design conditions are consolidated in Table 4 for ease of reference.

Table 4. Comparisons of performance, cost, and heat rate

Site	Combined Cycle--Wet Cooling				Combined Cycle--Dry Cooling			
	Capital Cost	Net Capacity	Cost per Capacity	Heat Rate	Capital Cost	Net Capacity	Cost per Capacity	Heat Rate
	MM$	MW	$/kW	Btu/kWh	MM$	MW	$/kW	Btu/kWh
Desert	195.6	457.8	427.3	6,596	213.6	445.5	479.5	6,795
Valley	197.0	457.8	430.3	6,588	223.7	458.0	488.4	6,686
Coast	197.9	481.8	410.8	6,573	222.0	486.3	456.5	6,596
Mountain	202.0	412.4	489.8	6,597	210.2	416.1	505.2	6,722

Differences in site meteorology affect the cost of plant cooling systems. The wet cooling towers, sized along with the plant condenser to maintain a turbine backpressure of 2.5 in Hga at the 1% wet bulb, are smaller and less expensive at sites with lower design wet bulb temperatures. As shown in Table 2, the site with the lowest design wet bulb temperature is the coast site, followed by the mountain, valley, and desert sites in order of increasing design wet bulb. However, the wet cooling tower is a relatively minor cost item (approximately $1.5 million out of ~$170 million, or less than 1% of plant cost). Similarly, gas turbine inlet fogging systems are affected by the variation in design wet bulb temperature or relative humidity. The inlet fogging systems are sized to cool the inlet air by 75% of the wet bulb depression (the difference between the ambient dry bulb and the ambient wet bulb). This depression varies from 8°F to 10°F (4.5°C to 5.5°C) at the coast to nearly 30°F (17°C) in the desert. However, the cost of these fogging systems is very small in comparison to the plant cooling system costs.

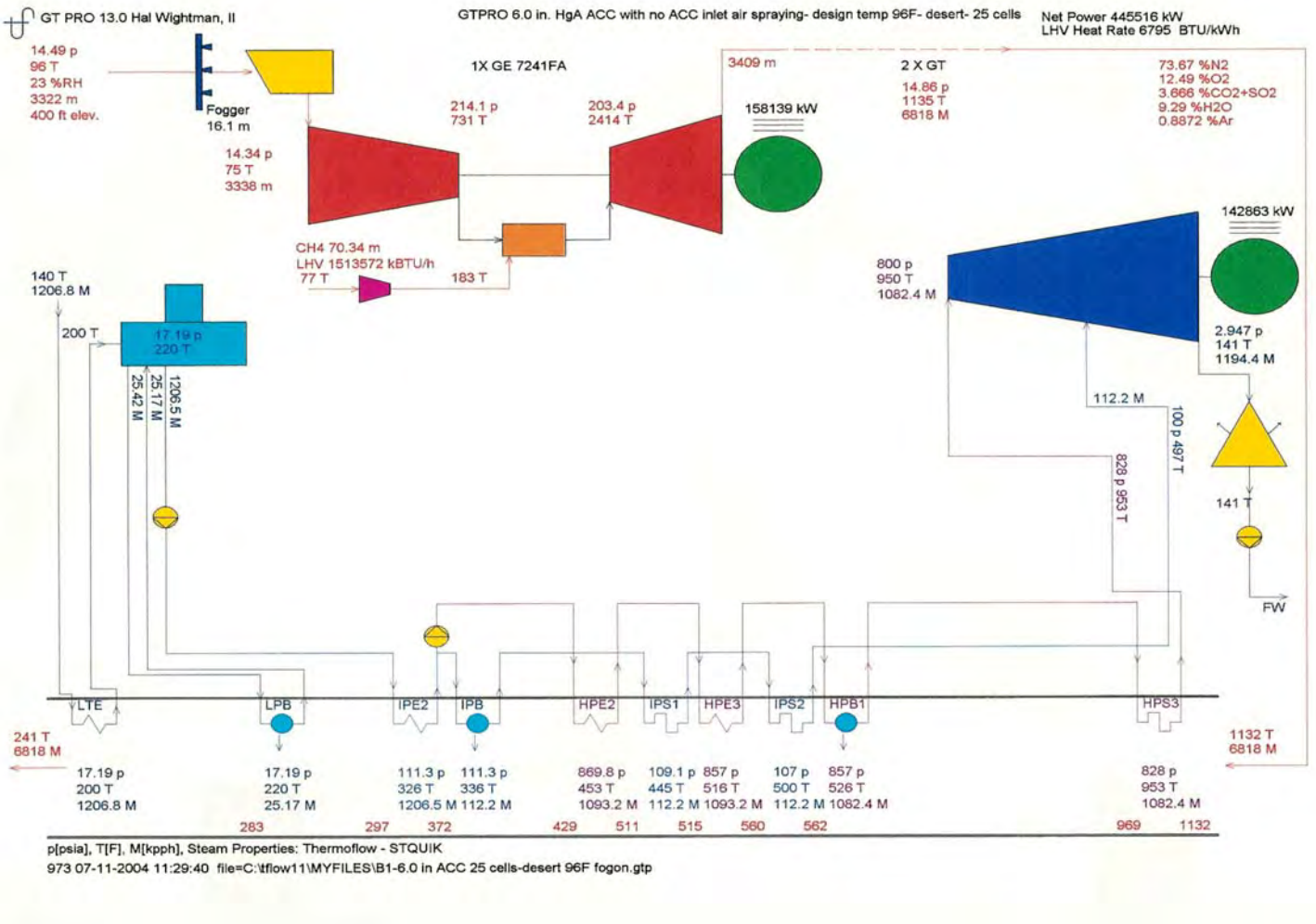


Figure 2. Schematic of a dry-cooled plant

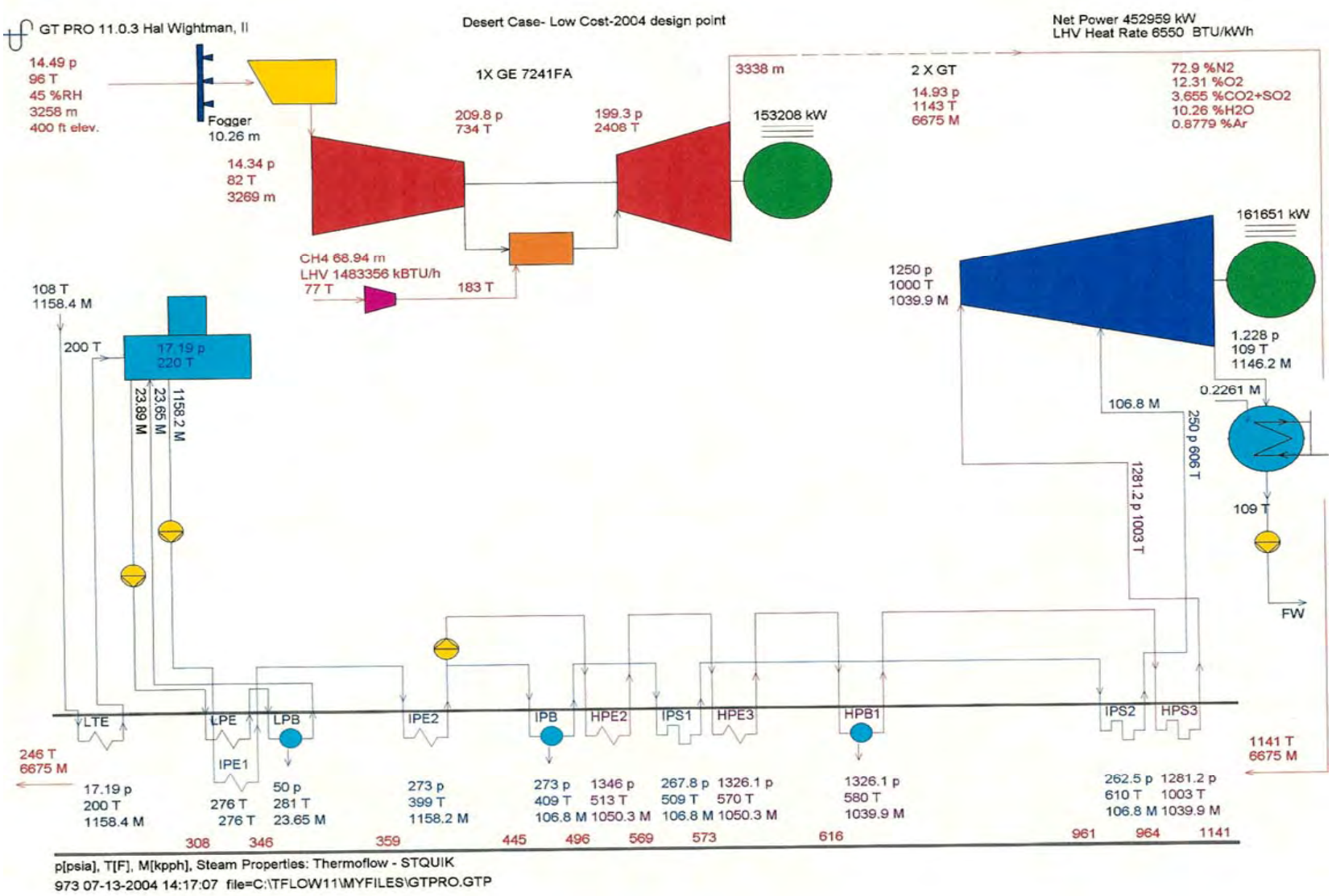


Figure 3. Schematic of a wet-cooled plant

Dry-cooled power plants exhibit a somewhat greater, but still modest, variation in capital cost, due largely to the variation in the size and cost of the air-cooled condensers. This variation is greater than the corresponding variation for wet cooling systems both because variation in the design dry bulb from site to site is greater than the corresponding variation in design wet bulb, and because the air-cooled condensers represents a greater fraction of the plant cost than does the wet cooling system.

Therefore, while the variation in plant capital costs with site meteorology is modest for both wet- and dry-cooled plants (+/- 2% for wet-cooled plants; +/- 3% for dry-cooled plants), the cost difference between wet- and dry-cooled plants and its variation from site to site is significant. The use of dry cooling adds from $8 million to $27 million (or 5% to 13%) to the cost of a (nominal) 500 MW combined-cycle plant.

The plant output and heat rate, on the other hand, varies significantly from site to site. This is due largely to the effect of ambient temperature and site elevation on ambient air density and gas turbine performance. The coastal site, with the lowest elevation and lowest design temperatures has the highest design capacity, lowest design heat rate, and the lowest normalized ($/kW) cost. The mountain site, at an elevation of 3,200 feet (975 meters), has an ambient air density at design that is only 85% of the value for the coast site and, as a result, the highest heat rate and the highest normalized cost of all the sites. Interestingly, since the effect on gas turbine performance dominates the plant characteristics at the higher elevation, the mountain site is the least affected of all the sites by the choice of cooling system.

These results are shown graphically in Figures 4, 5, and 6.

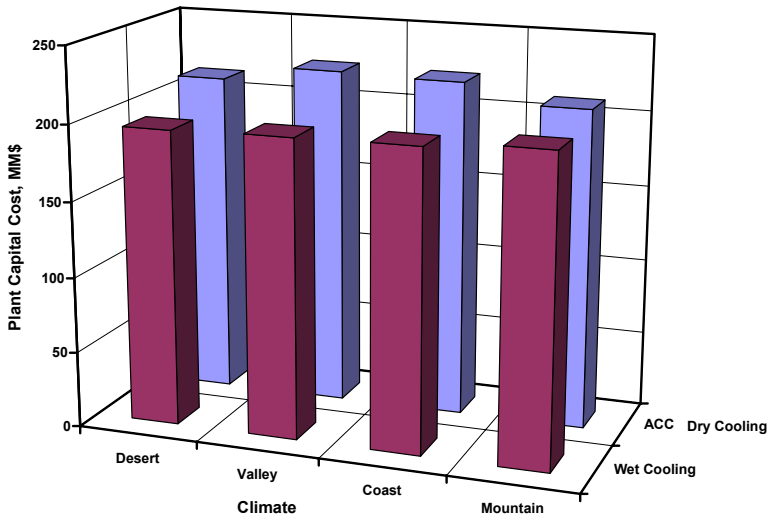


Figure 4. Plant capital costs at four sites

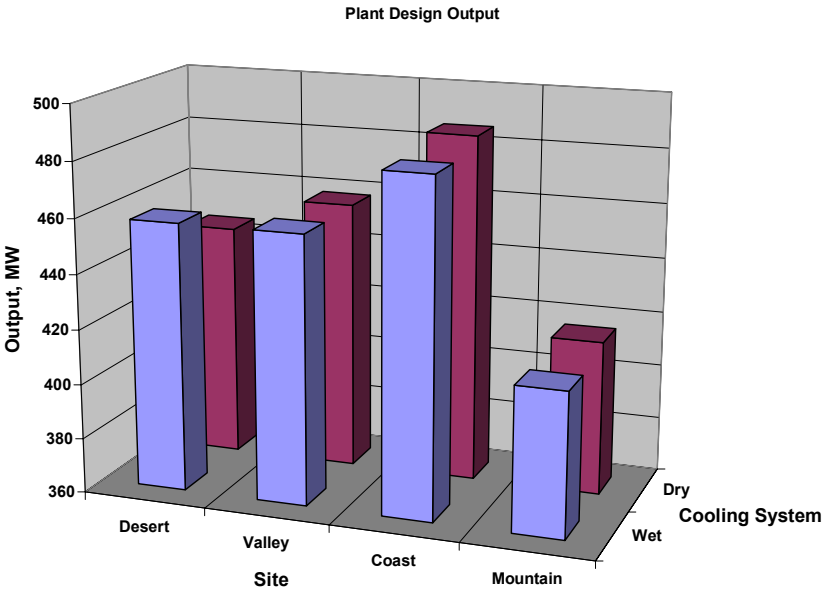


Figure 5. Comparison of plant design capacity at four sites

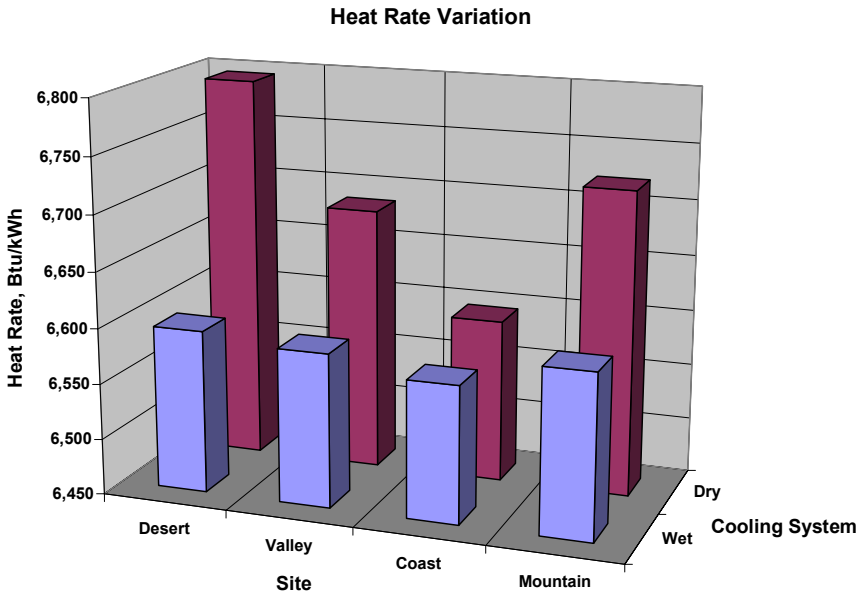


Figure 6. Comparison of plant heat rates at four sites

6.3. Plant Efficiency and Fuel Use

Table 5 lists the comparative levels of plant heat rate (expressed both as heat rate and percent efficiency) and firing rate for each plant type at each of the four sites.

Table 5. Comparative plant efficiency and firing rate

Site	Combined Cycle--Wet Cooling			Combined Cycle--Dry Cooling		
	Perf.		Fuel	Perf.		Fuel
	Btu/kWh	%	kBtu/hr-LHV	Btu/kWh	%	kBtu/hr-LHV
Desert	6,596	51.7	3,020,000	6,795	50.2	3,027,000
Valley	6,588	51.8	3,016,000	6,686	51.0	3,062,000
Coast	6,573	51.9	3,167,000	6,596	51.7	3,208,000
Mountain	6,597	51.7	2,720,000	6,722	50.8	2,797,000

The combined-cycle plants equipped with wet cooling show a small but consistently higher efficiency than do the plants with dry cooling. Note that these values are at the design points for each cooling system. The use of the 1% wet-bulb point as the design point for the wet system is a much more demanding condition than the summer or annual average is for the dry system. As will be noted later in the discussion of both hot day performance and the annual output of the several plants, the difference in performance at both the most critical times of the year and in terms of their annual energy production is greater than this modest difference in design point efficiency would suggest.

6.4. Hot Day Performance

As alluded to earlier, the comparison between alternative cooling systems is most critical on the hottest days of the year. It is on these days that the demand and the price for power are at their highest levels of the year. Therefore, if plant output is limited for any reason, including cooling system performance, the plant's potential revenue during these peak price periods is correspondingly limited.

Table 6 shows the difference between the design point performance and the performance at elevated temperature conditions for both the wet- and dry-cooled combined-cycle plants. The hot day is taken to be the 1% ambient dry-bulb condition and the accompanying mean coincident wet-bulb temperature for that condition. Specific hot day conditions for each site are listed in Section 4.2, Site Meteorology.

Table 6. Hot day performance comparisons

Site	Combined Cycle--Wet Cooling				Combined Cycle--Dry Cooling			
	Design Capacity	Hot Day Capacity	Lost Capacity	Percent Loss	Design Capacity	Hot Day Capacity	Lost Capacity	Percent Loss
	MW	MW	MW	%	MW	MW	MW	%
Desert	457.8	449.6	8.2	1.79	445.5	431.0	14.5	3.25
Valley	457.8	453.6	4.2	0.92	458.0	440.9	17.1	3.73
Coast	481.8	465.2	16.6	3.45	486.3	441.8	44.5	9.15
Mountain	412.4	404.0	8.4	2.04	416.1	381.1	35.0	8.41

For the combined-cycle plant with wet cooling, the fall-off in performance is modest, ranging from approximately 1% to 3.5 %, depending on the site. For the combined-cycle plant equipped with dry cooling, the effect can be much greater, ranging from over 3% to over 9 %.

It should be noted that, for combined-cycle plants, the reduction in plant output between design point conditions and "hot day" conditions is attributable in part to the fall-off in gas turbine performance as well as to any limitations imposed by the cooling system capability. The design point specifications (see Table 2) show that, in all but the desert case, the ambient dry bulb at design for the dry-cooled plant is lower than that at the design point for the wet-cooled case. Therefore, the difference in ambient temperature (and hence the reduction in gas turbine output) between the hot day and the design conditions is greater for the dry-cooled case than for the wet-cooled plant.

This is reflected in the greater fall-off in plant output and might appear to bias the comparison unfairly in favor of wet-cooled plants. It does not. The only appropriate comparison between plants with different cooling systems is between plants that have been optimized in their design choices. This topic is beyond the scope of this report but is discussed in depth elsewhere (EPRI 2004). An optimized design is one in which the total evaluated costs—including initial capital costs, operating power costs, and the costs of lower efficiency and limited plant output—are put on a common basis and minimized for the life of the plant.

In the instance of the dry-cooled plant, for example, the plant could have been designed at a higher design ambient temperature and equipped with a larger ACC. The result would have been improved capacity on the hot day, reduced fall-off between design and hot day performance, but higher capital and operating costs. The design points chosen in this study have been selected to represent plants for each site and choice of cooling system that have been optimized on a consistent basis with the use of Thermoflow design, performance, and costing programs; and based on the methodology developed and described in the EPRI report (EPRI 2004).

Figures 7 and 8 illustrate the fall-off in plant output with increasing ambient dry-bulb temperature for plants types with wet cooling (Figure 7) and dry cooling (Figure 8) at all four sites.

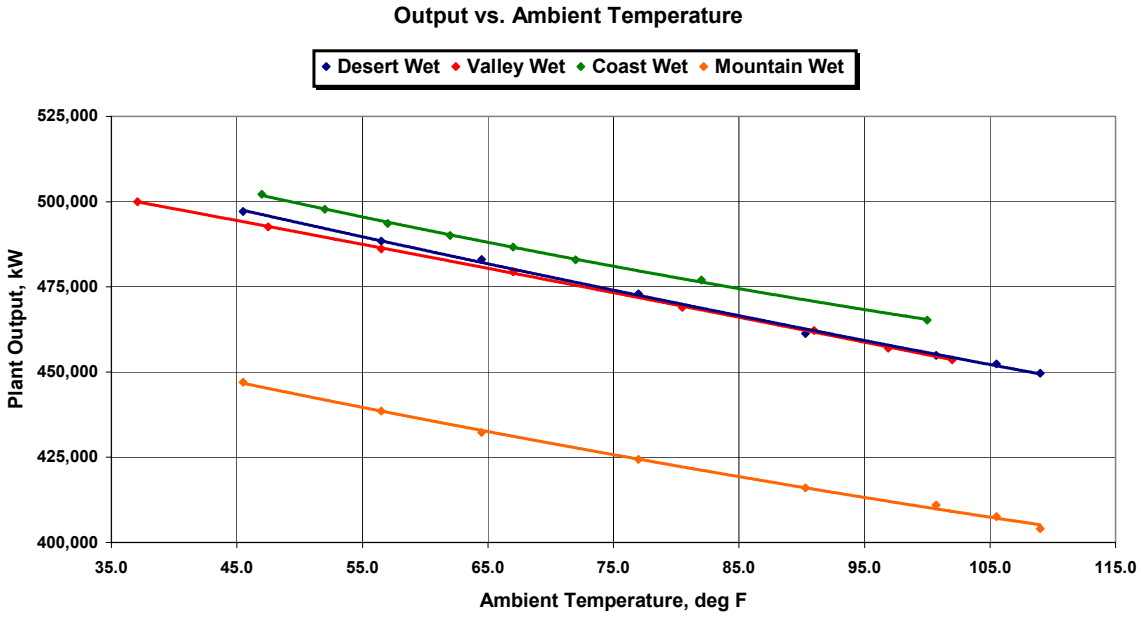


Figure 7. Output vs. ambient temperature—wet-cooled plants

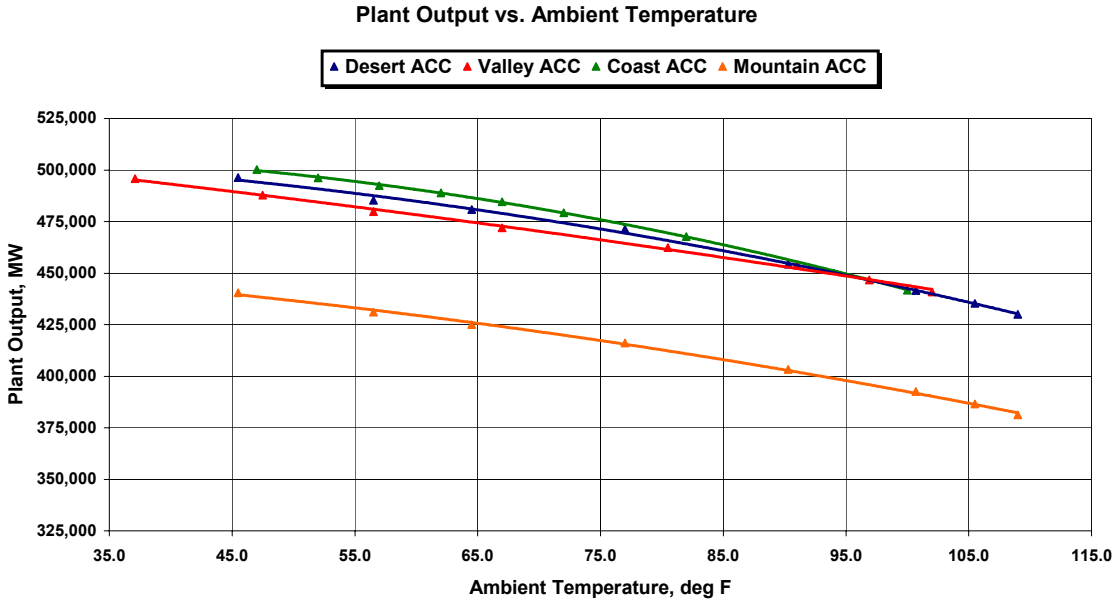


Figure 8. Output vs. ambient temperature—dry-cooled plants

Figures 9, 10, and 11 illustrate the comparisons between net plant output, gas firing rate, and water consumption on the hot days at each of the four sites.

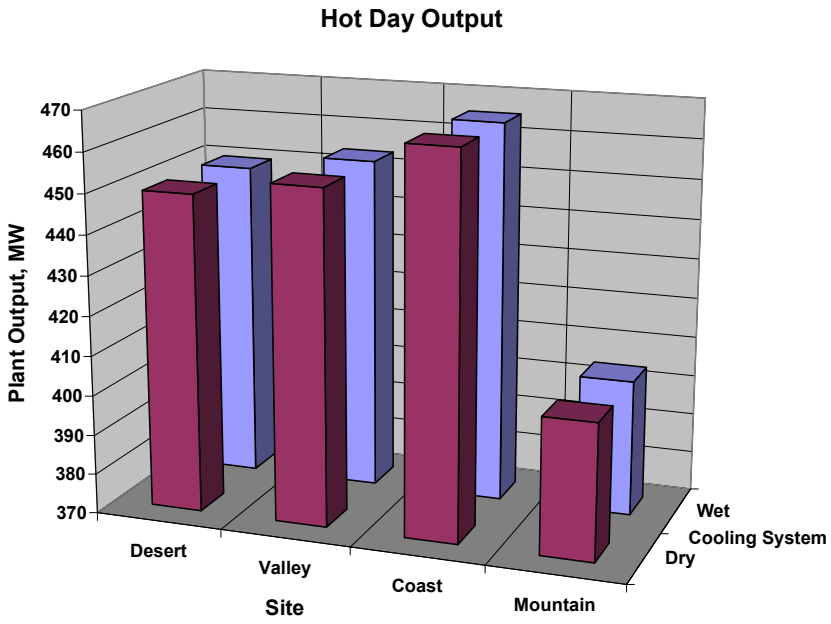


Figure 9. Hot day plant output comparison

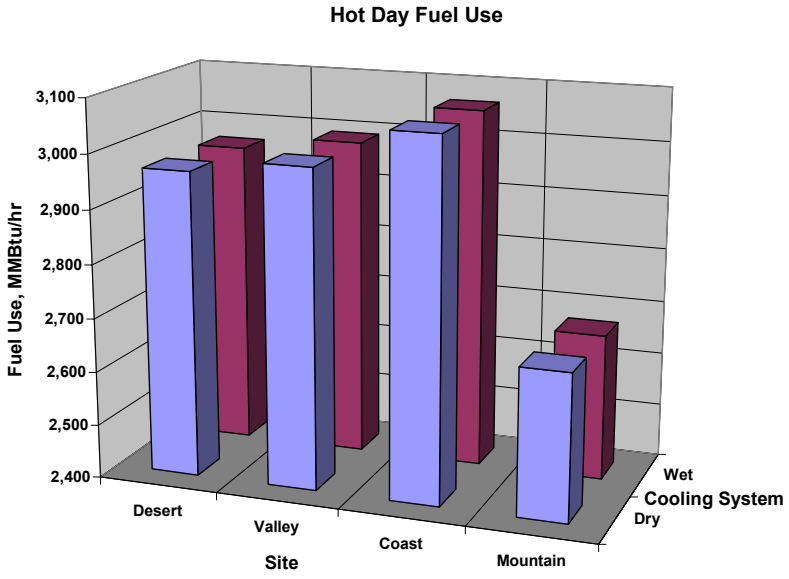


Figure 10. Hot day fuel use comparison

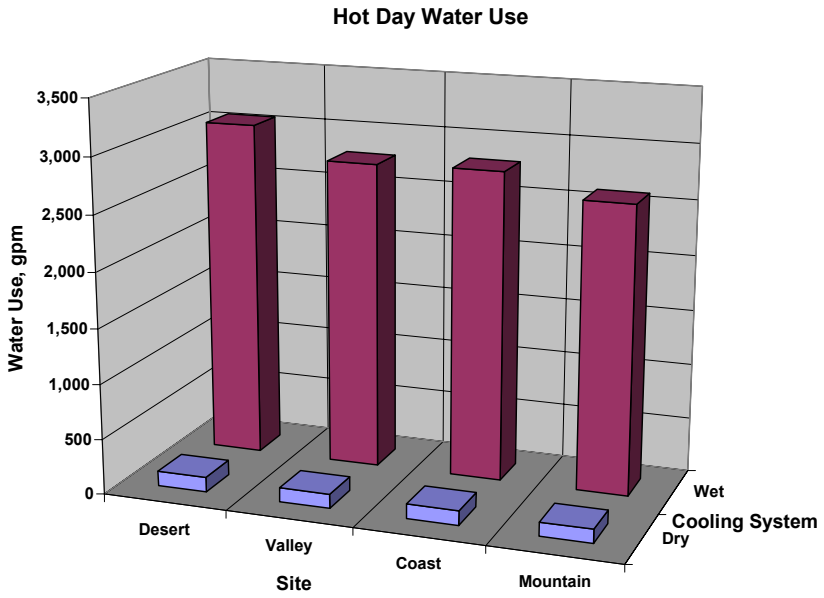


Figure 11. Hot day water use

6.5. Annual Performance Measures

The final analysis consisted of tracking the plant performance throughout the year to determine the annual power produced, the annual revenue generated, and the annual fuel and water consumed. This was accomplished by interpolating between the off-design values for each plant (as tabulated in Appendix C) to obtain the instantaneous values at each dry-bulb temperature. The temperature duration curves in Appendix A were then used to establish the number of hours at each temperature and summing the variables of interest over the 8,760 hours of the year. The values were then reduced by 20% to simulate an 80% capacity factor. No attempt was made to assign the outage hours to any particular season of the year. As noted earlier, all comparisons were conducted assuming the use of combustion turbine inlet cooling or "fogging" during periods when the ambient temperature exceeded 80°F (27°C).

The detailed results of these calculations are tabulated in Appendix D. Table 7 lists four important measures of annual performance for both wet- and dry-cooled plants at each of the four sites. These are: (1) the annual water use, (2) the annual energy output, (3) the annual fuel use, and (4) the annual revenue (computed for the annual energy output valued at $50/MWh). Figures 13, 14, and 15 illustrate these comparisons for the four sites.

Table 8 expresses the data in Table 7 as percent differences in the annual output, the annual fuel use and the annual revenue between the wet- and dry-cooled combined-cycle plants. For example, a combined-cycle plant in the California desert with a wet

tower has 1.07% more annual revenue than a comparable plant with an ACC. The difference in revenue is between 1% and 1.5 % for the desert and valley plants, less than 0.5% for the coastal plant, and nearly 2% at the mountain site.

Table 7. Water use, output, fuel use, and revenue comparisons

Site	Combined Cycle--Wet Cooling				Combined Cycle--Dry Cooling			
	Annual Water Use	Net Plant Output	Annual Fuel Use	Revenue (@$50/MWh)	Annual Water Use	Net Plant Output	Annual Fuel Use	Revenue (@$50/MWh)
	acre-ft/yr	MWh/yr	MMBtu/yr	$	acre-ft/yr	MWh/yr	MMBtu/yr	$
Desert	2,593	3,312,697	21,892,090	$165,634,842	98.5	3,277,130	21,904,839	$163,856,496
Valley	2,356	3,347,398	22,041,546	$167,369,917	86.2	3,298,395	22,040,955	$164,919,768
Coast	2,455	3,448,179	22,687,266	$172,408,932	73.0	3,435,335	22,689,242	$171,766,755
Mountain	2,099	3,033,479	20,036,397	$151,673,974	78.4	2,976,846	20,040,214	$148,842,279

Table 8. Percent differences between wet- and dry-cooled plants

Site	Output (%)	Fuel Use (%)	Revenue (%)
Desert	1.07	-0.06	1.07
Valley	1.46	0.00	1.46
Coast	0.37	-0.01	0.37
Mountain	1.87	-0.02	1.87

The percentage difference fuel use at the comparable plants is small, but the difference in cost amounts to between $1.5 and $2 million per year. Although this may appear modest in comparison to the total capital and operating costs of the plant, the effect on the overall economics of a project may be important.

Table 9 shows the annualized cost of capital and fuel (neglecting for this calculation O&M costs) assuming a capital recovery rate of 7.5% and a fuel cost of $6.00 per million Btu**.** This cost was chosen to provide a conservatively realistic (and easily scalable) comparison. Recent gas costs at an Eastern hub have varied considerably over the past year, as shown in Figure 12, rising to $8.00 per million Btu or higher. The use of a higher fuel cost will result in correspondingly higher annual cost differences between dry- and wet-cooled power plants. These costs are compared for the two plants at each site, and the result compared to both the capital cost (indicative of return on initial investment) and the annual revenue stream (indicative of cash flow considerations for a project).

The combined effect of the increased capital cost and the reduced revenue reduces the annual return, as a fraction of initial capital costs, by 6% to 15% and the annual revenue to annual cost ratio by 2% to 4.4 %. These differences are important in evaluating the attractiveness of a power plant development project.

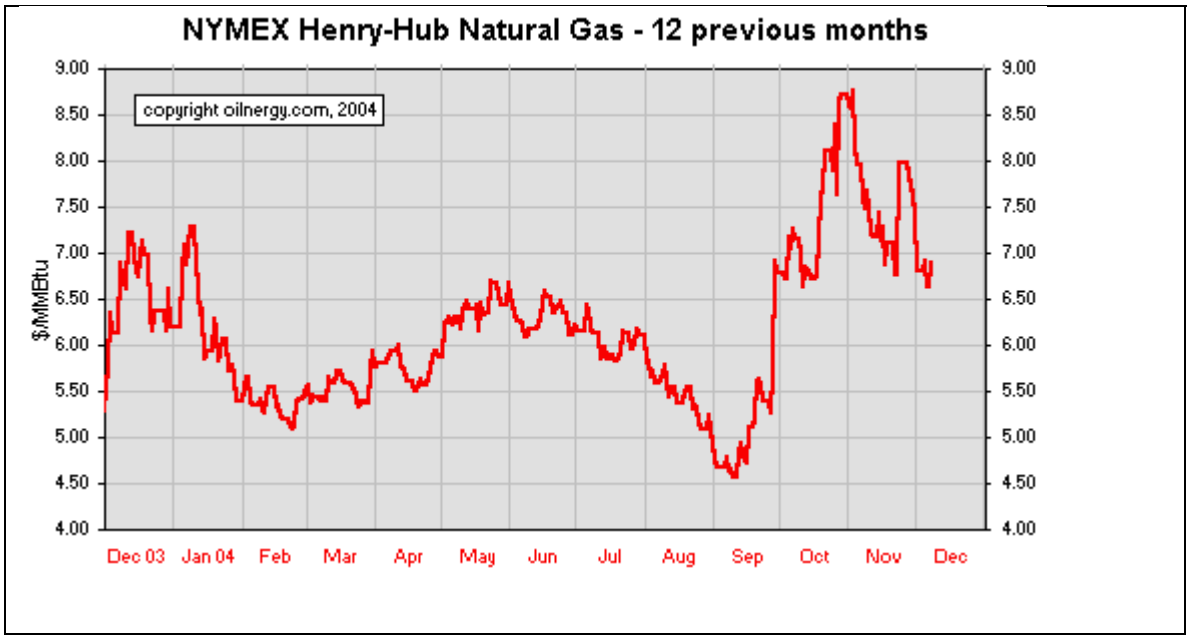


Figure 12. Gas price variation in past year

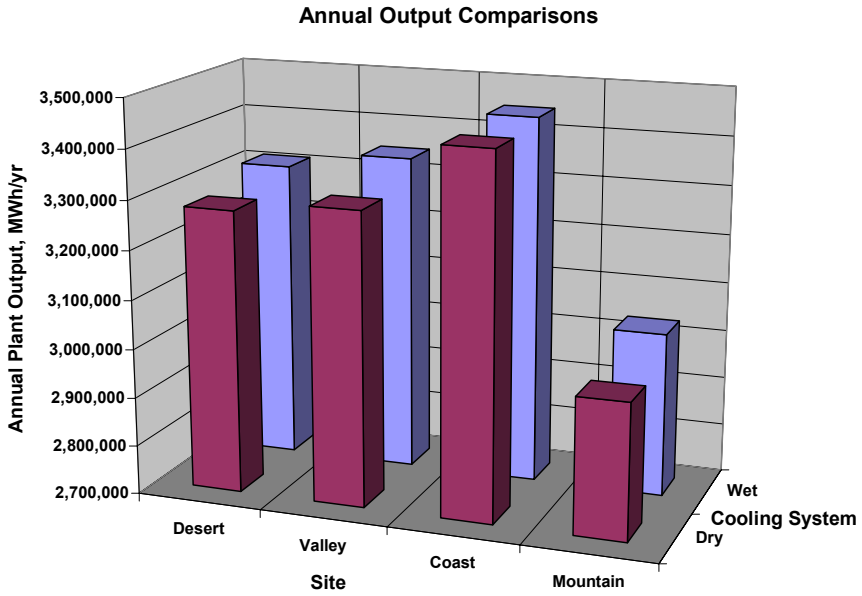


Figure 13. Annual output comparisons

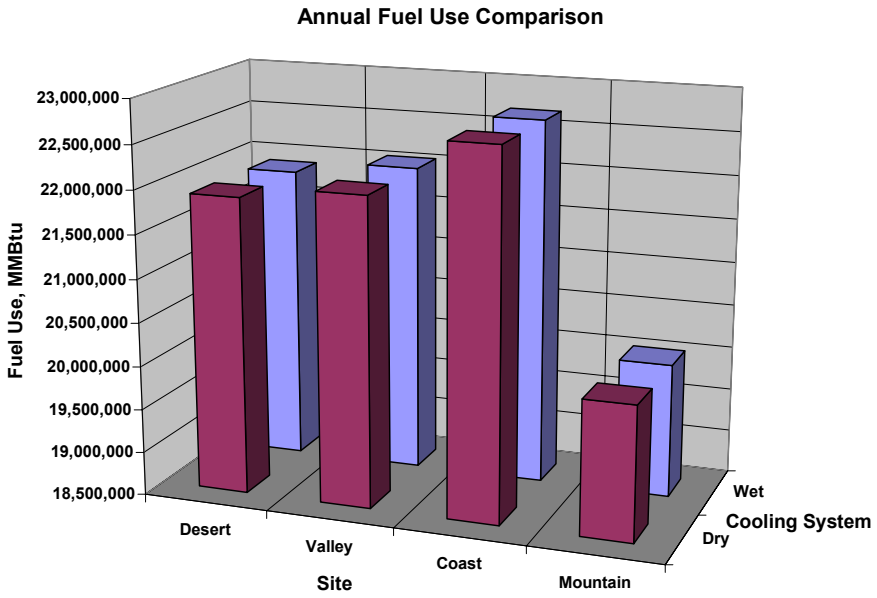


Figure 14. Annual fuel use comparisons

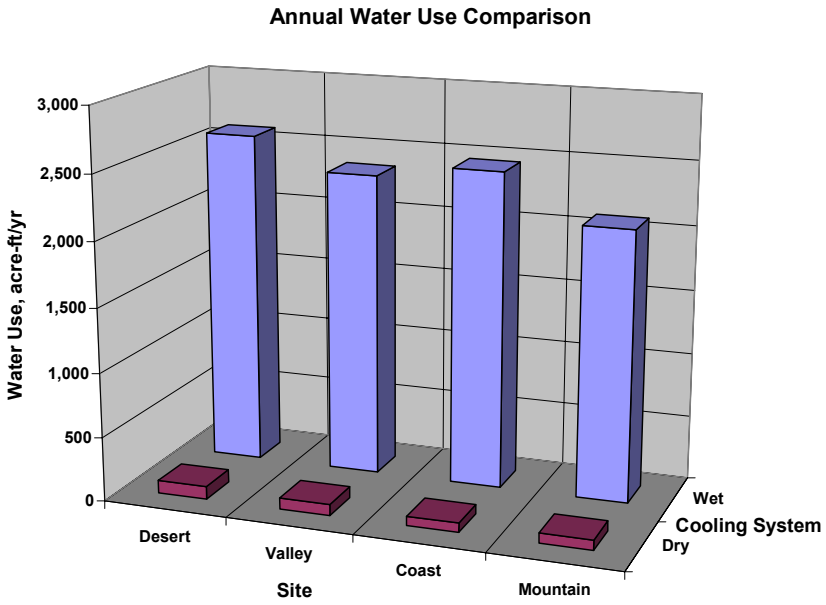


Figure 15. Annual water use comparisons

Table 9. Economics of cost and revenue differences

Site	Cooling System	Capital Cost (MM$)	Annual Fuel Use (MMBtu)	Annual Revenue (@$50/MWh) ($)	Annualized Cost ($)	Annual Revenue/ Capital Cost	Differnce in Annual Return on Capital (%)	Annual Revenue/ Annualized Cost	Difference in Revenue/Cost (%)
Desert	Wet	195.6	21,892,090	165,634,842	146,022,540	0.85	10.39	1.13	2.07
	Dry	213.6	21,904,839	163,856,496	147,449,034	0.77		1.11	
Valley	Wet	197.0	22,041,546	167,369,917	147,024,276	0.85	15.24	1.14	2.87
	Dry	223.7	22,040,955	164,919,768	149,023,230	0.74		1.11	
Coast	Wet	197.9	22,687,266	172,408,932	150,966,096	0.87	12.60	1.14	1.58
	Dry	222.0	22,689,242	171,766,755	152,785,452	0.77		1.12	
Mountain	Wet	202.0	20,036,397	151,673,974	135,368,382	0.75	6.04	1.12	2.38
	Dry	210.2	20,040,214	148,842,279	136,006,284	0.71		1.09	

6.6. Operating Costs

Another element of the comparison is that of the operating cost differences between the two cooling systems. Although these have been taken into account in the previous comparisons by comparing net (rather than gross) plant outputs, it is instructive to examine the details.

Table 10 shows several components of the in-plant power requirements, which are influenced by the choice of cooling system.

Table 10. Comparison of operating power requirements

Desert			Valley		
Item	**CC Wet**	**CC Dry**	**Item**	**CC Wet**	**CC Dry**
	kW	**kW**		**kW**	**kW**
Fuel Compressor	3,677	3,686	Fuel Compressor	3,672	3,727
Misc. Gas Turbine Aux	696	696	Misc. Gas Turbine Aux	696	696
Boiler Feedpump	1,803	1,794	Boiler Feedpump	1,803	1,805
Circ. Water Pump	2,350	0	Circ. Water Pump	1,709	0
Cooling Tower Fan	1,348	0	Cooling Tower Fan	1,020	0
ACC Fans	0	2,899	ACC Fans	0	3,697
Misc. ST Aux	334	305	Misc. ST Aux	336	323
Other Aux	1,772	1,969	Other Aux	1,776	2,003
Total Aux	**11,980**	**11,349**	**Total Aux**	**11,012**	**12,251**
Coast			**Mountain**		
Item	**CC Wet**	**CC Dry**	**Item**	**CC Wet**	**CC Dry**
	kW	**kW**		**kW**	**kW**
Fuel Compressor	3,855	3,906	Fuel Compressor	3,312	3,406
Misc. GT Aux	696	696	Misc. GT Aux	696	696
Boiler Feedpump	1,848	1,856	Boiler Feedpump	1,634	1,640
Circ. Water Pump	1,695	0	Circ. Water Pump	1,723	0
Cooling Tower Fan	1,016	0	Cooling Tower Fan	1,024	0
ACC Fans	0	2,968	ACC Fans	0	2,314
Misc. Steam Turbine Aux	343	343	Misc. Steam Turbine Aux	304	288
Other Aux	1,777	2,008	Other Aux	1,702	1,903
Total Aux	**11,230**	**11,777**	**Total Aux**	**10,395**	**10,247**

The major differences are the increased fan power cost for the dry system, which are offset by the reduction in circulating water pumping costs. These comparisons are highly site-specific. In most instances the fan power consumed by the air-cooled condenser exceeds the combined power requirements for the circulating water pumps and the cooling tower fans in the wet system. In some cases, however, the opposite is true as seen in the desert and mountain cases.

The "Miscellaneous" gas turbine and steam turbine auxiliary power items, which included sub-system water pumps, cooling fans, lube oil pumps, and other minor items, are nearly the same, whether the plant is wet- or dry-cooled. Alternatively, the "other auxiliary" power load is consistently higher by a few hundred kW for the dry-cooled

plant. This situation is likely attributable to increased power for vacuum pump air ejectors, auxiliary wet tower/fin-fan coolers, and water treatment equipment, which may be more extensive in the absence of a wet cooling tower in which to integrate some of the waste water streams.

7.0 Effect of Plant Water Supply

The foregoing comparisons have all been conducted under the assumption that an adequate supply of fresh water was available. Additional comparisons were made for situations where other water supplies were used. Specifically, reclaimed, brackish, and saline water were considered for some of the sites.

1. **Fresh water** (potable groundwater or surface water): Fresh water was assumed to be available in all four settings: desert, valley, coastal, and mountain power plants. It was also assumed that 10 cycles of concentration were achievable with fresh water.
2. **Reclaimed water** (treated municipal effluent): Treated municipal effluent was only considered for valley, coastal, and mountain areas because it is generated in sufficient quantities in dense population areas—that is, in California coastal areas, and to a lesser extent, in the valley (e.g., Fresno) and mountain (e.g., Redding) sites. Five cycles of concentration were assumed to be achievable for treated effluent and that the cooling tower blowdown could be discharged back to the municipal water treatment plant or to receiving waters. At inland sites, cooling tower blowdown would be treated with evaporator/crystallizers and operated at 10 to 12 cycles of concentration. There would be no final liquid waste and, therefore, no requirement for evaporation ponds. It should be noted that reclaimed water generates less wastewater for combined-cycle plants with zero liquid discharge (ZLD) than other types of water. This is because the chemical analysis used for the reclaimed water had very low silica content relative to the others; therefore, those cases were capable of higher cycles of concentration in the cooling tower. This illustrates the sensitivity that one chemical constituent can have on a source water comparison analysis.
3. **Brackish water** (Low-total dissolved solids (TDS) agricultural return or high-TDS groundwater or low-TDS oil-field produced water; TDS range of 2,000 to 5,000 milligrams per liter (mg/l)): The agricultural return water is generated in significant quantities in the Central Valley. Produced water is also generated in large quantities in certain areas of the Central Valley. Brackish water was assumed to be available for the valley and desert plants. Achievable cycles of concentration were assumed to be 5 to 10 for these saline sources of water with cooling tower blowdown being treated by high-efficiency reverse osmosis (HERO) and crystallizers. There would be no final liquid waste.
4. **Saline water** (high-TDS agricultural return or high-TDS oil-field produced water; TDS greater than 5,000 mg/l): As stated previously, agricultural return water and produced water are generated in large quantities in certain areas of the Central Valley. Depending on the location, there could be sources of agricultural return water or possible saline ground water available for power plant cooling in desert locations. Saline groundwater was assumed to be available for the valley and desert power plants. Achievable cycles of concentration were assumed to be 5 to 8 for these saline sources of water with

cooling tower blowdown being treated by high-efficiency reverse osmosis (HERO) and crystallizers. There would be no final liquid waste.

In all cases, blowdown from the HRSG and miscellaneous plant wastes (such as washdown water) were assumed to be reused in the cooling tower at plants equipped with wet cooling.

The amount of wastewater generated was determined for each case, as were the costs for the required water treatment equipment and the associated operational power requirements. These quantities are shown for the combined-cycle plant with wet cooling for each of the four sites.

The water treatment options, chosen as appropriate for each site, are described below.

HERO-Crystallizer is a combination of two treatment technologies. High efficiency reverse osmosis (HERO) is being utilized at many plants in lieu of evaporators (depending on water chemistry and treatment economics). HERO is standard reverse osmosis technology but operated at a high pH. In reverse osmosis, water is applied to a membrane surface under pressure. Water passes through the membrane, leaving the ions behind. Depending on the water, HERO feed pressure can range from 200 to 600 psi. HERO is operated at a high pH, which allows it to operate at high recoveries —up to 90% in some cases. Treated water (permeate) is of fairly high quality, i.e., less than 100 to 500 mg/l TDS. HERO permeate can be further treated for HRSG feedwater or fed directly to the cooling tower. Pretreatment for the HERO process is critical and consists of hardness removal, filtration and pH adjustment. HERO pretreatment can be configured for reuse/treatment of all liquid waste streams. The waste stream from the HERO (reject) is fed to a crystallizer where it is highly concentrated. Crystallizers can concentrate wastewater to 35% to 65% solids (depending on solids handling equipment). Crystallizer distillate is usually less than 10 mg/l TDS. Crystallizers require 200 to 300 kWh to evaporate 1,000 gallons (3,785 liters) of HERO reject.

Evaporator-Crystallizer is also a combination of two treatment technologies. Evaporators (also known as brine concentrators) are extensively utilized to treat wastewater generated by power plants. Preheated wastewater is fed to the evaporator where it is recirculated as a falling film through vertical tubes. As the water films and falls through the tubes, a small fraction is evaporated. The vapor is passed through a compressor (and elevated to a higher energy level) and allowed pass over the outside of the vertical tubes, thus providing a heat source for evaporation. Depending on wastewater quality, the evaporator can recover 90% to 99% of the wastewater as a high-quality effluent, i.e., less than 10 mg/l TDS. Evaporator distillate can be further treated for HRSG feedwater or fed directly to the cooling tower. The brine generated from the evaporator can be 10 to 100 times as concentrated as the wastewater. Evaporators require 85 to 95 kWh to evaporate 1,000 gallons of wastewater. Evaporator brine is fed to the crystallizer where it is highly concentrated. Crystallizers can concentrate wastewater to 35% to 65% solids (depending on solids handling equipment). Crystallizer and evaporator distillates

are of similar quality. Crystallizers require 200 to 300 kWh to evaporate 1,000 gallons of brine.

A table of alternative water and waste water management systems for different source waters is given in Appendix E and summarized in Table 11. The additional costs for the water treatment equipment, while substantial, do not have a significant effect of the previous conclusions comparing the wet- and dry-cooled plants.

7.1. Equivalent Cost of Water

A final comparison is to estimate what the breakeven cost of water would have to be in order to make the costs of wet cooling equal to that of dry cooling for the cases studied.

Two approaches were taken for this assessment: (1) installing water wells at the power plant site, and (2) purchasing water from a municipality, water district, or wholesaler. There are several examples of power plants in California that installed new wells or rehabilitated existing wells to provide water for the plant. This option is site specific. First, groundwater must be at a reasonable depth beneath the surface to install a well extraction system. Second, the water must be free to use, i.e., no one else has exclusive rights to use it. The investment cost for water delivery for well water is the installation of a well field or the cost to rehabilitate existing wells. Operating costs would include the power to bring it to the surface and occasional well maintenance. Operating costs in this delivery scenario are a fraction of the cost to purchased water.

Water for power generation in California is usually purchased from a municipality, water district, or wholesaler. This approach also applies to purchasing reclaimed water. In this case, the investment cost for water delivery would include money for a pipeline, charging pumps, a booster station, and other items. Operating costs would include the cost of the water, power to operate the pipeline, and occasional pipeline maintenance. The cost of water usually far exceeds the cost to pump it to the station. So in this scenario, the cost of water is an operating cost and the difference in the annualized capital and operating costs divided by the difference in annual water requirements give an equivalent water cost (typically expressed in $/1,000 gallons).

Table 12 shows the equivalent cost of water, calculated in these two different ways, for each of the four sites.

Water purchase costs of $3 to $5.50 per 1,000 gallons are high for most regions but have been approached in some arid regions of the country.

Table 11. Effect of water source

Site	Water Source	Water Supply Required (acre-feet/year)		Wastewater Generated (acre-feet/year)		Disposal or Treatment		Water Treatment Equipment Cost ($)		Water Treatment Power Requirement (kW)	
		Dry cooling	Wet cooling	Dry cooling	Wet cooling	Dry cooling	Wet cooling	Dry cooling	Wet cooling	Dry cooling	Wet cooling
Desert	fresh	98.5	2,593	69.2	348	Evap-Cryst	Evap-Cryst	2,500,000	5,200,000	235	1,016
	saline	na	3,241	na	326	na	HERO-Cryst	na	9,800,000	na	3,057
	brackish	na	3,241	na	300	na	HERO-Cryst	na	7,200,000	na	1,309
Valley	fresh	86.2	2,356	66.7	316	Evap-Cryst	Evap-Cryst	2,300,000	4,900,000	204	923
	saline	na	2,945	na	296	na	HERO-Cryst	na	9,200,000	na	2,778
	brackish	na	2,945	na	273	na	HERO-Cryst	na	6,800,000	na	1,189
	reclaimed	na	2,945	na	196	na	HERO-Cryst	na	5,500,000	na	1,075
Coast	fresh	73	2,455	63.4	245	Discharge	Discharge	1,000,000	2,000,000	13	60
	reclaimed	na	2,140	na	341	na	Discharge	na	2,200,000	na	78
Mountain	fresh	78.4	2,099	64.7	283	Evap-Cryst	Evap-Cryst	2,200,000	4,600,000	176	818
	reclaimed	na	2,624	na	175	na	Evap-Cryst	na	5,000,000	na	1,003

Table 12. Equivalent cost of water

Site	Item	Combined Cycle Wet Cooling	Combined Cycle Dry Cooling	Equivalent Water Cost ($/1,000 gallons)
Desert	Water Used, ac-ft/yr	2,593	98.5	3.75
	Capital Cost, MM$	195.6	213.6	
	Annual Revenue, MM$	165.6	163.9	
Valley	Water Used, ac-ft/yr	2,356	86.2	6.08
	Capital Cost, MM$	197.0	223.7	
	Annual Revenue, MM$	167.4	164.9	
Coast	Water Used, ac-ft/yr	2,455	73	3.39
	Capital Cost, MM$	212.8	238.6	
	Annual Revenue, MM$	172.4	171.7	
Mountain	Water Used, ac-ft/yr	2,089	78.4	5.36
	Capital Cost, MM$	202.0	210.2	
	Annual Revenue, MM$	151.7	148.8	

Equivalent Water Cost: Cap Cost x .075 plus difference in annual revenue divided by annual water use

8.0 Additional Comparisons

8.1. Simple-cycle Gas Turbine Plants

Simple-cycle gas turbine plants are common in California for limited use as peaking plants with low capacity factors. They consist of one or more "stand-alone" combustion turbines. Unlike combined-cycle plants, there is no recovery of heat from the combustion turbine exhaust gas and, hence, no steam cycle equipment such as the HRSG or steam turbine or condenser cooling system.

Simple-cycle plants are characterized by low capital costs but high heat rates, in comparison to combined cycles. The only essential use of water is for the plant "hotel" load. At some plants, additional water is used for turbine inlet air cooling and for NO_x control. However, both of these functions can be performed with dry technologies such as chillers for turbine inlet air cooling and DLN (dry low NO_x) combustors for NO_x control.

Table 13 compares the normalized costs (in $/kW), design heat rate, and water use (gallons/megawatt-hour (MWh)) at design conditions for simple-cycle and combined-cycle plants equipped with either an air-cooled condenser or a wet cooling tower at a Desert site. Each of the plants is assumed to operate with inlet air fogging, dry NO_x control, and a 30 gpm hotel load.

Both the simple cycle and the combined cycle with dry cooling provide large reductions in water requirements compared to the wet-cooled combined cycle plant. The simple-cycle plant has a much lower capital cost, although the normalized cost ($/kW) is only about 7% less than that for a combined-cycle plant with wet cooling and about 17% less than a combined-cycle plant with dry cooling. It should be noted that some recent simple-cycle designs have used increasing amounts of water for compressor inter-cooling in an attempt to increase cycle efficiency. In some instances, the water use rate has been reported as high as 3 gpm/MW. However, even in these cases, the high heat rate precludes the use of simple-cycle plants for all but perhaps a few hundred hours per year, to meet peak loads or occasional emergency conditions, and the annual revenue and potential return on investment is limited. Therefore, the technology does not play an important role in the annual power generation picture or in overall water use and conservation considerations for California. It is not considered further in this analysis.

Table 13. Simple- vs. combined-cycle plants

Plant	Design Conditions				Hot Day Conditions		
	Plant Output (MW)	Capital Cost (MM$)	Normalized Cost ($/kW)	Heat Rate (Btu/kWh)	Plant Output (MW)	Water Consumption	
						gpm	gal/Mwh
Simple Cycle[1]	302.4	119.9	396.5	9,815.0	302.4	111.2	22.1
Combined-cycle w. ACC[2]	445.5	213.6	479.5	6,795.0	431.0	135.6	18.9
Combined-cycle with wet cooling[2]	457.8	195.5	427.0	6,596.0	449.6	3,056.6	407.9

Notes:
1 Two stand-alone GE 7241 FA combustion turbines
2 2 x 1 CC with two GE 7241 FA combustion turbines

8.2. Plant Performance With and Without Inlet Fogging

All of the comparative cases in this study assumed the use of turbine inlet air cooling by spraying water into the inlet air stream, which is often referred to as "fogging." This is commonly done at both simple- and combined-cycle plants because gas turbines suffer a loss in capacity with increasing temperature. This loss occurs because they are essentially constant volume flow machines. As the ambient temperature rises and the air density decreases, the mass flow of gas flowing through the turbine and the resulting power output of the turbine decreases. Inlet air cooling maintains a mass flow consistent with the lowered temperature and restores the lost power output.

Although this can be accomplished without the evaporative use of water by installing active refrigeration units on the inlet air stream, evaporative systems are more commonly used because of their much lower capital cost. Fogging systems, in addition to maintaining the mass flow of air through the turbine, also provide a small amount of additional power output from the mass flow of fogging water that passes through the turbines.

It is interesting to consider the value of water in the inlet air cooling application in the form of increased plant output during the hottest hours of the year and improved plant efficiency throughout the year.

Table 14 shows the percentage increase in plant output for a simple-cycle plant and combined-cycle plant with wet and dry cooling at design conditions (1% dry bulb for the simple cycle) for the desert, valley, and coast sites. Table 15 displays the same results in terms of the water required per additional MW produced by the inlet air cooling at design.

Table 14. Effect of water use for gas turbine inlet fogging

Inlet Fogging	Output Capacity Hot Day (1% dry bulb) Conditions			Water Use
	Plant, Net (MW)	Gas Turbine, Gross (MW)	Steam Turbine, Gross (MW)	Fogging Rate (gpm)
Off	405.2	140.0	139.0	0.0
On	440.9	155.8	143.7	35.9

Several points are noteworthy. Inlet fogging increases the net output by 8 MW, to nearly 40 MW, depending on the plant type and site meteorology. Because nearly all the benefit is realized by the gas turbines, the increase is nearly as large for the nominally 300 MW simple-cycle plant as it is for the 500 MW combined-cycle plants. The benefit is less at the coast site, since the ambient temperature at design is lower and the amount of cooling provided is less, because, at the higher relative humidities, the ambient dry-bulb and wet-bulb temperatures are closer together than at either the desert or the valley site.

The benefit to combined-cycle plants with wet cooling is slightly greater than at those with dry cooling. This is because inlet fogging, in addition to producing additional power from the gas turbines, delivers more energy to the steam cycle. The additional steam flow from the steam cycle results in a higher backpressure increase and a greater

effect on the steam cycle efficiency for the plant with the air-cooled condenser than at the plant with a wet cooling system.

For all of the cases examined, the water use for inlet fogging ranged from 125 to 160 gallons per additional MWh at design conditions. This is a very effective use of water to enhance the capacity of simple- and combined-cycle power plants, particularly at hot, arid sites where a significant reduction in the inlet dry-bulb temperature can be realized with evaporative cooling of the turbine inlet air stream.

Table 15. Water requirements for increased capacity from inlet fogging

Site	Plant	Fog Flow	Additional Output	Water Requred per Unit Additional Output
		gpm	MW	gal/MWh
Desert	Simple Cycle	80.9	37.0	131.2
	Combined Cycle Wet Cooling	61.8	29.5	125.7
	Combined Cycle Dry Cooling	43.5	18.3	142.5
Valley	Simple Cycle	72.6	31.3	139.1
	Combined Cycle Wet Cooling	64.6	30.5	127.0
	Combined Cycle Dry Cooling	50.6	22.7	133.8
Coast	Simple Cycle	37.5	14.0	160.7
	Combined Cycle Wet Cooling	32.3	13.7	141.4
	Combined Cycle Dry Cooling	19.3	7.9	146.8

8.3. Steam Cycle Operating Pressure and Plant Optimization Criteria

The steam portion of the combined cycle can be designed for a range of steam supply pressures. High-pressure HRSGs and steam turbines are more costly but provide increased capacity at higher efficiency. However, this requires correspondingly higher cooling capacity with greater heat loads on either the dry or wet cooling systems. The base case examples are all evaluated at "low pressure" with an inlet steam pressure before the steam turbine stop valve of about 800 psia at design conditions.

Additionally, the Thermoflow design and performance programs for combined-cycle power plants can be set for a "low cost" or "high efficiency" design. Given that the combustion turbines are specified a priori (in this study they were the same for all cases), the difference is in the design and in the heat transfer effectiveness of the many heat recovery stages in the HRSG and in the steam turbine design. The higher efficiency design extracts more energy from the combustion turbine exhaust gases, resulting in a

lower stack temperature and a higher steam flow and temperature to the steam turbine. Here again, the steam cycle components are more costly and the cooling system capacity must be increased. The base case examples are all evaluated under the "low cost" criterion.

A set of comparisons was constructed for the desert site for the four combinations of "low pressure/low cost" (the base case conditions), "low pressure/high efficiency," "high pressure/low cost," and "high pressure/high efficiency."

Table 16 lists the net plant output, plant cost, normalized plant cost, design heat rate, "hot day capacity," and plant water consumption for each comparison. Figure 16 plots the net output vs. ambient temperature for the several cases.

Table 16. Effect of pressure and design criterion

Cooling System	Steam Pressure		Design Criterion		Design Conditions					
	800 psia	1200 psia	Low Cost	High Efficiency	Plant Capacity	Cap. Cost	Normalized Cost	Steam Output (gross)	Heat Rate	Plant Water Consumption
					MW	MM$	$/kW	MW	Btu/kWh	gpm
Dry-ACC	x		x		445.5	213.6	479.5	142.9	6,795	119.0
	x			x	449.1	234.4	521.9	149.3	6,739	119.4
		x	x		449.9	230.5	512.3	149.2	6,730	118.8
		x		x	453.9	240.2	529.2	153.1	6,670	112.6
Wet Tower	x		x		457.8	195.6	427.3	156.2	6,604	2817.9
		x	x		461.8	212.5	460.2	161.7	6,550	2684.3

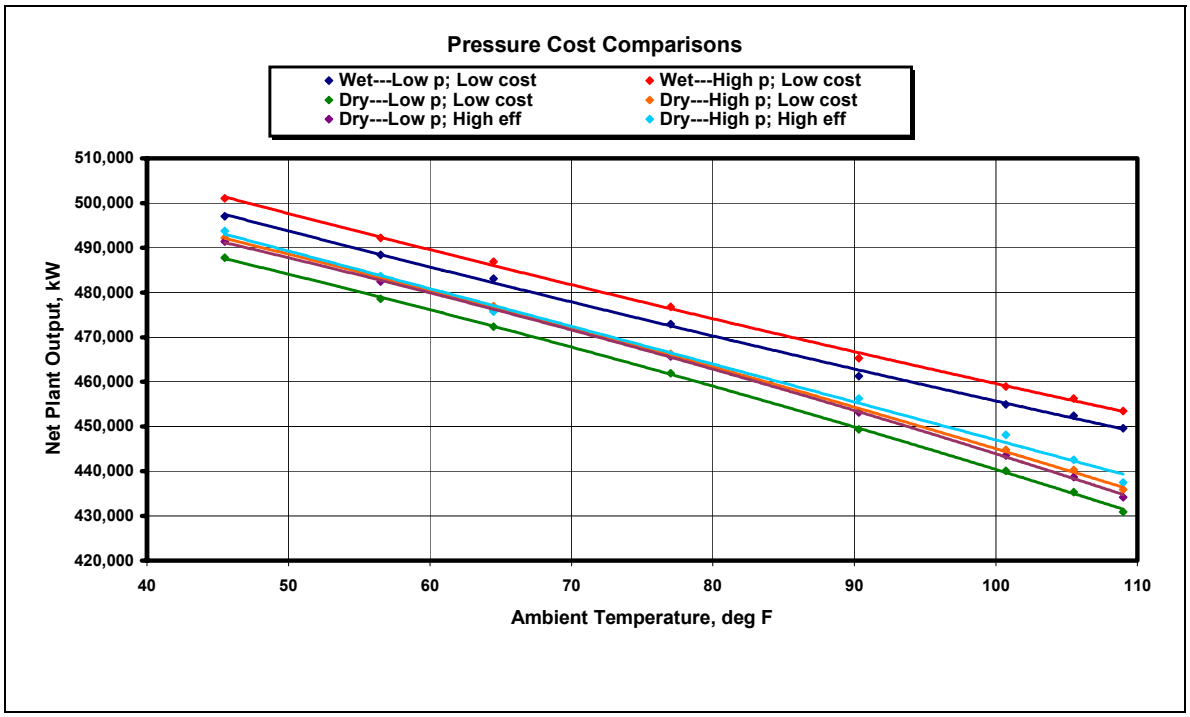


Figure 16.Effect of pressure and design criteria

The higher pressure or the "high efficiency" (versus low cost) designs provide higher capacity and lower water use rates; however, the capital costs and the normalized costs are also higher. The differences between wet- and dry-cooled plants by any of the above measures are minimally affected by the choice of design criteria. Therefore, the base case comparisons of the study, which were all done for "low pressure/low cost" design criteria, give a fair representation of the wet-cooled versus dry-cooled comparisons, even for situations with somewhat different design criteria.

9.0 Conclusions

The results of the analysis can be summarized in the following conclusions.

- For a 500 MW gas-fired, combined-cycle plant (typical of new plants in California) the use of dry cooling reduces the annual plant water requirements by approximately 2,000 to 2,500 acre-feet per year depending on the climate at the plant location.
- The associated costs are:
  - Increased plant capital cost of approximately $8 million to $27 million, or about 5% to 15% of the total plant cost
  - Potential reduction of energy production by about 13,000 to 56,000 MWh per year (1% to 2% of the total)
  - Capacity reduction on hot days of 13 to 23 MW (4% to 6% of total)
  - Potential annual revenue reduction of about $1.5 to $3.0 million (1% to 2% of total)
- The cost of dry cooling can be expressed an "effective cost" of water. This is defined as the additional cost of using dry cooling expressed on an annualized basis, divided by the annual reduction in water requirement achieved through the use of dry cooling. This "effective cost" of saved water ranges from $3.40 to $6.00 per 1,000 gallons. This compares to more typical costs for industrial and residential uses ranging from $1.00 to $2.50 per 1,000 gallons.
- The water savings achieved from the use of dry cooling vary from site to site and depend on the choice of source water. The site to site differences are due primarily to the differences in the water requirements for the wet cooling system and vary from 2,495 acre-feet per year at the desert site to 2,021 acre-feet per year at the mountain site.

Water requirements for alternate water sources are higher than for fresh water for two reasons. First, the wet cooling tower can be operated at higher cycles of concentration with fresh water make-up, thus reducing the blowdown flow. In addition, the alternate water sources must be treated prior to use and a wastewater discharge stream is created, which adds to the make-up requirements. The water saving with the alternate water sources vary from 3,143 acre-feet per year at the desert site to 2,546 acre-feet per year at the mountain site. It is important to understand that these costs and penalties are calculated for dry cooling systems which were sized using an optimization criterion of minimum total annualized cost based on current estimates of capital, fuel, and electricity costs. Other optimization criteria could have been chosen and would have yielded different results. For example, if a very high value were assigned to meeting peak power demands on the hotter days, a larger and more expensive cooling system would have been selected. While the total annualized cost would have been higher, the "hot day capacity reduction" would have been reduced or eliminated.

10.0 References

DiFilippo, M. October 2003. *Use of Degraded Water Sources as Cooling Water in Power Plants.* California Energy Commission and EPRI. P500-03-110.

EPRI. 2004. *Comparison of Alternate Cooling Technologies for U. S. Power Plants: Economic, Environmental and Other Tradeoffs.* EPRI: Palo Alto, California. 1005358.

Maulbetsch, J. S. 2002. *Comparison of Alternate Cooling Technologies for California Power Plants: Economic, Environmental and Other Tradeoffs.* 500-02-079F. California Energy Commission.

Thermoflow Software Suite. 2004. Edited by Thermoflow. Thermoflow, Inc.: Sudbury, Massachusetts.

11.0 Glossary

ACC	air-cooled condenser
CHP	combined heat and power
DLN	dry low NO_x
gpm	gallons per minute
HERO	high-efficiency reverse osmosis
Hga	inches of mercury absolute
HHV	higher heating value
HPT	high-pressure turbine
HRSG	heat recovery steam generator
IP	intermediate pressure
ITD	inlet temperature difference
kpph	thousand pounds per hour
kUSD	thousands of U.S. dollars
kW	kilowatt
kWh	kilowatthour
LHV	lower heating value
LPB	low-pressure boiler
LPT	low-pressure turbine
MM$	million dollars
MMBtu	million British thermal units
MW	megawatt
PIER	Public Interest Energy Research
psia	pounds per square inch absolute
PURPA	Public Utility Regulatory Policies Act of 1978
rh	relative humidity
ST	steam turbine
TDS	total dissolved solids
O&M	operation and maintenance
ZLD	zero liquid discharge

APPENDIX A

SITE METEOROLOGICAL DATA

From Engineering Weather Data CD

published by

National Climatic Data Center

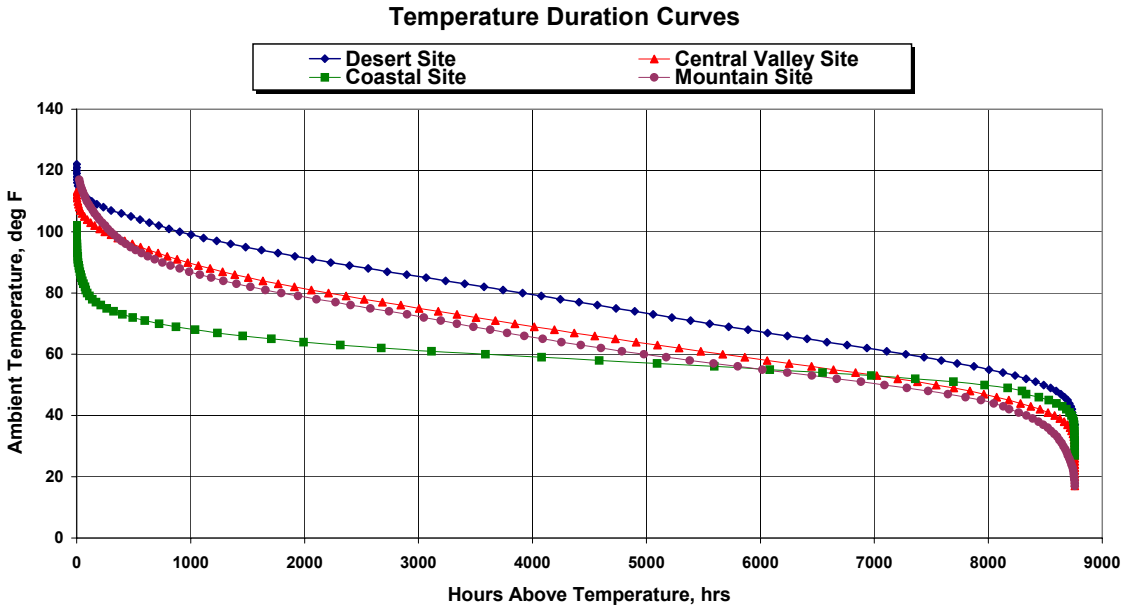


Figure A-1

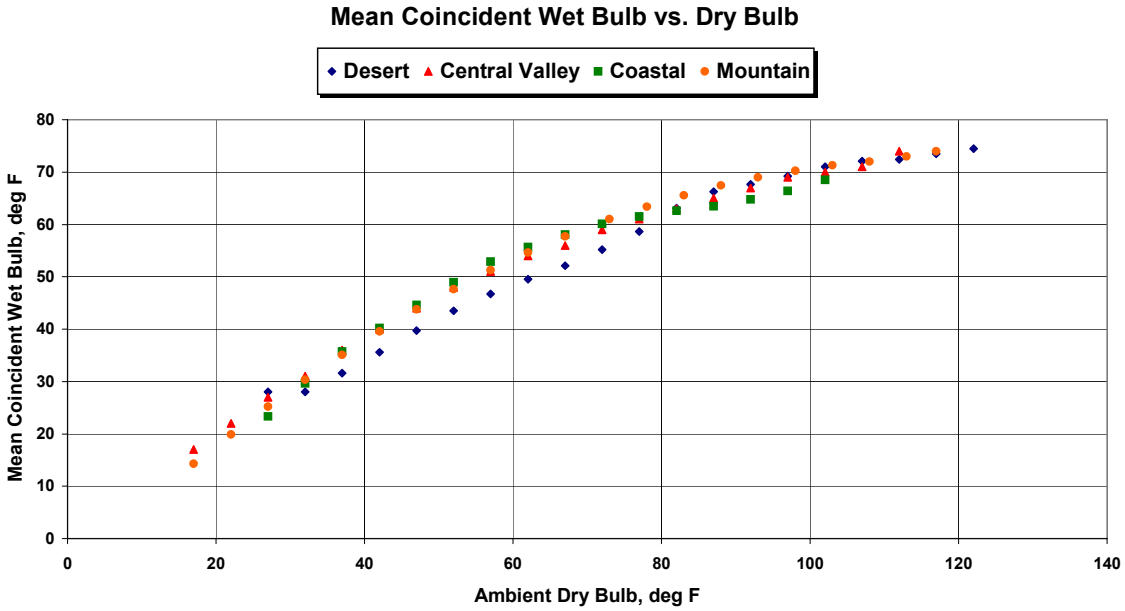


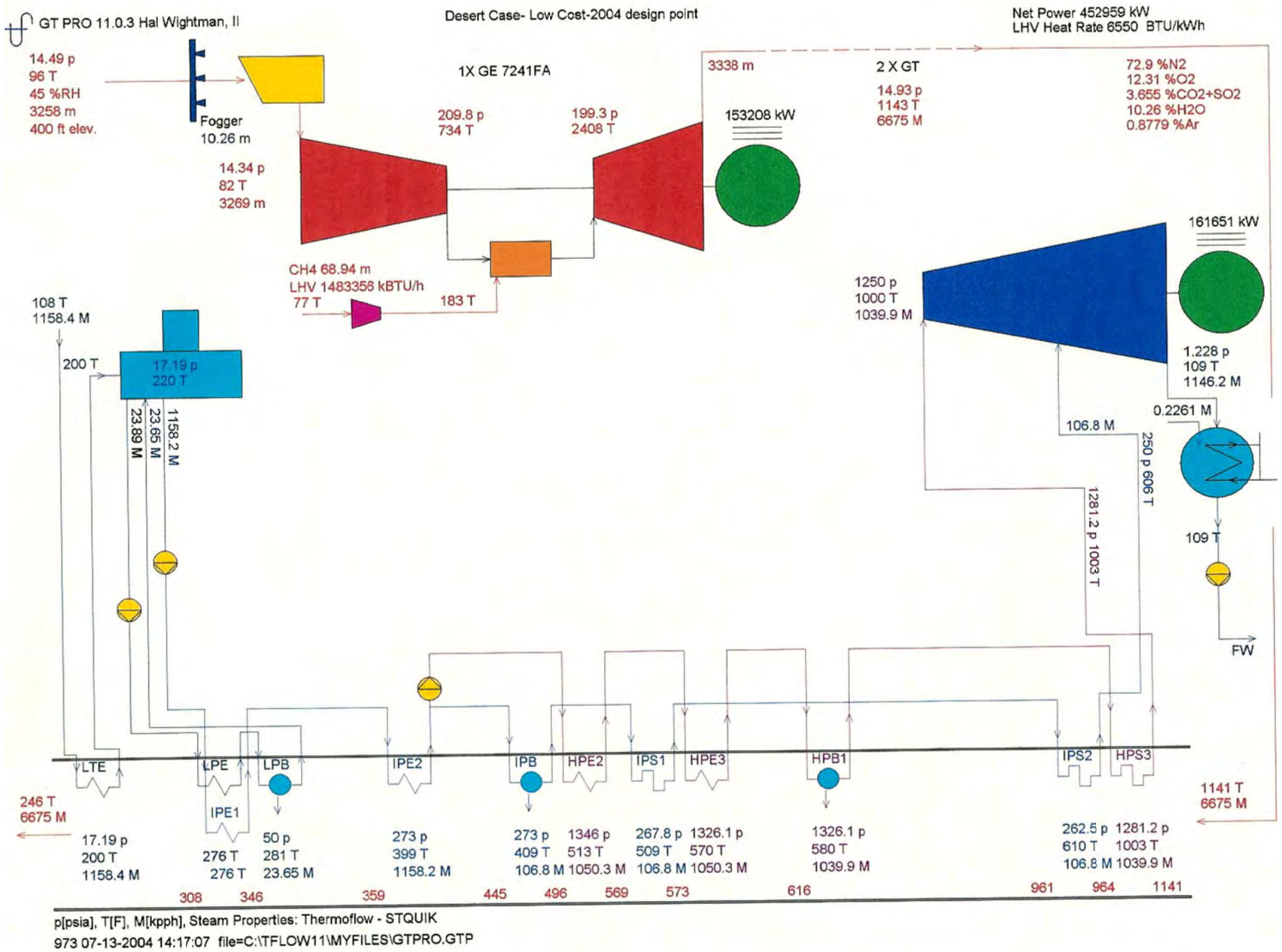
Figure A-2

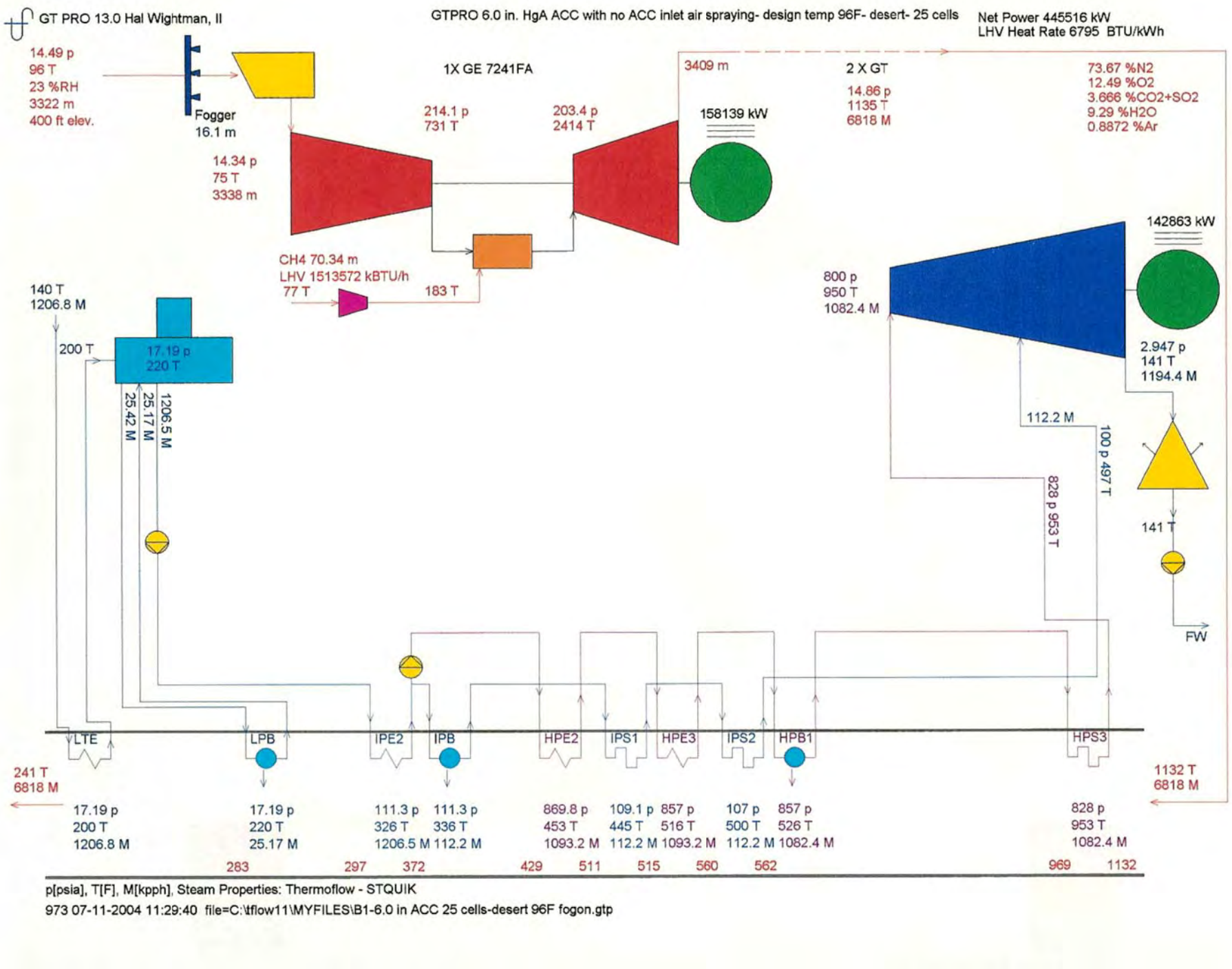
APPENDIX B

DESIGN COST AND PERFORMANCE DATA

B.1 Desert Site
B.2 Valley Site
B.3 Coast Site
B.4 Mountain Site

B.1 Desert Site Design Information


GT PRO 11.0.3 Hal Wightman, II
Desert Case- Low Cost-2004 design point
Net Power 452959 kW
LHV Heat Rate 6550 BTU/kWh
14.49 p
96 T
45 %RH
3258 m
400 ft elev.
Fogger
10.26 m
1X GE 7241FA
14.34 p
82 T
3269 m
209.8 p
734 T
199.3 p
2408 T
3338 m
153208 kW
2 X GT
14.93 p
1143 T
6675 M
72.9 %N2
12.31 %O2
3.655 %CO2+SO2
10.26 %H2O
0.8779 %Ar
CH4 68.94 m
LHV 1483356 kBTU/h
77 T
183 T
161651 kW
1250 p
1000 T
1039.9 M
108 T
1158.4 M
200 T
17.19 p
220 T
23.89 M
23.65 M
1158.2 M
1.228 p
109 T
1146.2 M
0.2261 M
106.8 M
250 p 606 T
1281.2 p 1003 T
109 T
FW
LTE
LPE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
HPB1
IPS2
HPS3
IPE1
246 T
6675 M
17.19 p
200 T
1158.4 M
276 T
276 T
50 p
281 T
23.65 M
273 p
399 T
1158.2 M
273 p
409 T
106.8 M
1346 p
513 T
1050.3 M
267.8 p
509 T
106.8 M
1326.1 p
570 T
1050.3 M
1326.1 p
580 T
1039.9 M
262.5 p
610 T
106.8 M
1281.2 p
1003 T
1039.9 M
1141 T
6675 M
308
346
359
445
496
569
573
616
961
964
1141
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 07-13-2004 14:17:07 file=C:\TFLOW11\MYFILES\GTPRO.GTP


GT PRO 13.0 Hal Wightman, II
GTPRO 6.0 in. HgA ACC with no ACC inlet air spraying- design temp 96F- desert- 25 cells
Net Power 445516 kW
LHV Heat Rate 6795 BTU/kWh
14.49 p
96 T
23 %RH
3322 m
400 ft elev.
Fogger
16.1 m
1X GE 7241FA
14.34 p
75 T
3338 m
214.1 p
731 T
203.4 p
2414 T
158139 kW
3409 m
2 X GT
14.86 p
1135 T
6818 M
73.67 %N2
12.49 %O2
3.666 %CO2+SO2
9.29 %H2O
0.8872 %Ar
CH4 70.34 m
LHV 1513572 kBTU/h
77 T
183 T
142863 kW
800 p
950 T
1082.4 M
140 T
1206.8 M
200 T
17.19 p
220 T
25.42 M
25.17 M
1206.5 M
2.947 p
141 T
1194.4 M
112.2 M
100 p 497 T
828 p 953 T
141 T
FW
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
241 T
6818 M
1132 T
6818 M
17.19 p
200 T
1206.8 M
17.19 p
220 T
25.17 M
111.3 p
326 T
1206.5 M
111.3 p
336 T
112.2 M
869.8 p
453 T
1093.2 M
109.1 p
445 T
112.2 M
857 p
516 T
1093.2 M
107 p
500 T
112.2 M
857 p
526 T
1082.4 M
828 p
953 T
1082.4 M
283
297
372
429
511
515
560
562
969
1132
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 07-11-2004 11:29:40 file=C:\tflow11\MYFILES\B1-6.0 in ACC 25 cells-desert 96F fogon.gtp

Desert Site----Base Case Design Costs		
	DRY COOLING--ACC	WET COOLING--MECH. DRAFT
SPECIALIZED EQUIPMENT:		
Gas Turbine Package [kUSD]	$64,974	$64,974
Steam Turbine Package [kUSD]	$11,682	$14,219
Heat Recovery Boiler [kUSD]	$13,714	$14,236
Water-cooled Condenser [kUSD]	NA	$1,927
Air-cooled Condenser [kUSD]	$14,106	NA
Inlet Air Chilling / Heating System [kUSD]	NA	NA
Fuel Gas Compressor [kUSD]	$2,459	$3,111
Continuous Emissions Monitoring System [kUSD]	$451	$451
Distributed Control System [kUSD]	$1,067	$1,077
Transmission Voltage Equipment [kUSD]	$7,686	$7,828
Generating Voltage Equipment [kUSD]	$6,925	$6,377
Total Specialized Equipment	**$123,063**	**$114,199**
OTHER EQUIPMENT:		
Pumps [kUSD]	$1,436	$2,270
Tanks [kUSD]	$490	$399
Cooling Tower [kUSD]	NA	$1,860
Auxiliary Heat Exchangers [kUSD]	$315	$46
Feedwater Heater(s) [kUSD]	NA	NA
Auxiliary Boiler [kUSD]	NA	NA
Makeup Water Treatment System [kUSD]	NA	NA
Waste Water Treatment System [kUSD]	NA	NA
Bridge Crane(s) [kUSD]	$288	$310
Station/Instrument Air Compressors [kUSD]	$86	$86
Recip Engine Genset(s) [kUSD]	NA	NA
General Plant Instrumentation [kUSD]	$329	$332
Medium Voltage Equipment [kUSD]	$721	$1,081
Low Voltage Equipment [kUSD]	$760	$388
Miscellaneous Equipment [kUSD]	$221	$339
Total Other Equipment	**$4,645**	**$7,111**
CIVIL:		
Site Work [kUSD]	$2,537	$1,862
Excavation & Backfill [kUSD]	$113	$161
Concrete [kUSD]	$4,160	$4,231
Roads, Parking, Walkways [kUSD]	$220	$178
Total Civil	**$7,029**	**$6,432**
MECHANICAL:		
On-Site Transportation & Rigging [kUSD]	$1,791	$1,823
Equipment Erection & Assembly [kUSD]	$10,629	$6,455
Piping [kUSD]	$4,706	$5,942
Steel [kUSD]	$1,207	$1,241
Total Mechanical	**$18,332**	**$15,461**
ELECTRICAL ASSEMBLY & WIRING:		
Controls [kUSD]	$770	$3,566
Assembly & Wiring [kUSD]	$4,864	$0
Total Electrical Assembly and Wiring	**$5,634**	**$3,566**
BUILDINGS:		
Turbine Hall [kUSD]	$2,781	$2,995
Administration, Control Room, Machine Shop / Warehouse [kUSD]	$1,078	$1,078
Water Treatment System [kUSD]	NA	NA
Guard House [kUSD]	$15	$15
Total Buildings	**$3,874**	**$4,088**
ENGINEERING & PLANT STARTUP:		
Engineering [kUSD]	$7,480	$7,254
Start-Up [kUSD]	$1,243	$1,218
Total Engineerng and Plant Startup	**$8,723**	**$8,472**
SOFT & MISCELLANEOUS COSTS:		
Contractor's Soft Costs [kUSD]	$24,692	$21,881
Owner's Soft Costs [kUSD]	$17,639	$14,381
Total Soft & Miscellaneous Costs	**$42,331**	**$36,262**
TOTAL EQUIPMENT AND LABOR	**$162,578**	**$150,857**
E'QPT AND LABOR PLUS ENG'G AND START-UP	**$171,301**	**$159,329**
TOTAL COST (INCLUDING SOFT & MISCELLANEOUS COSTS)	**$213,632**	**$195,591**

Table B.1-1

Desert Site---Design Performance

Plant Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	400	400
Ambient pressure [psia]	14.49	14.49
Summer Average/Coincident Wet Bulb [F]	96/68	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	78/96
Ambient relative humidity [%]	23	45
Plant gross output [kW]	459,167	472,165
Plant net output [kW]	445,522	457,825
Gross LHV heat rate [BTU/kWh]	6,593	6,396
Net LHV heat rate [BTU/kWh]	6,795	6,596
Plant gross elec eff [%]	51.76	53.35
Plant net elec eff [%]	50.22	51.73
PURPA eff [%]	50.22	51.73
CHP eff [%]	50.22	51.73
Power gen. eff on chargeable energy [%]	50.22	51.73
Canadian Class 43 heat rate [BTU/kWh]	7,316	7,097
Plant total fuel HHV input [kBtu/hr]	3,359,195	3,350,971
Plant total fuel LHV input [kBtu/hr]	3,027,356	3,019,944
Fuel compressor [kW]	3,686	3,677
Supercharging fan [kW]	0	0
Electric chiller [kW]	0	0
Miscellaneous GT aux. [kW]	696	696
Boiler feedpump [kW]	1,794	1,803
Circulating water pump [kW]	0	2,350
Air-cooled condenser fan [kW]	2,899	0.00
Cooling tower fan [kW]	0	1,348
Miscellaneous ST aux. [kW]	305	334
Transformer losses [kW]	2,296	2,361
All other auxiliaries [kW]	1,969	1,772
Plant total auxiliaries [kW]	11,349	11,979
GT fuel HHV/LHV ratio	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11
Plant water consumption [kpph]	44.5	1,393
Plant water discharge [kpph]	12.2	282.26
Plant emission - CO2 (net) [kpph]	386.0	385.0

Desert Site---Design Performance---Plant Summaries
Table B.1-2a

Desert Site---Design Performance Gas Turbine Summary		
	Dry Cooling--ACC	**Wet Cooling--Mech. Draft Tower**
Design Conditions		
Site Elevation [ft]	400	400
Ambient pressure [psia]	14.49	14.49
Summer Average/Coincident Wet Bulb [F]	96/68	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	78/96
Ambient relative humidity [%]	23	45
GT gross power [kW]	158,160	157,549
GT gross LHV eff [%]	35.65	35.60
GT LHV gross heat rate [BTU/kWh]	9,571	9,585
Compressor inlet mass flow [kpph]	3,339	3,331
Compressor inlet temperature [F]	75	76
Turbine inlet mass flow [kpph]	2,939	2,933
Turbine inlet temperature [F]	2,414	2,413
Turbine exhaust mass flow [kpph]	3,409	3,402
Turbine exhaust temperature [F]	1,135	1,136
GT fuel HHV input [kBtu/hr]	1,679,598	1,675,485
GT fuel LHV input [kBtu/hr]	1,513,678	1,509,972
Exhaust gas molecular weight	28.28	28.27
Exhaust gas N2+Ar mole percentage [%]	74.56	74.48
Exhaust gas O2 mole percentage [%]	12.49	12.48
Exhaust gas CO2 mole percentage [%]	3.67	3.66
Exhaust gas H2O mole percentage [%]	9.29	9.38
GT fuel flow [kpph]	70.35	70.17
Combustor steam injection [kpph]	0.00	0.00
Combustor water injection [kpph]	0.00	0.00
Inlet filter pressure loss [inch H2O]	4.00	4.10
Total exhaust pressure loss [inch H2O]	10.40	10.75
Fogging water mass flow [kpph]	16.11	15.49
Number of chillers in plant	0	0

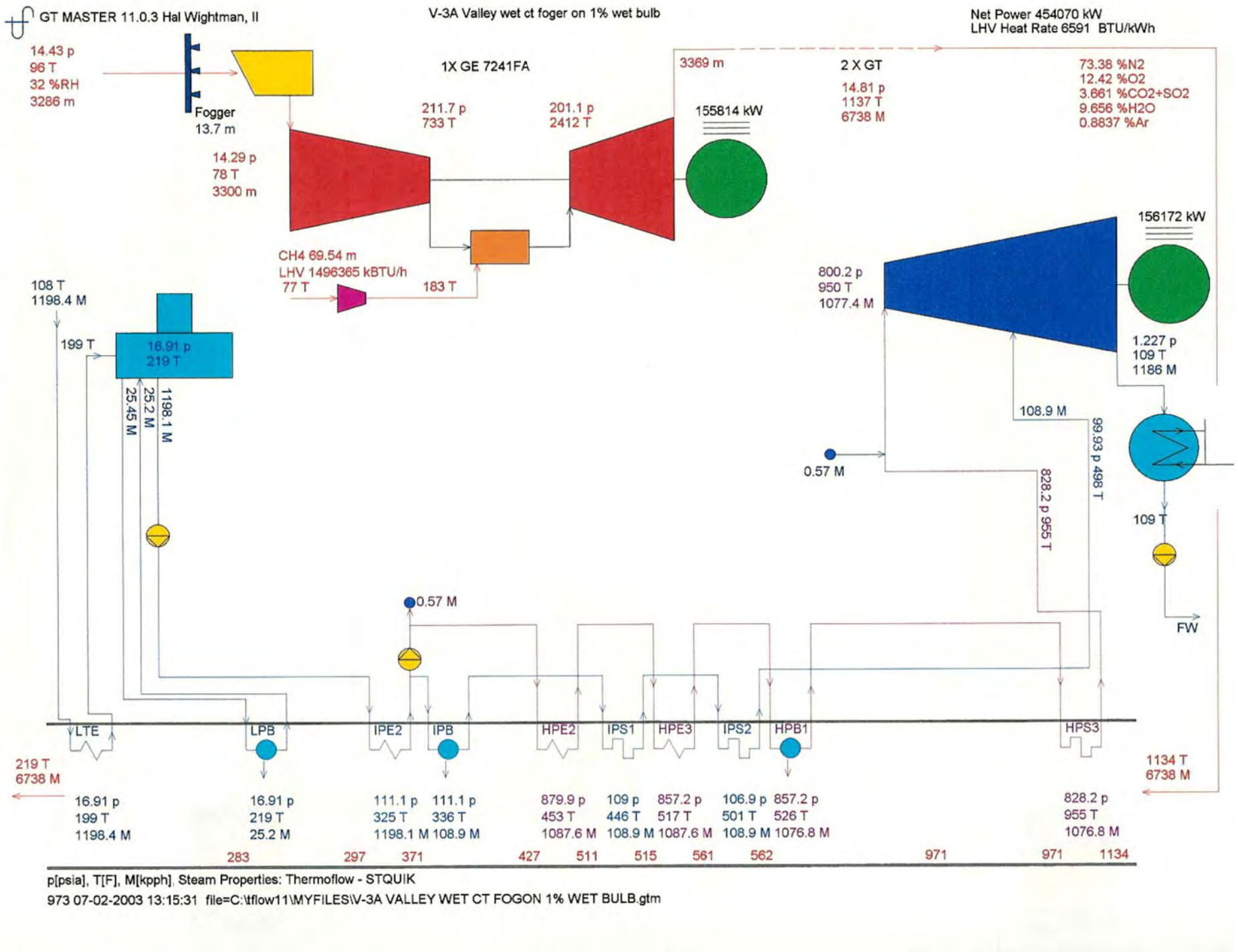
Desert Site---Design Performance---Gas Turbine Summaries
Table B.1-2b

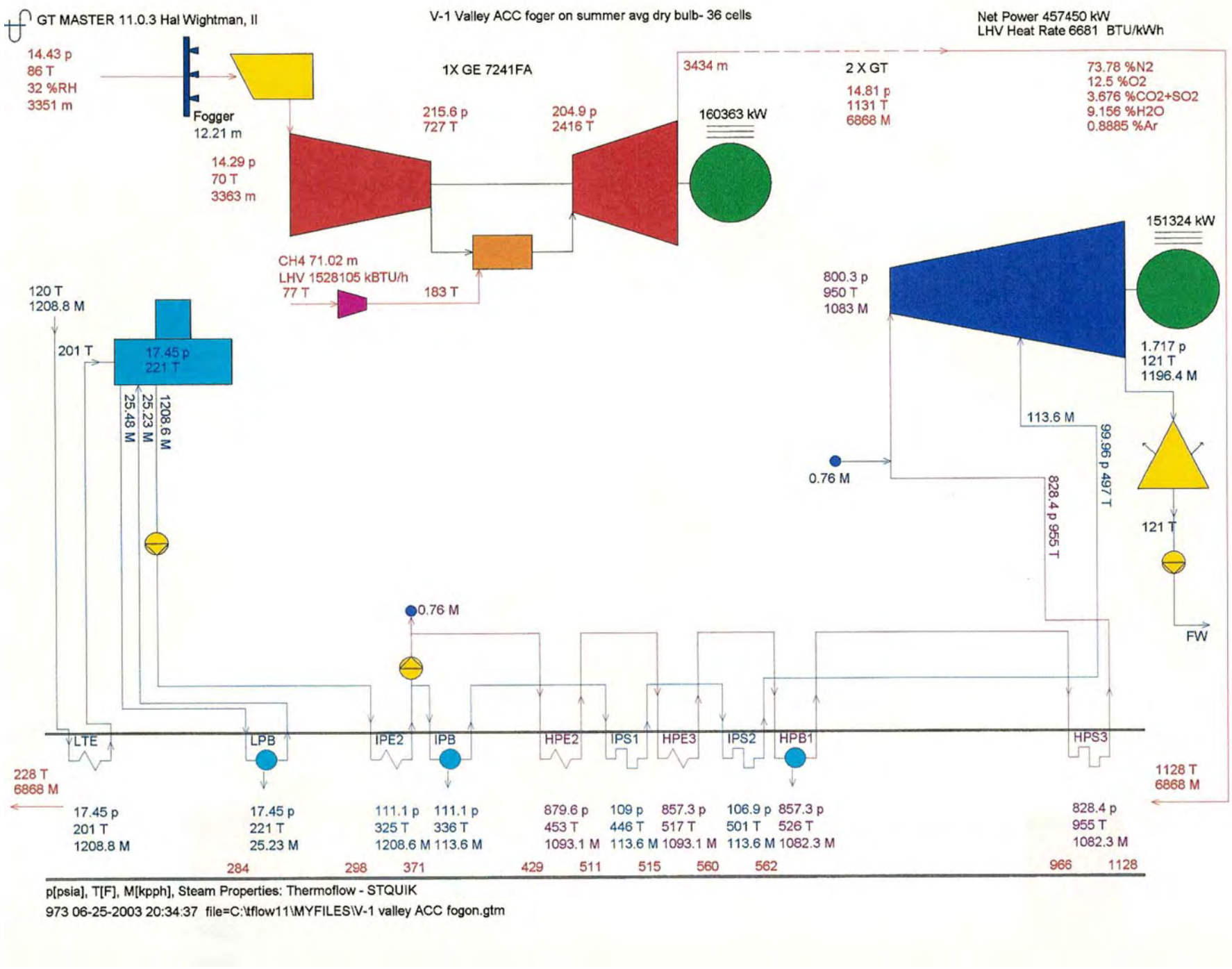
Desert Site---Design Performance
Steam Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	400	400
Ambient pressure [psia]	14.49	14.49
Summer Average/Coincident Wet Bulb [F]	96/68	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	78/96
Ambient relative humidity [%]	23	45
Gas temperature reaching HRSG [F]	1,132	1,133
Stack temperature [F]	241	217
Stack mass flow per HRSG [kpph]	3,409	3,402
Plant total ST gross output [kW]	142,847	157,066
Steam cycle gross eff [%]	25.80	28.39
Net process heat output [kBtu/hr]	0	0.00
HRSG eff [%]	85.75	88.03
Plant duct burner fuel flow [kpph]	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0
HPT pressure before stop valve [psia]	800.2	803.2
HPT temperature before stop valve [F]	950	946.2
Plant HPT mass flow before stop valve [kpph]	1082.8	1,084.6
HP superheater steam pressure [psia]	828.3	831.4
HP superheater steam temperature [F]	954.6	949.6
HP superheater steam mass flow per HRSG [kpph	541.1	542.3
HPB pinch temperature difference [F]	36.2	36.7
IP superheater steam pressure [psia]	106.9	107.5
IP superheater steam temperature [F]	501.2	500.8
IP superheater steam mass flow per HRSG [kpph]	55.7	54.3
IPB pinch temperature difference [F]	35.9	36.3
LPB steam production rate per HRSG [kpph]	12.6	13.0
LPB pinch temperature difference [F]	63.1	64.7
Deaerator pressure [psia]	17.4	16.2
Deaerator temperature [F]	220.7	217.0
Condenser pressure [psia]	2.95	1.05
Condenser saturation temp [F]	140.8	103.4
Plant LPT exhaust mass flow [kpph]	1193.9	1,193.0
Condenser coolant supply temp [F]	96.0	82.3
Condenser coolant discharge temp [F]	126.3	99.5
Condenser coolant mass flow [kpph]	152,338	64,903
Stack gas molecular weight	28.3	28.3
Stack gas N2+Ar mole percentage [%]	74.6	74.5
Stack gas O2 mole percentage [%]	12.5	12.5
Stack gas CO2 mole percentage [%]	3.7	3.7
Stack gas H2O mole percentage [%]	9.3	9.4
Duct burner exit temperature [F]	1131.9	1,132.7
Exhaust DT across main duct burner [F]	0	0
Exhaust DT across HPB2 burner [F]	0	0

Desert Site---Design Performance---Steam Summaries
Table B.1-2c

B.2 Valley Site Design Information


GT MASTER 11.0.3 Hal Wightman, II
V-3A Valley wet ct foger on 1% wet bulb
Net Power 454070 kW
LHV Heat Rate 6591 BTU/kWh
14.43 p
96 T
32 %RH
3286 m
Fogger
13.7 m
1X GE 7241FA
211.7 p
733 T
201.1 p
2412 T
3369 m
155814 kW
2 X GT
14.81 p
1137 T
6738 M
73.38 %N2
12.42 %O2
3.661 %CO2+SO2
9.656 %H2O
0.8837 %Ar
14.29 p
78 T
3300 m
CH4 69.54 m
LHV 1496365 kBTU/h
77 T
183 T
156172 kW
800.2 p
950 T
1077.4 M
1.227 p
109 T
1186 M
108 T
1198.4 M
199 T
16.91 p
219 T
25.45 M
25.2 M
1198.1 M
108.9 M
99.93 p 498 T
0.57 M
828.2 p 955 T
109 T
FW
0.57 M
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
219 T
6738 M
1134 T
6738 M
16.91 p
199 T
1198.4 M
16.91 p
219 T
25.2 M
111.1 p
325 T
1198.1 M
111.1 p
336 T
108.9 M
879.9 p
453 T
1087.6 M
109 p
446 T
108.9 M
857.2 p
517 T
1087.6 M
106.9 p
501 T
108.9 M
857.2 p
526 T
1076.8 M
828.2 p
955 T
1076.8 M
283
297
371
427
511
515
561
562
971
971
1134
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 07-02-2003 13:15:31 file=C:\tflow11\MYFILES\V-3A VALLEY WET CT FOGON 1% WET BULB.gtm


GT MASTER 11.0.3 Hal Wightman, II
V-1 Valley ACC foger on summer avg dry bulb- 36 cells
Net Power 457450 kW
LHV Heat Rate 6681 BTU/kWh
14.43 p
86 T
32 %RH
3351 m
Fogger
12.21 m
1X GE 7241FA
215.6 p
727 T
204.9 p
2416 T
3434 m
160363 kW
2 X GT
14.81 p
1131 T
6868 M
73.78 %N2
12.5 %O2
3.676 %CO2+SO2
9.156 %H2O
0.8885 %Ar
14.29 p
70 T
3363 m
CH4 71.02 m
LHV 1528105 kBTU/h
77 T
183 T
151324 kW
800.3 p
950 T
1083 M
120 T
1208.8 M
201 T
17.45 p
221 T
25.48 M
25.23 M
1208.6 M
1.717 p
121 T
1196.4 M
113.6 M
99.96 p 497 T
0.76 M
828.4 p 955 T
121 T
FW
0.76 M
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
228 T
6868 M
1128 T
6868 M
17.45 p
201 T
1208.8 M
17.45 p
221 T
25.23 M
111.1 p
325 T
1208.6 M
111.1 p
336 T
113.6 M
879.6 p
453 T
1093.1 M
109 p
446 T
113.6 M
857.3 p
517 T
1093.1 M
106.9 p
501 T
113.6 M
857.3 p
526 T
1082.3 M
828.4 p
955 T
1082.3 M
284
298
371
429
511
515
560
562
966
1128
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 06-25-2003 20:34:37 file=C:\tflow11\MYFILES\V-1 valley ACC fogon.gtm

Valley Site----Base Case Design Costs		
	DRY COOLING--ACC	WET COOLING--MECH. DRAFT TOWER
SPECIALIZED EQUIPMENT:		
Gas Turbine Package [kUSD]	$64,974	$64,974
Steam Turbine Package [kUSD]	$12,738	$14,222
Heat Recovery Boiler [kUSD]	$14,165	$14,286
Water-cooled Condenser [kUSD]	NA	$1,664
Air-cooled Condenser [kUSD]	$17,883	NA
Inlet Air Chilling / Heating System [kUSD]	NA	NA
Fuel Gas Compressor [kUSD]	$3,199	$3,137
Continuous Emissions Monitoring System [kUSD]	$451	$451
Distributed Control System [kUSD]	$1,073	$1,077
Transmission Voltage Equipment [kUSD]	$7,776	$7,828
Generating Voltage Equipment [kUSD]	$7,371	$6,372
Total Specialized Equipment	**$129,630**	**$114,010**
OTHER EQUIPMENT:		
Pumps [kUSD]	$1,438	$2,159
Tanks [kUSD]	$490	$490
Cooling Tower [kUSD]	NA	$1,681
Auxiliary Heat Exchangers [kUSD]	$317	$46
Feedwater Heater(s) [kUSD]	NA	NA
Auxiliary Boiler [kUSD]	NA	NA
Makeup Water Treatment System [kUSD]	NA	NA
Waste Water Treatment System [kUSD]	NA	NA
Bridge Crane(s) [kUSD]	$298	$310
Station/Instrument Air Compressors [kUSD]	$86	$86
Recip Engine Genset(s) [kUSD]	NA	NA
General Plant Instrumentation [kUSD]	$331	$332
Medium Voltage Equipment [kUSD]	$722	$1,062
Low Voltage Equipment [kUSD]	$854	$389
Miscellaneous Equipment [kUSD]	$227	$328
Total Other Equipment	**$4,763**	**$6,882**
CIVIL:		
Site Work [kUSD]	$2,747	$1,880
Excavation & Backfill [kUSD]	$115	$154
Concrete [kUSD]	$4,488	$4,197
Roads, Parking, Walkways [kUSD]	$229	$179
Total Civil	**$7,578**	**$6,410**
MECHANICAL:		
On-Site Transportation & Rigging [kUSD]	$1,820	$1,828
Equipment Erection & Assembly [kUSD]	$12,028	$6,426
Piping [kUSD]	$4,763	$5,757
Steel [kUSD]	$1,228	$1,241
Total Mechanical	**$19,839**	**$15,252**
ELECTRICAL ASSEMBLY & WIRING:		
Controls [kUSD]	$5,443	$3,528
Assembly & Wiring [kUSD]	$0	$0
Total Electrical Assembly & Wiring	**$5,443**	**$3,528**
BUILDINGS:		
Turbine Hall [kUSD]	$2,896	$2,998
Administration, Control Room, Machine Shop / Warehouse [kUSD]	$943	$943
Water Treatment System [kUSD]	NA	NA
Guard House [kUSD]	$13	$13
Total Buildings	**$3,852**	**$3,953**
ENGINEERING & PLANT STARTUP:		
Engineering [kUSD]	$7,546	$7,254
Start-Up [kUSD]	$1,262	$1,218
Total Enginering & Plant Startup	**$8,808**	**$8,472**
SOFT & MISCELLANEOUS COSTS:		
Contractor's Soft Costs [kUSD]	$25,188	$22,191
Owner's Soft Costs [kUSD]	$18,459	$16,263
Total Soft & Miscellaneous Costs	**$43,647**	**$38,454**
TOTAL EQUIPMENT AND LABOR	**$171,105**	**$150,034**
E'QPT AND LABOR PLUS ENG'G AND START-UP	**$179,913**	**$158,506**
TOTAL COST (INCLUDING SOFT & MISCELLANEOUS COSTS)	**$223,560**	**$196,960**

Table B.2-1

Valley Site---Design Performance Plant Summary		
	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	500	500
Ambient pressure [psia]	14.4	14.40
Summer Average/Coincident Wet Bulb [F]	86/64	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	72/96
Ambient relative humidity [%]	30	32
Plant gross output [kW]	472,591	471,189
Plant net output [kW]	457,977	457,820
Gross LHV heat rate [BTU/kWh]	6,479	6,401
Net LHV heat rate [BTU/kWh]	6,686	6,588
Plant gross elec eff [%]	52.67	53.31
Plant net elec eff [%]	51.04	51.80
PURPA eff [%]	51.04	51.80
CHP eff [%]	51.04	51.80
Power gen. eff on chargeable energy [%]	51.04	51.80
Canadian Class 43 heat rate [BTU/kWh]	7,189	7,102
Plant total fuel HHV input [kBtu/hr]	3,397,256	3,346,539
Plant total fuel LHV input [kBtu/hr]	3,061,657	3,015,949
Fuel compressor [kW]	3,727.29	3,671.64
Supercharging fan [kW]	0.00	0.00
Electric chiller [kW]	0.00	0.00
Miscellaneous GT aux. [kW]	696.00	696.00
Boiler feedpump [kW]	1,805.01	1,803.60
Circulating water pump [kW]	0.00	1,709.30
Air-cooled condenser fan [kW]	3,697.10	0.00
Cooling tower fan [kW]	0.00	1,020.36
Miscellaneous ST aux. [kW]	323.10	335.80
Transformer losses [kW]	2,362.98	2,355.91
All other auxiliaries [kW]	2,002.88	1,775.98
Plant total auxiliaries [kW]	12,251.24	11,012.86
GT fuel HHV/LHV ratio	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11
Plant water consumption [kpph]	37.79	1,331.13
Plant water discharge [kpph]	12.22	269.46
Plant emission - CO2 (net) [kpph]	390.3	384.5

Valley Site---Design Performance---Plant Summaries
B.2-2a

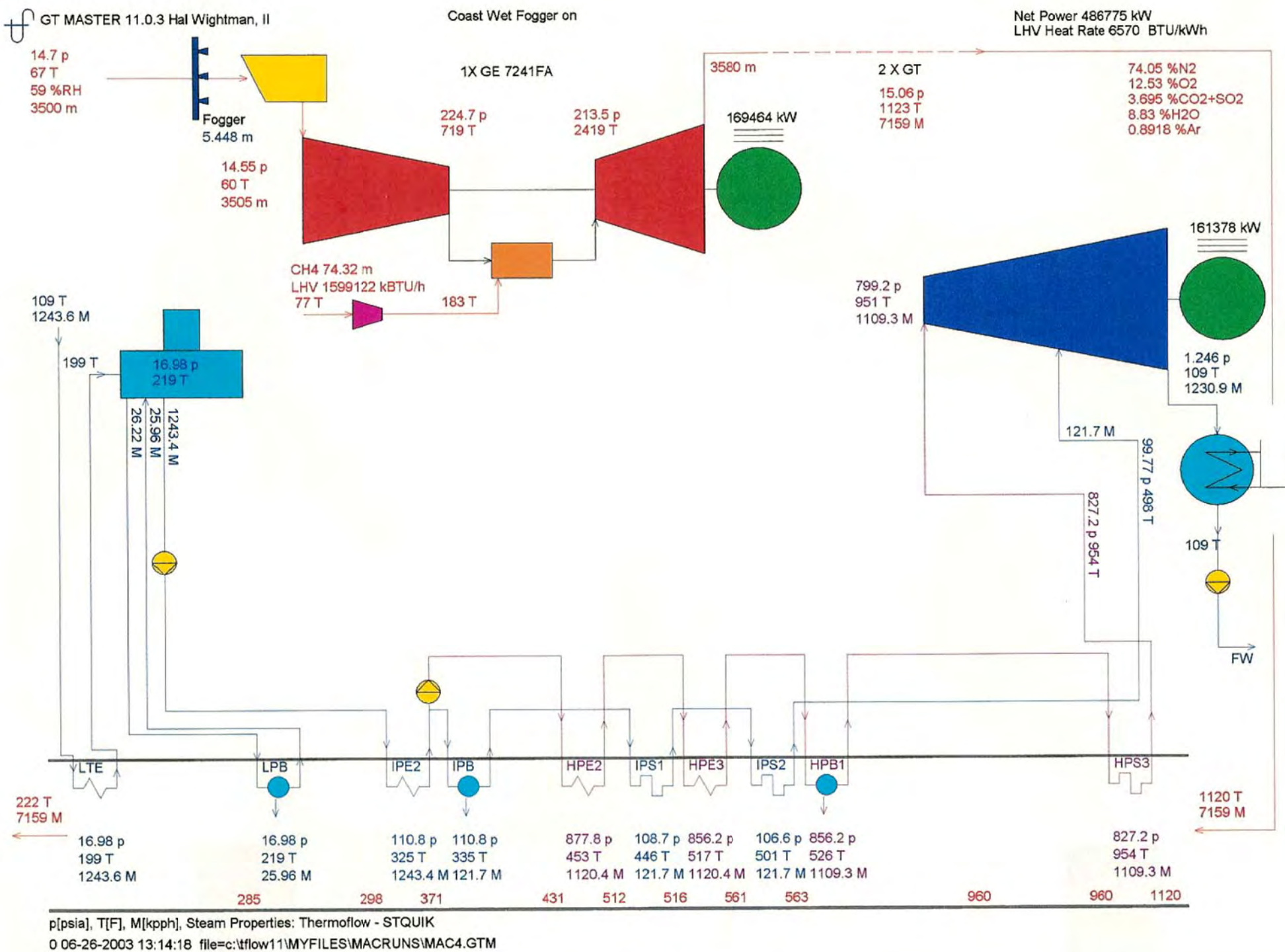
Valley Site---Design Performance Gas Turbine Summary		
	Dry Cooling--ACC	**Wet Cooling--Mech. Draft Tower**
Design Conditions		
Site Elevation [ft]	500	500
Ambient pressure [psia]	14.4	14.40
Summer Average/Coincident Wet Bulb [F]	86/64	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	72/96
Ambient relative humidity [%]	30	32
GT gross power [kW]	160,756	157,562
GT gross LHV eff [%]	35.8	35.6
GT LHV gross heat rate [BTU/kWh]	9,523	9,571
Compressor inlet mass flow [kpph]	3,369.10	3,325.58
Compressor inlet temperature [F]	69.42	74.88
Turbine inlet mass flow [kpph]	2,966.29	2,927.64
Turbine inlet temperature [F]	2,416.02	2,414.21
Turbine exhaust mass flow [kpph]	3,440.57	3,395.73
Turbine exhaust temperature [F]	1,130.84	1,135.06
GT fuel HHV input [kBtu/hr]	1,698,628	1,673,270
GT fuel LHV input [kBtu/hr]	1,530,828	1,507,975
Exhaust gas molecular weight	28.30	28.27
Exhaust gas N2+Ar mole percentage [%]	74.72	74.54
Exhaust gas O2 mole percentage [%]	12.51	12.48
Exhaust gas CO2 mole percentage [%]	3.67	3.67
Exhaust gas H2O mole percentage [%]	9.09	9.30
GT fuel flow [kpph]	71.14	70.08
Combustor steam injection [kpph]	0.00	0.00
Combustor water injection [kpph]	0.00	0.00
Inlet filter pressure loss [inch H2O]	4.01	4.06
Total exhaust pressure loss [inch H2O]	10.44	10.23
Fogging water mass flow [kpph]	12.73	16.01
Number of chillers in plant	0.00	0.00

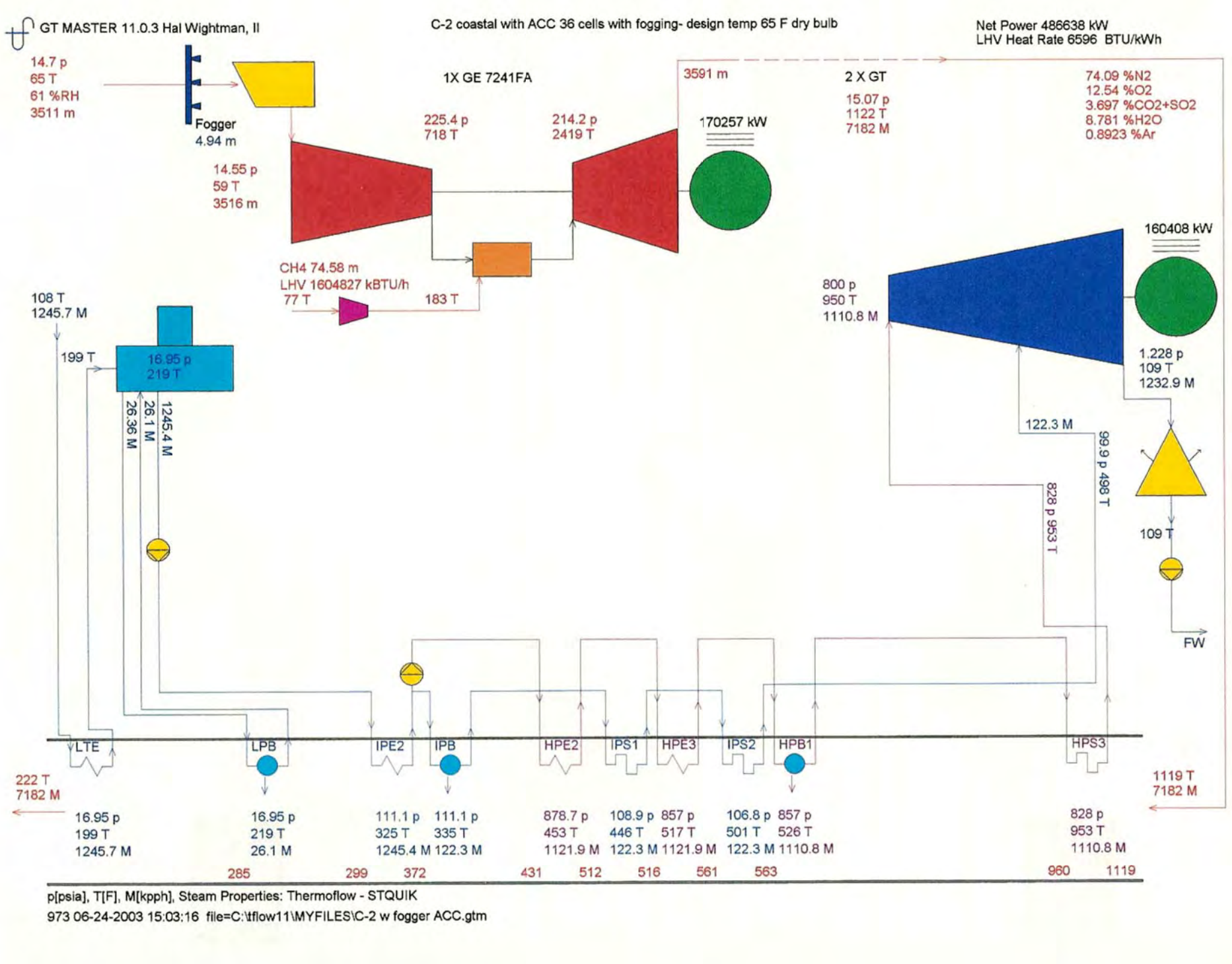
Valley Site---Design Performance---Gas Turbine Summaries
B.2-2b

Valley Site---Design Performance
Steam Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	500	500
Ambient pressure [psia]	14.4	14.40
Summer Average/Coincident Wet Bulb [F]	86/64	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	72/96
Ambient relative humidity [%]	30	32
Gas temperature reaching HRSG [F]	1,128	1,132
Stack temperature [F]	228	220
Stack mass flow per HRSG [kpph]	3,441	3,396
Plant total ST gross output [kW]	151,079	156,065
Steam cycle gross eff [%]	26.93	28.29
Net process heat output [kBtu/hr]	0.00	0.00
HRSG eff [%]	86.11	87.69
Plant duct burner fuel flow [kpph]	0.00	0.00
Plant fuel HHV to duct burner(s) [kBtu/hr]	0.00	0.00
Plant fuel LHV to duct burner(s) [kBtu/hr]	0.00	0.00
HPT pressure before stop valve [psia]	800.63	797.14
HPT temperature before stop valve [F]	949.71	950.00
Plant HPT mass flow before stop valve [kpph]	1,083.60	1,078.67
HP superheater steam pressure [psia]	828.68	825.05
HP superheater steam temperature [F]	954.47	958.03
HP superheater steam mass flow per HRSG [kpph	541.43	538.22
HPB pinch temperature difference [F]	35.92	35.51
IP superheater steam pressure [psia]	106.94	106.26
IP superheater steam temperature [F]	500.63	500.72
IP superheater steam mass flow per HRSG [kpph]	56.95	55.71
IPB pinch temperature difference [F]	35.79	35.16
LPB steam production rate per HRSG [kpph]	12.63	12.51
LPB pinch temperature difference [F]	63.45	63.28
Deaerator pressure [psia]	17.51	16.98
Deaerator temperature [F]	220.88	219.34
Condenser pressure [psia]	1.74	1.29
Condenser saturation temp [F]	120.55	110.44
Plant LPT exhaust mass flow [kpph]	1,197.28	1,189.87
Condenser coolant supply temp [F]	86.00	80.99
Condenser coolant discharge temp [F]	109.16	104.84
Condenser coolant mass flow [kpph]	199,448	46,401
Stack gas molecular weight	28.30	28.27
Stack gas N2+Ar mole percentage [%]	74.72	74.54
Stack gas O2 mole percentage [%]	12.51	12.48
Stack gas CO2 mole percentage [%]	3.67	3.67
Stack gas H2O mole percentage [%]	9.09	9.30
Duct burner exit temperature [F]	1,128	1,132
Exhaust DT across main duct burner [F]	0.00	0.00
Exhaust DT across HPB2 burner [F]	0.00	0.00

B.3 Coast Site Design Information


GT MASTER 11.0.3 Hal Wightman, II
Coast Wet Fogger on
Net Power 486775 kW
LHV Heat Rate 6570 BTU/kWh
14.7 p
67 T
59 %RH
3500 m
Fogger
5.448 m
1X GE 7241FA
224.7 p
719 T
213.5 p
2419 T
169464 kW
14.55 p
60 T
3505 m
3580 m
2 X GT
15.06 p
1123 T
7159 M
74.05 %N2
12.53 %O2
3.695 %CO2+SO2
8.83 %H2O
0.8918 %Ar
CH4 74.32 m
LHV 1599122 kBTU/h
77 T
183 T
161378 kW
799.2 p
951 T
1109.3 M
109 T
1243.6 M
199 T
16.98 p
219 T
26.22 M
25.96 M
1243.4 M
1.246 p
109 T
1230.9 M
121.7 M
99.77 p 498 T
827.2 p 954 T
109 T
FW
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
222 T
7159 M
1120 T
7159 M
16.98 p
199 T
1243.6 M
16.98 p
219 T
25.96 M
110.8 p
325 T
1243.4 M
110.8 p
335 T
121.7 M
877.8 p
453 T
1120.4 M
108.7 p
446 T
121.7 M
856.2 p
517 T
1120.4 M
106.6 p
501 T
121.7 M
856.2 p
526 T
1109.3 M
827.2 p
954 T
1109.3 M
285
298
371
431
512
516
561
563
960
960
1120
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
0 06-26-2003 13:14:18 file=c:\tflow11\MYFILES\MACRUNS\MAC4.GTM


GT MASTER 11.0.3 Hal Wightman, II
C-2 coastal with ACC 36 cells with fogging- design temp 65 F dry bulb
Net Power 486638 kW
LHV Heat Rate 6596 BTU/kWh
14.7 p
65 T
61 %RH
3511 m
Fogger
4.94 m
1X GE 7241FA
14.55 p
59 T
3516 m
225.4 p
718 T
214.2 p
2419 T
3591 m
170257 kW
2 X GT
15.07 p
1122 T
7182 M
74.09 %N2
12.54 %O2
3.697 %CO2+SO2
8.781 %H2O
0.8923 %Ar
CH4 74.58 m
LHV 1604827 kBTU/h
77 T
183 T
160408 kW
800 p
950 T
1110.8 M
1.228 p
109 T
1232.9 M
108 T
1245.7 M
199 T
16.95 p
219 T
26.36 M
26.1 M
1245.4 M
122.3 M
99.9 p 498 T
828 p 953 T
109 T
FW
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
222 T
7182 M
16.95 p
199 T
1245.7 M
16.95 p
219 T
26.1 M
111.1 p
325 T
1245.4 M
111.1 p
335 T
122.3 M
878.7 p
453 T
1121.9 M
108.9 p
446 T
122.3 M
857 p
517 T
1121.9 M
106.8 p
501 T
122.3 M
857 p
526 T
1110.8 M
828 p
953 T
1110.8 M
1119 T
7182 M
285
299
372
431
512
516
561
563
960
1119
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 06-24-2003 15:03:16 file=C:\tflow11\MYFILES\C-2 w fogger ACC.gtm

Coast Site----Base Case Design Costs		
	DRY COOLING--ACC	WET COOLING--MECH. DRAFT TOWER
SPECIALIZED EQUIPMENT:		
Gas Turbine Package [kUSD]	$64,974	$64,974
Steam Turbine Package [kUSD]	$14,167	$14,545
Heat Recovery Boiler [kUSD]	$14,862	$14,862
Water-cooled Condenser [kUSD]	NA	$1,326
Air-cooled Condenser [kUSD]	$15,418	NA
Inlet Air Chilling / Heating System [kUSD]	NA	NA
Fuel Gas Compressor [kUSD]	$3,350	$3,350
Continuous Emissions Monitoring System [kUSD]	$451	$451
Distributed Control System [kUSD]	$1,080	$1,081
Transmission Voltage Equipment [kUSD]	$7,874	$7,887
Generating Voltage Equipment [kUSD]	$7,290	$6,437
Total Specialized Equipment	**$129,465**	**$114,913**
OTHER EQUIPMENT:		
Pumps [kUSD]	$1,453	$2,035
Tanks [kUSD]	$491	$491
Cooling Tower [kUSD]	NA	$1,499
Auxiliary Heat Exchangers [kUSD]	$322	$47
Feedwater Heater(s) [kUSD]	NA	NA
Auxiliary Boiler [kUSD]	NA	NA
Makeup Water Treatment System [kUSD]	NA	NA
Waste Water Treatment System [kUSD]	NA	NA
Bridge Crane(s) [kUSD]	$310	$310
Station/Instrument Air Compressors [kUSD]	$86	$86
Recip Engine Genset(s) [kUSD]	NA	NA
General Plant Instrumentation [kUSD]	$333	$333
Medium Voltage Equipment [kUSD]	$723	$812
Low Voltage Equipment [kUSD]	$789	$474
Miscellaneous Equipment [kUSD]	$225	$304
Total Other Equipment	**$4,732**	**$6,392**
CIVIL:		
Site Work [kUSD]	$2,595	$1,887
Excavation & Backfill [kUSD]	$117	$149
Concrete [kUSD]	$4,491	$4,252
Roads, Parking, Walkways [kUSD]	$224	$180
Total Civil	**$7,426**	**$6,468**
MECHANICAL:		
On-Site Transportation & Rigging [kUSD]	$1,864	$1,867
Equipment Erection & Assembly [kUSD]	$11,348	$6,500
Piping [kUSD]	$4,745	$5,591
Steel [kUSD]	$1,252	$1,255
Total Mechanical	**$19,209**	**$15,213**
ELECTRICAL ASSEMBLY & WIRING:		
Controls [kUSD]	$5,002	$3,805
Assembly & Wiring [kUSD]	$0	$0
Total Electrical Assembly & Wiring	**$5,002**	**$3,805**
BUILDINGS:		
Turbine Hall [kUSD]	$2,994	$3,016
Administration, Control Room, Machine Shop / Warehouse [kUSD]	$953	$953
Water Treatment System [kUSD]	NA	NA
Guard House [kUSD]	$13	$13
Total Buildings	**$3,960**	**$3,982**
ENGINEERING & PLANT STARTUP:		
Engineering [kUSD]	$7,617	$7,295
Start-Up [kUSD]	$1,283	$1,230
Total Engineering & Plant Startup	**$8,900**	**$8,525**
SOFT & MISCELLANEOUS COSTS:		
Contractor's Soft Costs [kUSD]	$25,017	$22,302
Owner's Soft Costs [kUSD]	$18,334	$16,344
Total Soft & Miscellaneous Costs	**$43,351**	**$38,645**
EQUIPMENT AND LABOR TOTALS	**$169,795**	**$150,772**
E'QPT AND LABOR PLUS ENG'G AND START-UP	**$178,695**	**$159,297**
TOTAL COST (INCLUDING SOFT & MISCELLANEOUS COSTS)	**$222,046**	**$197,943**

Table B.3-1

Coast Site---Design Performance

Plant Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	0	0
Ambient pressure [psia]	14.7	14.70
Summer Average/Coincident Wet Bulb [F]	65/57	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	63/74
Ambient relative humidity [%]	62	55
Plant gross output [kW]	500,576	495,476
Plant net output [kW]	486,297	481,768
Gross LHV heat rate [BTU/kWh]	6,409	6,391
Net LHV heat rate [BTU/kWh]	6,596	6,573
Plant gross elec eff [%]	53.24	53.39
Plant net elec eff [%]	51.73	51.92
PURPA eff [%]	51.73	51.92
CHP eff [%]	51.73	51.92
Power gen. eff on chargeable energy [%]	51.73	51.92
Canadian Class 43 heat rate [BTU/kWh]	7,111	7,091
Plant total fuel HHV input [kBtu/hr]	3,559,611	3,513,717
Plant total fuel LHV input [kBtu/hr]	3,207,974	3,166,613
Fuel compressor [kW]	3,906	3,855
Supercharging fan [kW]	0	0
Electric chiller [kW]	0	0
Miscellaneous GT aux. [kW]	696	696
Boiler feedpump [kW]	1,856	1,848
Circulating water pump [kW]	0	1,695
Air-cooled condenser fan [kW]	2,968	0.00
Cooling tower fan [kW]	0	1,016
Miscellaneous ST aux. [kW]	343	343
Transformer losses [kW]	2,503	2,477
All other auxiliaries [kW]	2,008	1,777
Plant total auxiliaries [kW]	11,776	11,231
GT fuel HHV/LHV ratio	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11
Plant water consumption [kpph]	22.4	1,179.9
Plant water discharge [kpph]	12.6	242.7
Plant emission - CO2 (net) [kpph]	409.04	403.74

Coast Site---Design Performance---Plant Summaries
B.3-2a

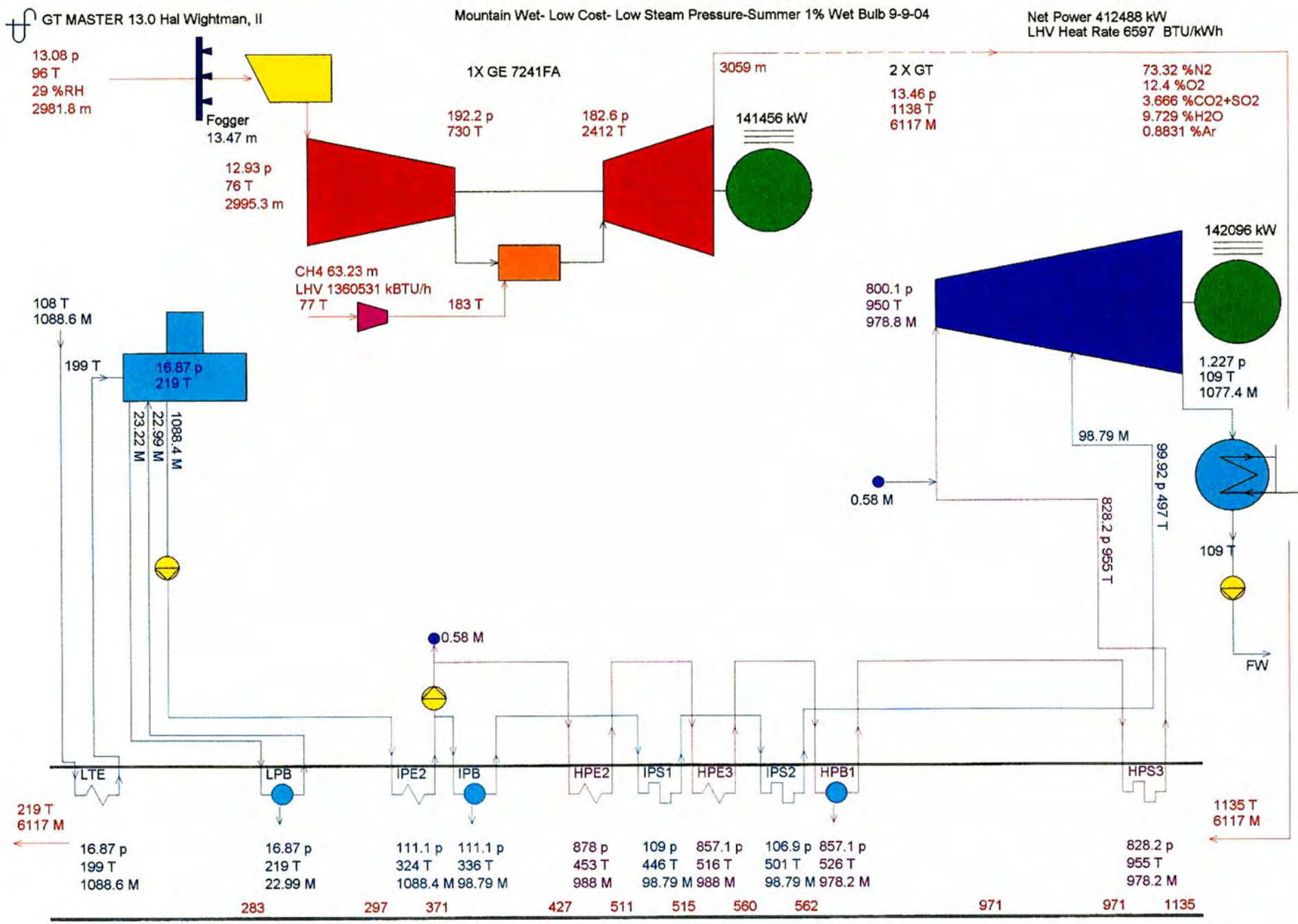
Coast Site---Design Performance Gas Turbine Summary		
	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	0	0
Ambient pressure [psia]	14.7	14.70
Summer Average/Coincident Wet Bulb [F]	65/57	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	63/74
Ambient relative humidity [%]	62	55
GT gross power [kW]	170,115	167,225
GT gross LHV eff [%]	36	36
GT LHV gross heat rate [BTU/kWh]	9,429	9,468
Compressor inlet mass flow [kpph]	3,515	3476.2
Compressor inlet temperature [F]	59	63.8
Turbine inlet mass flow [kpph]	3,094	3,060.8
Turbine inlet temperature [F]	2,419	2,418
Turbine exhaust mass flow [kpph]	3,590	3,549.8
Turbine exhaust temperature [F]	1,123	1,126.3
GT fuel HHV input [kBtu/hr]	1,779,805	1,756,858
GT fuel LHV input [kBtu/hr]	1,603,987	1,583,306
Exhaust gas molecular weight	28.33	28.318
Exhaust gas N2+Ar mole percentage [%]	74.97	74.858
Exhaust gas O2 mole percentage [%]	12.54	12.53
Exhaust gas CO2 mole percentage [%]	3.70	3.688
Exhaust gas H2O mole percentage [%]	8.79	8.924
GT fuel flow [kpph]	74.54	73.584
Combustor steam injection [kpph]	0	0
Combustor water injection [kpph]	0	0
Inlet filter pressure loss [inch H2O]	3.9976	4.024
Total exhaust pressure loss [inch H2O]	10.21	10.288
Fogging water mass flow [kpph]	4.8392	8.108
Number of chillers in plant	0	0

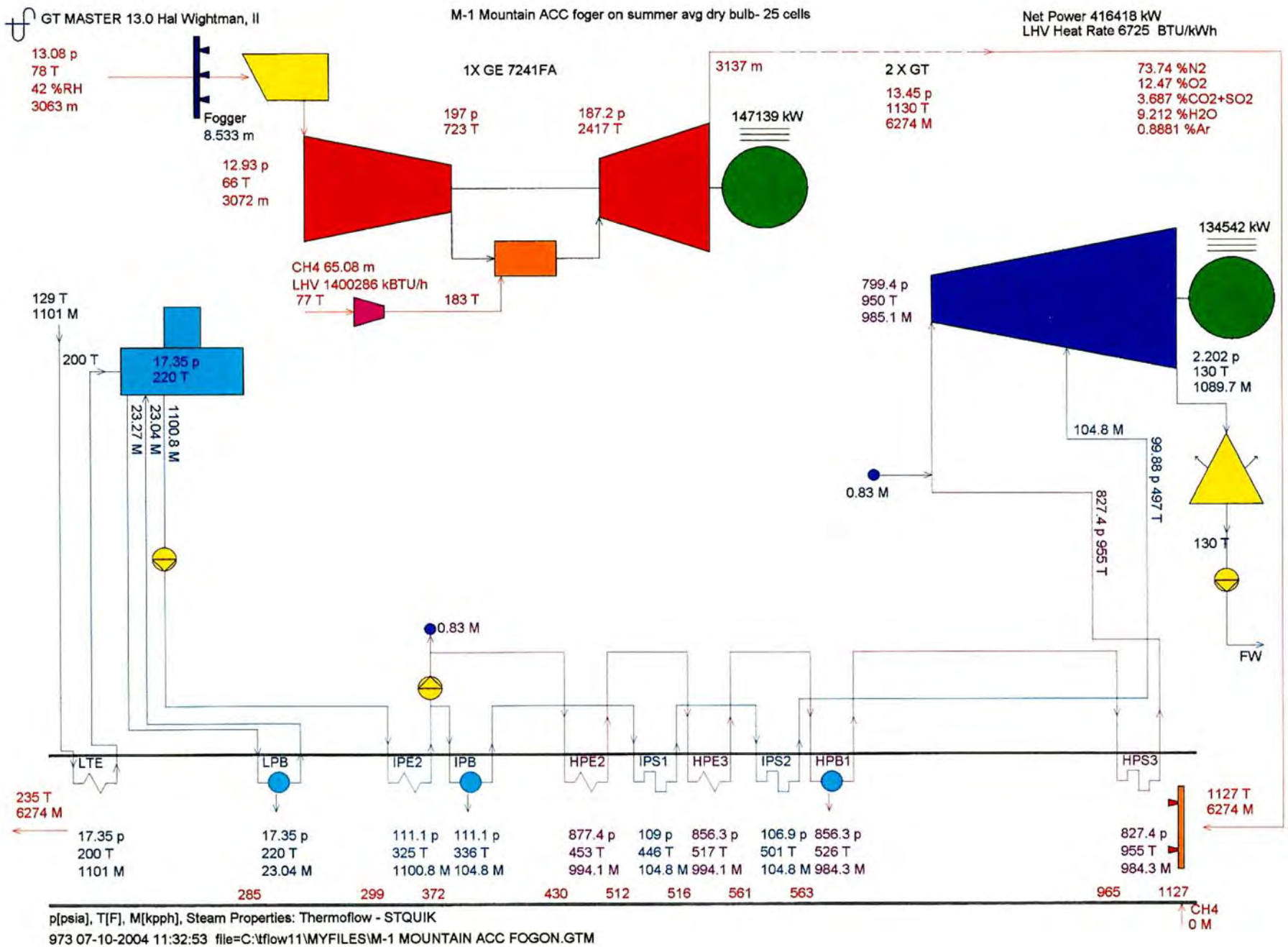
Coast Site---Design Performance---Gas Turbine Summaries
B.3-2b

Coast Site---Design Performance
Steam Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	0	0
Ambient pressure [psia]	14.7	14.70
Summer Average/Coincident Wet Bulb [F]	65/57	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	63/74
Ambient relative humidity [%]	62	55
Gas temperature reaching HRSG [F]	1,124	1,123
Stack temperature [F]	221	221
Stack mass flow per HRSG [kpph]	3,546	3,550
Plant total ST gross output [kW]	159,323	161,026
Steam cycle gross eff [%]	27.2	27.7
Net process heat output [kBtu/hr]	0	0
HRSG eff [%]	85.1	85.8
Plant duct burner fuel flow [kpph]	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0
HPT pressure before stop valve [psia]	795.4	800.6
HPT temperature before stop valve [F]	950.0	948.2
Plant HPT mass flow before stop valve [kpph]	1,104.3	1,107.8
HP superheater steam pressure [psia]	823.2	828.7
HP superheater steam temperature [F]	957.2	951.6
HP superheater steam mass flow per HRSG [kpph	551.1	553.9
HPB pinch temperature difference [F]	36.2	37.2
IP superheater steam pressure [psia]	106.0	107.0
IP superheater steam temperature [F]	500.8	501.0
IP superheater steam mass flow per HRSG [kpph]	59.7	59.4
IPB pinch temperature difference [F]	35.5	36.5
LPB steam production rate per HRSG [kpph]	12.9	13.0
LPB pinch temperature difference [F]	64.9	65.3
Deaerator pressure [psia]	16.6	16.8
Deaerator temperature [F]	218.2	218.8
Condenser pressure [psia]	1.22	1.19
Condenser saturation temp [F]	108.4	107.5
Plant LPT exhaust mass flow [kpph]	1,223.6	1,226.4
Condenser coolant supply temp [F]	65.0	76.7
Condenser coolant discharge temp [F]	93.2	101.7
Condenser coolant mass flow [kpph]	167,190	45,609
Stack gas molecular weight	28	28
Stack gas N2+Ar mole percentage [%]	75	75
Stack gas O2 mole percentage [%]	12.6	12.5
Stack gas CO2 mole percentage [%]	3.7	3.7
Stack gas H2O mole percentage [%]	8.6	8.9
Duct burner exit temperature [F]	1123.8	1123.3
Exhaust DT across main duct burner [F]	0	0
Exhaust DT across HPB2 burner [F]	0	0

B.4 Mountain Site Design Information


GT MASTER 13.0 Hal Wightman, II
Mountain Wet- Low Cost- Low Steam Pressure-Summer 1% Wet Bulb 9-9-04
Net Power 412488 kW
LHV Heat Rate 6597 BTU/kWh
13.08 p
96 T
29 %RH
2981.8 m
Fogger
13.47 m
1X GE 7241FA
192.2 p
730 T
182.6 p
2412 T
141456 kW
3059 m
2 X GT
13.46 p
1138 T
6117 M
73.32 %N2
12.4 %O2
3.666 %CO2+SO2
9.729 %H2O
0.8831 %Ar
12.93 p
76 T
2995.3 m
CH4 63.23 m
LHV 1360531 kBTU/h
77 T
183 T
142096 kW
800.1 p
950 T
978.8 M
1.227 p
109 T
1077.4 M
108 T
1088.6 M
199 T
16.87 p
219 T
23.22 M
22.99 M
1088.4 M
98.79 M
99.92 p 497 T
0.58 M
828.2 p 955 T
109 T
FW
0.58 M
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
219 T
6117 M
1135 T
6117 M
16.87 p
199 T
1088.6 M
16.87 p
219 T
22.99 M
111.1 p
324 T
1088.4 M
111.1 p
336 T
98.79 M
878 p
453 T
988 M
109 p
446 T
98.79 M
857.1 p
516 T
988 M
106.9 p
501 T
98.79 M
857.1 p
526 T
978.2 M
828.2 p
955 T
978.2 M
283
297
371
427
511
515
560
562
971
971
1135
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 09-09-2004 10:51:04 file=C:\Tflow13\MYFILES\MOUNTAIN WET 2004 FOGON LOW EFFIC LOW ST PRESSURE 9-9-04 SUMMER 1% WB.GTM


GT MASTER 13.0 Hal Wightman, II
M-1 Mountain ACC foger on summer avg dry bulb- 25 cells
Net Power 416418 kW
LHV Heat Rate 6725 BTU/kWh
13.08 p
78 T
42 %RH
3063 m
Fogger
8.533 m
1X GE 7241FA
197 p
723 T
187.2 p
2417 T
3137 m
147139 kW
2 X GT
13.45 p
1130 T
6274 M
73.74 %N2
12.47 %O2
3.687 %CO2+SO2
9.212 %H2O
0.8881 %Ar
12.93 p
66 T
3072 m
CH4 65.08 m
LHV 1400286 kBTU/h
77 T
183 T
134542 kW
799.4 p
950 T
985.1 M
2.202 p
130 T
1089.7 M
129 T
1101 M
200 T
17.35 p
220 T
23.27 M
23.04 M
1100.8 M
104.8 M
99.88 p 497 T
0.83 M
827.4 p 955 T
130 T
FW
0.83 M
LTE
LPB
IPE2
IPB
HPE2
IPS1
HPE3
IPS2
HPB1
HPS3
235 T
6274 M
17.35 p
200 T
1101 M
17.35 p
220 T
23.04 M
111.1 p
325 T
1100.8 M
111.1 p
336 T
104.8 M
877.4 p
453 T
994.1 M
109 p
446 T
104.8 M
856.3 p
517 T
994.1 M
106.9 p
501 T
104.8 M
856.3 p
526 T
984.3 M
827.4 p
955 T
984.3 M
1127 T
6274 M
285
299
372
430
512
516
561
563
965
1127
CH4
0 M
p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK
973 07-10-2004 11:32:53 file=C:\tflow11\MYFILES\M-1 MOUNTAIN ACC FOGON.GTM

Mountain Site----Base Case Design Costs		
	DRY COOLING--ACC	WET COOLING--MECH. DRAFT TOWER
SPECIALIZED EQUIPMENT:		
Gas Turbine Package [kUSD]	$64,974	$64,974
Steam Turbine Package [kUSD]	$11,680	$13,613
Heat Recovery Boiler [kUSD]	$14,657	$13,510
Water-cooled Condenser [kUSD]	NA	$1,483
Air-cooled Condenser [kUSD]	$12,100	NA
Inlet Air Chilling / Heating System [kUSD]	NA	NA
Fuel Gas Compressor [kUSD]	$2,431	$2,595
Continuous Emissions Monitoring System [kUSD]	$451	$451
Distributed Control System [kUSD]	$1,060	$1,066
Transmission Voltage Equipment [kUSD]	$7,600	$7,679
Generating Voltage Equipment [kUSD]	$6,682	$6,196
Total Specialized Equipment	**$121,635**	**$111,567**
OTHER EQUIPMENT:		
Pumps [kUSD]	$1,393	$2,031
Tanks [kUSD]	$488	$397
Cooling Tower [kUSD]	$0	$1,490
Auxiliary Heat Exchangers [kUSD]	$308	$45
Feedwater Heater(s) [kUSD]	NA	NA
Auxiliary Boiler [kUSD]	NA	NA
Makeup Water Treatment System [kUSD]	NA	NA
Waste Water Treatment System [kUSD]	NA	NA
Bridge Crane(s) [kUSD]	$288	$310
Station/Instrument Air Compressors [kUSD]	$86	$86
Recip Engine Genset(s) [kUSD]	NA	NA
General Plant Instrumentation [kUSD]	$327	$329
Medium Voltage Equipment [kUSD]	$704	$983
Low Voltage Equipment [kUSD]	$670	$371
Miscellaneous Equipment [kUSD]	$213	$302
Total Other Equipment	**$4,477**	**$6,344**
CIVIL:		
Site Work [kUSD]	$2,428	$2,172
Excavation & Backfill [kUSD]	$113	$165
Concrete [kUSD]	$4,099	$5,180
Roads, Parking, Walkways [kUSD]	$216	$196
Total Civil	**$6,856**	**$7,713**
MECHANICAL:		
On-Site Transportation & Rigging [kUSD]	$1,783	$2,113
Equipment Erection & Assembly [kUSD]	$9,931	$8,151
Piping [kUSD]	$4,862	$6,282
Steel [kUSD]	$1,186	$1,375
Total Mechanical	**$17,762**	**$17,920**
ELECTRICAL ASSEMBLY & WIRING:		
Controls [kUSD]	$735	$724
Assembly & Wiring [kUSD]	$4,624	$4,153
Total Electrical Assembly & Wiring	**$5,359**	**$4,877**
BUILDINGS:		
Turbine Hall [kUSD]	$2,869	$3,541
Administration, Control Room, Machine Shop / Warehouse [kUSD]	$927	$1,275
Water Treatment System [kUSD]	NA	NA
Guard House [kUSD]	$13	$18
Total Buildings	**$3,809**	**$4,834**
ENGINEERING & PLANT STARTUP:		
Engineering [kUSD]	$7,545	$7,149
Start-Up [kUSD]	$1,245	$1,187
Total Engineering & Startup	**$8,790**	**$8,336**
SOFT & MISCELLANEOUS COSTS:		
Contractor's Soft Costs [kUSD]	$24,174	$23,694
Owner's Soft Costs [kUSD]	$17,356	$16,676
Total Soft & Miscellaneoous Costs	**$41,530**	**$40,370**
EQUIPMENT AND LABOR TOTALS	**$159,898**	**$153,254**
E'QPT AND LABOR PLUS ENG'G AND START-UP	**$168,688**	**$161,590**
TOTAL COST (INCLUDING SOFT & MISCELLANEOUS COSTS)	**$210,218**	**$201,960**

Table B.4-1

Mountain Site---Design Performance

Plant Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	3,200	3,200
Ambient pressure [psia]	13.08	13.08
Summer Average/Coincident Wet Bulb [F]	78/62	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	70/96
Ambient relative humidity [%]	42	29
Plant gross output [kW]	428,508	424,896
Plant net output [kW]	416,119	412,378
Gross LHV heat rate [BTU/kWh]	6,528	6,403
Net LHV heat rate [BTU/kWh]	6,722	6,597
Plant gross elec eff [%]	52.27	53.30
Plant net elec eff [%]	50.76	51.73
PURPA eff [%]	50.76	51.73
CHP eff [%]	50.76	51.73
Power gen. eff on chargeable energy [%]	50.76	51.73
Canadian Class 43 heat rate [BTU/kWh]	7,244	7,104
Plant total fuel HHV input [kBtu/hr]	3,103,961	3,018,644
Plant total fuel LHV input [kBtu/hr]	2,797,335	2,720,446
Fuel compressor [kW]	3,406	3,312
Supercharging fan [kW]	0	0
Electric chiller [kW]	0	0
Miscellaneous GT aux. [kW]	696	696
Boiler feedpump [kW]	1,640	1,634
Circulating water pump [kW]		1,723
Air-cooled condenser fan [kW]	2,314	0
Cooling tower fan [kW]	0	1,024
Miscellaneous ST aux. [kW]	288	304
Transformer losses [kW]	2,143	2,125
All other auxiliaries [kW]	1,903	1,702
Plant total auxiliaries [kW]	10,246	10,394
GT fuel HHV/LHV ratio	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11
Plant water consumption [kpph]	26.18	1,210.4
Plant water discharge [kpph]	11.12	245.5
Plant emission - CO2 (net) [kpph]	356.7	346.8

Mountain Site---Design Performance---Plant Summaries
B.4-2a

Mountain Site---Design Performance Gas Turbine Summary		
	Dry Cooling--ACC	**Wet Cooling--Mech. Draft Tower**
Design Conditions		
Site Elevation [ft]	3,200	3,200
Ambient pressure [psia]	13.08	13.08
Summer Average/Coincident Wet Bulb [F]	78/62	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	70/96
Ambient relative humidity [%]	42	29
GT gross power [kW]	146,894	141,412
GT gross LHV eff [%]	35.84	35.47
GT LHV gross heat rate [BTU/kWh]	9,522	9,619
Compressor inlet mass flow [kpph]	3,067	2,995
Compressor inlet temperature [F]	66	76.42
Turbine inlet mass flow [kpph]	2,701	2,636.5
Turbine inlet temperature [F]	2,416	2,411.9
Turbine exhaust mass flow [kpph]	3,132	3,058
Turbine exhaust temperature [F]	1,130	1,137.8
GT fuel HHV input [kBtu/hr]	1,551,980	1,509,322
GT fuel LHV input [kBtu/hr]	1,398,668	1,360,223
Exhaust gas molecular weight	28.28	28.23
Exhaust gas N2+Ar mole percentage [%]	74.56	74.2
Exhaust gas O2 mole percentage [%]	12.45	12.4
Exhaust gas CO2 mole percentage [%]	3.69	3.67
Exhaust gas H2O mole percentage [%]	9.30	9.74
GT fuel flow [kpph]	65.00	63.21
Combustor steam injection [kpph]	0	0
Combustor water injection [kpph]	0	0
Inlet filter pressure loss [inch H2O]	3.981	3.999
Total exhaust pressure loss [inch H2O]	10.33	10.55
Fogging water mass flow [kpph]	7.481	13.4
Number of chillers in plant	0	0

Mountain Site---Design Performance—Gas Turbine Summaries
B.4-2b

Mountain Site---Design Performance
Steam Summary

	Dry Cooling--ACC	Wet Cooling--Mech. Draft Tower
Design Conditions		
Site Elevation [ft]	3,200	3,200
Ambient pressure [psia]	13.08	13.08
Summer Average/Coincident Wet Bulb [F]	78/62	(--)
1% Wet Bulb/Coincident Dry Bulb [F]	(--)	70/96
Ambient relative humidity [%]	42	29
Gas temperature reaching HRSG [F]	1,127	1,135
Stack temperature [F]	235	219.0
Stack mass flow per HRSG [kpph]	3,132	3,058
Plant total ST gross output [kW]	134,720	142,073
Steam cycle gross eff [%]	26	28.44
Net process heat output [kBtu/hr]	0	0
HRSG eff [%]	84.81	87.82
Plant duct burner fuel flow [kpph]	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0
HPT pressure before stop valve [psia]	799.2	800.1
HPT temperature before stop valve [F]	950.0	950.0
Plant HPT mass flow before stop valve [kpph]	985.0	978.8
HP superheater steam pressure [psia]	827.2	828.1
HP superheater steam temperature [F]	955.6	954.8
HP superheater steam mass flow per HRSG [kpph	492.0	489.1
HPB pinch temperature difference [F]	36.8	35.9
IP superheater steam pressure [psia]	106.8	106.8
IP superheater steam temperature [F]	500.6	500.6
IP superheater steam mass flow per HRSG [kpph]	52.3	49.37
IPB pinch temperature difference [F]	36.3	35.65
LPB steam production rate per HRSG [kpph]	11.6	11.48
LPB pinch temperature difference [F]	64.7	63.43
Deaerator pressure [psia]	17.1	16.86
Deaerator temperature [F]	219.8	219
Condenser pressure [psia]	2.1	1.229
Condenser saturation temp [F]	128.6	108.7
Plant LPT exhaust mass flow [kpph]	1,089.3	1,077.3
Condenser coolant supply temp [F]	77.0	83.1
Condenser coolant discharge temp [F]	112.8	104.0
Condenser coolant mass flow [kpph]	117,339	47,732
Stack gas molecular weight	28.28	28.23
Stack gas N2+Ar mole percentage [%]	74.56	74.2
Stack gas O2 mole percentage [%]	12.45	12.4
Stack gas CO2 mole percentage [%]	3.69	3.67
Stack gas H2O mole percentage [%]	9.3	9.74
Duct burner exit temperature [F]	1,127	1,135
Exhaust DT across main duct burner [F]	0	0
Exhaust DT across HPB2 burner [F]	0	0

APPENDIX C

OFF-DESIGN PERFORMANCE DATA

C.1 Desert Site Operation

Desert Comparisons; ACC; Low pressure; Low cost									
				DESIGN					
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	17.44	18.76	21.96	23	29.79	32.28	36.87	45.43	51.66
Ambient wet bulb [F]	73	71.7	70.5	67.9	67.2	58.6	50.6	46.3	38.4
Plant gross output [kW]	444,464	448,912	453,672	459,167	463,078	475,735	485,392	490,852	499,710
Plant net output [kW]	430,951	435,360	440,083	445,522	449,406	461,895	472,376	478,571	487,799
Gross LHV heat rate [BTU/kWh]	6,676	6,649	6,618	6,593	6,575	6,571	6,586	6,592	6,603
Net LHV heat rate [BTU/kWh]	6,886	6,856	6,822	6,795	6,775	6,768	6,768	6,762	6,765
Plant gross elec eff [%]	51.11	51.32	51.56	51.76	51.9	51.93	51.81	51.76	51.67
Plant net elec eff [%]	49.56	49.77	50.02	50.22	50.37	50.42	50.42	50.47	50.44
PURPA eff [%]	49.56	49.77	50.02	50.22	50.37	50.42	50.42	50.47	50.44
CHP eff [%]	49.56	49.77	50.02	50.22	50.37	50.42	50.42	50.47	50.44
Power gen. eff on chargeable energy [%]	49.56	49.77	50.02	50.22	50.37	50.42	50.42	50.47	50.44
Canadian Class 43 heat rate [BTU/kWh]	7408	7378	7343	7316	7296	7291	7308	7315	7327
Plant total fuel HHV input [kBtu/hr]	3,292,687	3,311,848	3,331,328	3,359,195	3,378,471	3,468,696	3,547,408	3,590,611	3,661,531
Plant total fuel LHV input [kBtu/hr]	2,967,417	2,984,686	3,002,241	3,027,356	3,044,727	3,126,039	3,196,976	3,235,911	3,299,825
Fuel compressor [kW]	3,613	3,634	3,655	3,686	3,707	3,806	3,892	3,940	4,017
Supercharging fan [kW]	0	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1,792.6	1,793.1	1,793.4	1,794.4	1,794.6	1,803.0	1,812.1	1,816.5	1,823.4
Air-cooled condenser fan [kW]	2,901.7	2,900.7	2,898.5	2,898.7	2,895.7	2,899.7	1,938.4	1,132.1	636.9
Cooling tower fan [kW]	0	0	0	0	0	0	0	0	0
Miscellaneous ST aux. [kW]	304.9	304.9	304.9	304.9	304.9	304.9	304.9	304.9	304.9
Transformer losses [kW]	2,222.3	2,244.6	2,268.4	2,295.8	2,315.4	2,378.7	2,427.0	2,454.3	2,498.5
All other auxiliaries [kW]	1,982.1	1,978.9	1,971.9	1,969.2	1,958.0	1,952.4	1,944.9	1,937.3	1,933.1
Plant total auxiliaries [kW]	11,290	11,307	11,320	11,349	11,356	11,462	10,588	9,826	9,412
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	52.79	50.56	46.72	44.52	39.09	34.27	29.31	25.09	21.62
Plant water discharge [kpph]	12.08	12.11	12.14	12.19	12.22	12.38	12.52	12.59	12.7
Plant emission - CO2 (net) [kpph]	378.3	380.5	382.8	386	388.2	398.6	407.6	412.6	420.7

Desert Site---Dry Cooling—Off-Design Plant Summary
Table C.1-1a

Desert Comparisons; ACC; Low pressure; Low cost									
				DESIGN					
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	17.44	18.76	21.96	23	29.79	32.28	36.87	45.43	51.66
Ambient wet bulb [F]	73	71.7	70.5	67.9	67.2	58.6	50.6	46.3	38.4
GT gross power [kW]	153,916	155,171	156,390	158,160	159,351	165,068	169,843	172,350	176,462
GT gross LHV eff [%]	35.4	35.48	35.55	35.65	35.72	36.04	36.26	36.35	36.5
GT LHV gross heat rate [BTU/kWh]	9,640	9,617	9,599	9,571	9,554	9,469	9,412	9,388	9,350
Compressor inlet mass flow [kpph]	3,281	3,297	3,314	3,339	3,354	3,434	3,503	3,541	3,604
Compressor inlet temperature [F]	81.84	79.99	77.9	74.84	72.83	63.08	54.05	48.84	40.15
Turbine inlet mass flow [kpph]	2,888.1	2,902.9	2,917.3	2,939.3	2,952.8	3,023.0	3,085.0	3,118.0	3,174.0
Turbine inlet temperature [F]	2,411.4	2,412.2	2,412.9	2,414.1	2,414.5	2,417.8	2,419.8	2,420.5	2,420.7
Turbine exhaust mass flow [kpph]	3,350	3,367	3,383	3,409	3,425	3,507	3,578	3,616	3,681
Turbine exhaust temperature [F]	1,140.5	1,138.9	1,137.3	1,134.9	1,133.4	1,125.8	1,119.1	1,115.5	1,108.9
GT fuel HHV input [kBtu/hr]	1,646,343	1,655,924	1,665,664	1,679,598	1,689,236	1,734,348	1,773,704	1,795,306	1,830,765
GT fuel LHV input [kBtu/hr]	1,483,709	1,492,343	1,501,121	1,513,678	1,522,364	1,563,020	1,598,488	1,617,956	1,649,913
Exhaust gas molecular weight	28.24	28.25	28.26	28.28	28.28	28.33	28.37	28.39	28.41
Exhaust gas N2+Ar mole percentage [%]	74.29	74.36	74.41	74.56	74.56	74.97	75.25	75.36	75.55
Exhaust gas O2 mole percentage [%]	12.45	12.46	12.46	12.49	12.48	12.56	12.6	12.62	12.65
Exhaust gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.67	3.69	3.7	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.61	9.52	9.46	9.29	9.28	8.78	8.44	8.31	8.08
GT fuel flow [kpph]	68.95	69.35	69.76	70.35	70.75	72.64	74.29	75.19	76.68
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.06	4.046	4.016	4	3.957	3.922	3.875	3.833	3.789
Total exhaust pressure loss [inch H2O]	10.13	10.21	10.28	10.4	10.46	10.86	11.21	11.4	11.73
Fogging water mass flow [kpph]	20.3	19.17	17.23	16.11	13.38	10.89	8.345	6.199	4.404

Desert Site---Dry Cooling—Off-Design Gas Turbine Summary
Table C.1-1b

Desert Comparisons; ACC; Low pressure; Low cost									
				DESIGN					
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	17.44	18.76	21.96	23	29.79	32.28	36.87	45.43	51.66
Ambient wet bulb [F]	73	71.7	70.5	67.9	67.2	58.6	50.6	46.3	38.4
Gas temperature reaching HRSG [F]	1,137.5	1,135.9	1,134.3	1,131.9	1,130.4	1,122.8	1,116.1	1,112.5	1,105.9
Stack temperature [F]	247.3	245.7	243.4	241.4	238.7	235.3	234.6	235.3	236.6
Stack mass flow per HRSG [kpph]	3,350	3,367	3,383	3,409	3,425	3,507	3,578	3,616	3,681
Plant total ST gross output [kW]	136,632	138,569	140,891	142,847	144,376	145,599	145,705	146,153	146,785
Steam cycle gross eff [%]	25.22	25.42	25.66	25.8	25.86	25.43	24.88	24.63	24.25
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0	0
HRSG eff [%]	86.3	86.16	85.97	85.75	85.53	84.7	83.71	82.99	81.95
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HPT pressure before stop valve [psia]	796.0	797.2	798.5	800.2	801.6	804.8	807.7	810.7	815.0
HPT temperature before stop valve [F]	950.0	950.0	950.0	950.0	949.9	944.4	939.6	936.6	931.3
Plant HPT mass flow before stop valve [kpph]	1,076.9	1,078.6	1,080.4	1,082.8	1,084.6	1,091.6	1,097.8	1,103.3	1,111.8
HP superheater steam pressure [psia]	823.9	825.2	826.5	828.3	829.7	833.0	836.0	839.1	843.5
HP superheater steam temperature [F]	959.1	957.8	956.5	954.6	953.3	947.9	943.1	940.1	934.8
HP superheater steam mass flow per HRSG [kpph]	537.0	538.2	539.4	541.1	542.3	545.8	548.9	551.7	555.9
HPB pinch temperature difference [F]	35.6	35.8	36.0	36.2	36.4	37.1	37.8	38.1	38.6
IP superheater steam pressure [psia]	106.2	106.4	106.6	106.9	107	108	109.1	109.7	110.8
IP superheater steam temperature [F]	500.2	500.5	500.8	501.2	501.6	502	502.1	502.2	502.4
IP superheater steam mass flow per HRSG [kpph]	55.14	55.27	55.37	55.68	55.72	57.15	58.7	59.61	61.18
IPB pinch temperature difference [F]	35.55	35.63	35.7	35.87	35.91	36.68	37.49	37.97	38.79
LPB steam production rate per HRSG [kpph]	11.73	11.95	12.25	12.57	12.91	13.48	13.85	14.06	14.42
LPB pinch temperature difference [F]	58.97	60.04	61.57	63.11	64.86	67.2	68.42	69.13	70.36
Deaerator pressure [psia]	20.16	19.37	18.33	17.42	16.3	15.47	15.47	15.47	15.47
Deaerator temperature [F]	228.4	226.3	223.3	220.7	217.3	214.6	214.6	214.6	214.6
Condenser pressure [psia]	4.10	3.75	3.32	2.95	2.54	1.80	1.47	1.47	1.47
Condenser pressure [in Hga]	8.34	7.64	6.76	6.00	5.18	3.67	3.00	3.00	3.00
Condenser saturation temp [F]	153.9	150.4	145.5	140.8	135.1	122.3	115.1	115.1	115.1
Plant LPT exhaust mass flow [kpph]	1,187.0	1,189.0	1,190.9	1,193.9	1,195.9	1,205.7	1,215.0	1,222.3	1,233.9
Condenser coolant supply temp [F]	109.0	105.5	100.7	96.0	90.3	77.0	64.5	56.5	45.5
Condenser coolant discharge temp [F]	139.9	136.3	131.2	126.3	120.4	107.0	99.8	100.7	101.9
Condenser coolant mass flow [kpph]	148,768	149,713	150,983	152,338	153,850	157,919	136,333	109,629	86,714
Stack gas molecular weight	28.24	28.25	28.26	28.28	28.28	28.33	28.37	28.39	28.41
Stack gas N2+Ar mole percentage [%]	74.29	74.36	74.41	74.56	74.56	74.97	75.25	75.36	75.55
Stack gas O2 mole percentage [%]	12.45	12.46	12.46	12.49	12.48	12.56	12.6	12.62	12.65
Stack gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.67	3.69	3.7	3.71	3.72
Stack gas H2O mole percentage [%]	9.61	9.52	9.46	9.29	9.28	8.78	8.44	8.31	8.08
Duct burner exit temperature [F]	1,138	1,136	1,134	1,132	1,130	1,123	1,116	1,113	1,106
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0	0

Desert Site---Dry Cooling—Off-Design Steam Summary
Table C.1-1c

Desert Comparisons; Wet Cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient Relative Humidity [%]	17.44	18.76	21.96	29.79	32.28	36.87	45.43	51.66
Ambient Wet Bulb [F]	73	71.7	70.5	67.2	58.6	50.6	46.3	38.4
Plant gross output [kW]	463,850	466,668	469,271	475,675	487,517	497,856	503,257	512,090
Plant net output [kW]	449,636	452,413	454,975	461,281	472,925	483,087	488,394	497,065
Gross LHV heat rate [BTU/kWh]	6,394	6,393	6,394	6,398	6,409	6,418	6,427	6,441
Net LHV heat rate [BTU/kWh]	6,596	6,594	6,595	6,597	6,607	6,615	6,622	6,636
Plant gross elec eff [%]	53.37	53.38	53.36	53.34	53.24	53.17	53.09	52.97
Plant net elec eff [%]	51.73	51.75	51.74	51.72	51.65	51.59	51.53	51.42
PURPA eff [%]	51.73	51.75	51.74	51.72	51.65	51.59	51.53	51.42
CHP eff [%]	51.73	51.75	51.74	51.72	51.65	51.59	51.53	51.42
Power gen. eff on chargeable energy [%]	51.73	51.75	51.74	51.72	51.65	51.59	51.53	51.42
Canadian Class 43 heat rate [BTU/kWh]	7095	7093	7095	7099	7112	7122	7131	7147
Plant total fuel HHV input [kBtu/hr]	3,291,061	3,310,208	3,329,675	3,376,798	3,466,993	3,545,656	3,588,852	3,660,121
Plant total fuel LHV input [kBtu/hr]	2,965,952	2,983,208	3,000,752	3,043,219	3,124,505	3,195,397	3,234,326	3,298,555
Fuel compressor [kW]	3,611	3,632	3,653	3,705	3,804	3,890	3,938	4,016
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1,796.6	1,798.6	1,800.7	1,805.7	1,814.4	1,821.7	1,826.1	1,832.7
CW pump [kW]	2,346.8	2,346.8	2,348.9	2,351.1	2,355.3	2,361.7	2,363.9	2,370.3
Cooling tower fan [kW]	1,320.5	1,327.9	1,338.0	1,360.9	1,393.8	1,425.7	1,446.6	1,477.0
Miscellaneous ST aux. [kW]	333.5	333.5	333.5	333.5	333.5	333.5	333.5	333.5
Transformer losses [kW]	2,319.3	2,333.3	2,346.4	2,378.4	2,437.6	2,489.3	2,516.3	2,560.4
All other auxiliaries [kW]	1,791.1	1,787.0	1,778.9	1,763.6	1,757.6	1,750.4	1,742.7	1,738.5
Plant total auxiliaries [kW]	11,895	11,922	11,949	12,016	12,154	12,279	12,346	12,464
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	1,512.7	1,483.4	1,437.2	1,340.3	1,250.4	1,154.6	1,082.6	995.4
Plant water discharge [kpph]	304.1	298.7	290.3	272.5	255.6	237.6	224.1	207.5
Plant emission - CO2 (net) [kpph]	378.2	380.4	382.6	388.0	398.4	407.4	412.4	420.6

Desert Site---Wet Cooling—Off-Design Plant Summary
Table C.1-2a

Desert Comparisons; Wet Cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	17.44	18.76	21.96	29.79	32.28	36.87	45.43	51.66
Ambient wet bulb [F]	73	71.7	70.5	67.2	58.6	50.6	46.3	38.4
GT gross power [kW]	153,742	154,996	156,213	159,170	164,882	169,652	172,157	176,288
GT gross LHV eff [%]	35.38	35.46	35.53	35.69	36.01	36.23	36.33	36.47
GT LHV gross heat rate [BTU/kWh]	9,646	9,624	9,605	9,560	9,475	9,418	9,394	9,356
Compressor inlet mass flow [kpph]	3,280	3,296	3,313	3,353	3,433	3,502	3,540	3,603
Compressor inlet temperature [F]	81.84	79.98	77.89	72.83	63.08	54.05	48.83	40.15
Turbine inlet mass flow [kpph]	2,887	2,902	2,917	2,952	3,023	3,084	3,117	3,173
Turbine inlet temperature [F]	2,411	2,412	2,412	2,414	2,417	2,419	2,420	2,420
Turbine exhaust mass flow [kpph]	3,349	3,366	3,383	3,424	3,506	3,577	3,615	3,680
Turbine exhaust temperature [F]	1,141	1,139	1,138	1,134	1,126	1,119	1,116	1,109
GT fuel HHV input [kBtu/hr]	1,645,530	1,655,104	1,664,837	1,688,399	1,733,496	1,772,828	1,794,426	1,830,061
GT fuel LHV input [kBtu/hr]	1,482,976	1,491,604	1,500,376	1,521,610	1,562,252	1,597,698	1,617,163	1,649,277
Exhaust gas molecular weight	28.24	28.25	28.26	28.28	28.33	28.37	28.39	28.41
Exhaust gas N2+Ar mole percentage [%]	74.29	74.36	74.41	74.56	74.97	75.25	75.36	75.55
Exhaust gas O2 mole percentage [%]	12.45	12.46	12.47	12.49	12.56	12.61	12.62	12.65
Exhaust gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.69	3.70	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.61	9.52	9.46	9.28	8.78	8.44	8.31	8.08
GT fuel flow [kpph]	68.92	69.32	69.73	70.71	72.60	74.25	75.16	76.65
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.174	4.16	4.129	4.069	4.033	3.985	3.942	3.897
Total exhaust pressure loss [inch H2O]	10.50	10.58	10.66	10.86	11.27	11.64	11.83	12.17
Fogging water mass flow [kpph]	20.310	19.170	17.230	13.380	10.900	8.343	6.198	4.403

Desert Site---Wet Cooling—Off-Design Gas Turbine Summary
Table C.1-2b

Desert Comparisons; Wet Cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.49	14.49	14.49	14.49	14.49	14.49	14.49	14.49
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient Relative Humidity [%]	17.44	18.76	21.96	29.79	32.28	36.87	45.43	51.66
Ambient Wet Bulb [F]	73	71.7	70.5	67.2	58.6	50.6	46.3	38.4
Wet Tower Approach [F]	12.03	12.45	12.8	13.87	17.21	20.61	22.45	26.09
Gas temperature reaching HRSG [F]	1,138	1,136	1,135	1,131	1,123	1,116	1,113	1,106
Stack temperature [F]	217	217	217	217	216	216	216	216
Stack mass flow per HRSG [kpph]	3,349	3,366	3,383	3,424	3,506	3,577	3,615	3,680
Plant total ST gross output [kW]	156,366	156,676	156,845	157,334	157,753	158,552	158,942	159,514
Steam cycle gross eff [%]	28.87	28.75	28.57	28.18	27.56	27.08	26.78	26.35
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	89.12	88.82	88.42	87.55	86.46	85.43	84.76	83.83
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	798.8	800.2	801.7	805.1	810.9	815.6	817.9	821.3
HPT temperature before stop valve [F]	950.2	948.9	947.6	944.4	938.2	932.9	930.1	925.2
Plant HPT mass flow before stop valve [kpph]	1,076.7	1,079.3	1,081.9	1,087.9	1,098.9	1,107.9	1,112.4	1,119.4
HP superheater steam pressure [psia]	826.9	828.3	829.8	833.3	839.3	844.2	846.6	850.1
HP superheater steam temperature [F]	953.7	952.4	951.0	947.9	941.7	936.4	933.6	928.8
HP superheater steam mass flow per HRSG [kpph]	538.4	539.6	540.9	544.0	549.4	553.9	556.2	559.7
HPB pinch temperature difference [F]	36.2	36.3	36.5	36.9	37.6	38.2	38.6	39.1
IP superheater steam pressure [psia]	106.7	106.9	107.2	107.8	109.1	110.2	110.9	111.9
IP superheater steam temperature [F]	500.5	500.6	500.7	500.9	501.3	501.6	501.7	501.8
IP superheater steam mass flow per HRSG [kpph]	53.17	53.53	53.9	54.78	56.43	57.94	58.8	60.32
IPB pinch temperature difference [F]	35.7	35.9	36.1	36.59	37.49	38.3	38.77	39.58
LPB steam production rate per HRSG [kpph]	12.71	12.81	12.91	13.16	13.69	14.11	14.33	14.69
LPB pinch temperature difference [F]	63.59	63.96	64.33	65.25	67.26	68.81	69.52	70.71
Deaerator pressure [psia]	16.41	16.35	16.29	16.13	15.71	15.47	15.47	15.47
Deaerator temperature [F]	217.6	217.4	217.2	216.7	215.4	214.6	214.6	214.6
Condenser pressure [psia]	1.128	1.102	1.078	1.016	0.882	0.776	0.725	0.642
Condenser pressure [in Hga]	2.30	2.24	2.19	2.07	1.79	1.58	1.48	1.31
Condenser saturation temp [F]	105.8	105.0	104.3	102.3	97.6	93.4	91.2	87.3
Plant LPT exhaust mass flow [kpph]	1,182.9	1,186.1	1,189.5	1,197.3	1,211.5	1,223.5	1,229.8	1,239.8
Condenser coolant supply temp [F]	85.0	84.2	83.3	81.1	75.8	71.2	68.8	64.5
Condenser coolant discharge temp [F]	102.0	101.2	100.4	98.3	93.4	89.0	86.7	82.6
Condenser coolant mass flow [kpph]	64,903	64,903	64,903	64,903	64,903	64,903	64,903	64,903
Stack gas molecular weight	28.24	28.25	28.26	28.28	28.33	28.37	28.39	28.41
Stack gas N2+Ar mole percentage [%]	74.29	74.36	74.41	74.56	74.97	75.25	75.36	75.55
Stack gas O2 mole percentage [%]	12.45	12.46	12.47	12.49	12.56	12.61	12.62	12.65
Stack gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.69	3.70	3.71	3.72
Stack gas H2O mole percentage [%]	9.61	9.52	9.46	9.28	8.78	8.44	8.31	8.08
Duct burner exit temperature [F]	1,137.6	1,136.0	1,134.5	1,130.6	1,123.0	1,116.3	1,112.6	1,106.1
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Desert Site---Wet Cooling—Off-Design Steam Summary
Table C.1-2c

C.2 Valley Site Operation

Valley Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
Plant gross output [kW]	455,344	461,268	468,492	477,100	486,797	493,143	500,211	507,785
Plant net output [kW]	440,882	446,761	453,914	462,447	472,017	479,753	487,862	495,825
Gross LHV heat rate [BTU/kWh]	6,569	6,528	6,493	6,463	6,476	6,494	6,503	6,518
Net LHV heat rate [BTU/kWh]	6,785	6,740	6,702	6,668	6,679	6,676	6,667	6,675
Plant gross elec eff [%]	51.94	52.27	52.55	52.80	52.69	52.54	52.47	52.35
Plant net elec eff [%]	50.30	50.63	50.92	51.18	51.09	51.12	51.18	51.12
PURPA eff [%]	50.30	50.63	50.92	51.18	51.09	51.12	51.18	51.12
CHP eff [%]	50.30	50.63	50.92	51.18	51.09	51.12	51.18	51.12
Power gen. eff on chargeable energy [%]	50.30	50.63	50.92	51.18	51.09	51.12	51.18	51.12
Canadian Class 43 heat rate [BTU/kWh]	7,289	7,244	7,205	7,171	7,186	7,206	7,216	7,233
Plant total fuel HHV input [kBtu/hr]	3,319,070	3,341,331	3,375,347	3,421,356	3,498,014	3,553,648	3,609,291	3,672,558
Plant total fuel LHV input [kBtu/hr]	2,991,194	3,011,256	3,041,912	3,083,376	3,152,462	3,202,599	3,252,746	3,309,763
Fuel compressor [kW]	3,642	3,666	3,703	3,754	3,838	3,899	3,960	4,029
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1,803	1,803	1,804	1,806	1,812	1,818	1,823	1,828
Air-cooled condenser fan [kW]	3,702	3,699	3,699	3,695	3,697	2,219	1,081	582
Cooling tower fan [kW]	0	0	0	0	0	0	0	0
Miscellaneous ST aux. [kW]	323	323	323	323	323	323	323	323
Transformer losses [kW]	2,277	2,306	2,343	2,386	2,434	2,466	2,501	2,539
All other auxiliaries [kW]	2,021	2,014	2,010	1,995	1,980	1,970	1,965	1,962
Plant total auxiliaries [kW]	12,185	12,201	12,236	12,268	12,346	10,925	9,848	9,421
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	48.55	44.72	41.73	33.46	25.63	19.98	16.52	14.05
Plant water discharge [kpph]	12.09	12.13	12.18	12.26	12.39	12.49	12.58	12.67
Plant emission - CO2 (net) [kpph]	381.4	383.9	387.8	393.1	401.9	408.3	414.7	422

Valley Site---Dry Cooling—Off-Design Plant Summary
Table C.2-1a

Valley Comparisons; ACC; Low pressure; Low cost								
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
GT gross power [kW]	155,836	157,232	159,386	162,263	167,075	170,317	173,552	177,173
GT gross LHV eff [%]	35.55	35.63	35.76	35.91	36.17	36.29	36.41	36.53
GT LHV gross heat rate [BTU/kWh]	9597	9576	9543	9501	9434	9402	9371	9340
Compressor inlet mass flow [kpph]	3,302	3,321	3,351	3,389	3,455	3,504	3,553	3,614
Compressor inlet temperature [F]	77.85	75.45	71.74	66.87	58.69	51.88	45.14	36.33
Turbine inlet mass flow [kpph]	2,907	2,924	2,950	2,984	3,042	3,086	3,129	3,183
Turbine inlet temperature [F]	2,413	2,414	2,415	2,417	2,419	2,420	2,421	2,419
Turbine exhaust mass flow [kpph]	3,371	3,391	3,422	3,461	3,529	3,579	3,629	3,691
Turbine exhaust temperature [F]	1,137	1,136	1,133	1,129	1,123	1,118	1,113	1,105
GT fuel HHV input [kBtu/hr]	1,659,535	1,670,665	1,687,674	1,710,678	1,749,007	1,776,824	1,804,646	1,836,279
GT fuel LHV input [kBtu/hr]	1,495,597	1,505,628	1,520,956	1,541,688	1,576,231	1,601,300	1,626,373	1,654,882
Exhaust gas molecular weight	28.26	28.27	28.29	28.31	28.34	28.36	28.39	28.41
Exhaust gas N2+Ar mole percentage [%]	74.45	74.52	74.67	74.78	75.02	75.2	75.36	75.56
Exhaust gas O2 mole percentage [%]	12.47	12.48	12.51	12.52	12.55	12.58	12.61	12.65
Exhaust gas CO2 mole percentage [%]	3.66	3.67	3.67	3.68	3.7	3.71	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.41	9.33	9.15	9.02	8.73	8.52	8.31	8.07
GT fuel flow [kpph]	69.51	69.97	70.68	71.65	73.25	74.42	75.58	76.91
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.093	4.063	4.04	3.975	3.912	3.858	3.819	3.777
Total exhaust pressure loss [inch H2O]	10.13	10.21	10.35	10.53	10.84	11.08	11.33	11.63
Fogging water mass flow [kpph]	18.17	16.24	14.72	10.55	6.56	3.69	1.92	0.64

Valley Site---Dry Cooling—Off-Design Gas Turbine Summary
Table C.2-1b

Valley Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
Gas temperature reaching HRSG [F]	1134.3	1132.5	1129.6	1125.9	1119.5	1114.7	1110	1102.4
Stack temperature [F]	235.5	233	230.4	225.7	221.4	220.6	221.6	222.8
Stack mass flow per HRSG [kpph]	3371	3391	3422	3461	3529	3579	3629	3691
Plant total ST gross output [kW]	143673	146804	149719	152575	152647	152509	153107	153439
Steam cycle gross eff [%]	26.3	26.65	26.9	26.97	26.36	25.87	25.56	25.18
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	86.79	86.59	86.32	85.88	85.15	84.35	83.51	82.5
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	795.7	797.1	799.2	802.2	805.3	807.5	811.3	813.8
HPT temperature before stop valve [F]	950	950	950	949.4	944.7	941.2	937.3	931.6
Plant HPT mass flow before stop valve [kpph]	1076.6	1078.6	1081.5	1085.9	1092.3	1096.9	1104	1110.2
HP superheater steam pressure [psia]	823.5	825	827.2	830.3	833.5	835.8	839.7	842.3
HP superheater steam temperature [F]	959.8	958.3	955.9	952.9	948.2	944.7	940.8	935.1
HP superheater steam mass flow per HRSG [kpph]	536.7	538.1	540.1	542.9	546.1	548.5	552	555.1
HPB pinch temperature difference [F]	35.28	35.47	35.74	36.12	36.76	37.22	37.63	38.06
IP superheater steam pressure [psia]	106.1	106.4	106.7	107.2	108.1	108.8	109.6	110.5
IP superheater steam temperature [F]	499.6	500	500.3	501	501.5	501.6	501.8	501.6
IP superheater steam mass flow per HRSG [kpph]	56.26	56.36	56.76	57.15	58.26	59.38	60.57	62.16
IPB pinch temperature difference [F]	35.39	35.46	35.68	35.91	36.51	37.08	37.7	38.51
LPB steam production rate per HRSG [kpph]	11.68	11.96	12.34	12.95	13.53	13.79	14.06	14.41
LPB pinch temperature difference [F]	58.77	60.2	61.99	65.06	67.55	68.42	69.34	70.52
Deaerator pressure [psia]	20.56	19.47	18.39	16.54	15.47	15.47	15.47	15.47
Deaerator temperature [F]	229.4	226.5	223.5	218	214.6	214.6	214.6	214.6
Condenser pressure [psia]	2.66	2.31	1.97	1.48	1.01	0.86	0.86	0.86
Condenser pressure [in Hga]	5.41	4.71	4.01	3.01	2.06	1.75	1.75	1.75
Condenser saturation temp [F]	136.7	131.5	125.5	115.1	102.1	96.7	96.7	96.7
Plant LPT exhaust mass flow [kpph]	1,188.9	1,191.1	1,194.8	1,200.0	1,208.6	1,215.5	1,224.9	1,234.3
Condenser coolant supply temp [F]	102.0	96.9	91.0	80.5	67.0	56.5	47.5	37.1
Condenser coolant discharge temp [F]	125.7	120.4	114.3	103.5	90.0	84.8	85.8	87.0
Condenser coolant mass flow [kpph]	193,671	195,445	197,638	201,438	206,715	170,030	126,599	97,957
Stack gas molecular weight	28.26	28.27	28.29	28.31	28.34	28.36	28.39	28.41
Stack gas N2+Ar mole percentage [%]	74.45	74.52	74.67	74.78	75.02	75.2	75.36	75.56
Stack gas O2 mole percentage [%]	12.47	12.48	12.51	12.52	12.55	12.58	12.61	12.65
Stack gas CO2 mole percentage [%]	3.66	3.67	3.67	3.68	3.7	3.71	3.71	3.72
Stack gas H2O mole percentage [%]	9.41	9.33	9.15	9.02	8.73	8.52	8.31	8.07
Duct burner exit temperature [F]	1,134.3	1,132.5	1,129.6	1,125.9	1,119.5	1,114.7	1,110.0	1,102.4
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Valley Site---Dry Cooling—Off-Design Steam Summary
Table C.2-1c

Valley Comnparisons; Wet cooling; Low pressure; Low cost								
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
Plant gross output [kW]	466,947	470,387	475,643	482,491	493,078	499,961	506,541	514,041
Plant net output [kW]	453,634	457,029	462,213	468,972	479,400	486,169	492,634	499,999
Gross LHV heat rate [BTU/kWh]	6,406	6,402	6,395	6,391	6,393	6,406	6,421	6,439
Net LHV heat rate [BTU/kWh]	6,594	6,589	6,581	6,575	6,576	6,587	6,603	6,620
Plant gross elec eff [%]	53.27	53.30	53.36	53.40	53.37	53.27	53.14	53.00
Plant net elec eff [%]	51.75	51.79	51.85	51.90	51.89	51.80	51.68	51.55
PURPA eff [%]	51.75	51.79	51.85	51.90	51.89	51.80	51.68	51.55
CHP eff [%]	51.75	51.79	51.85	51.90	51.89	51.80	51.68	51.55
Power gen. eff on chargeable energy [%]	51.75	51.79	51.85	51.90	51.89	51.80	51.68	51.55
Canadian Class 43 heat rate [BTU/kWh]	7,108	7,103	7,096	7,091	7,094	7,108	7,125	7,144
Plant total fuel HHV input [kBtu/hr]	3,319,097	3,341,351	3,375,360	3,421,360	3,498,002	3,553,632	3,609,282	3,672,567
Plant total fuel LHV input [kBtu/hr]	2,991,219	3,011,274	3,041,924	3,083,380	3,152,451	3,202,585	3,252,737	3,309,771
Fuel compressor [kW]	3,642	3,666	3,703	3,754	3,838	3,899	3,960	4,029
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1801.3	1803.2	1805.8	1809.8	1817.3	1822.7	1827.8	1832.4
CW pump [kW]	1709.3	1709.3	1709.3	1709.3	1712.3	1715.4	1718.4	1721.5
Cooling tower fan [kW]	1010.6	1018.8	1029	1046.8	1071.7	1092.2	1110.8	1133.3
Miscellaneous ST aux. [kW]	335.8	335.8	335.8	335.8	335.8	335.8	335.8	335.8
Transformer losses [kW]	2334.7	2351.9	2378.2	2412.5	2465.4	2499.8	2532.7	2570.2
All other auxiliaries [kW]	1784.3	1776.7	1772	1755.3	1741.4	1731	1725.8	1723.3
Plant total auxiliaries [kW]	10979	11006	11051	11107	11212	11292	11375	11472
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	1375.3	1336.9	1299.1	1215.8	1122.5	1049.3	991.8	925.4
Plant water discharge [kpph]	277.4	270.5	263.7	248.7	231.8	218.3	207.6	194.9
Plant emission - CO2 (net) [kpph]	381.4	383.9	387.8	393.1	401.9	408.3	414.7	422

Valley Site---Wet Cooling—Off-Design Plant Summary
Table C.2-2a

Valley Comnparisons; Wet cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
GT gross power [kW]	155,838	157,234	159,387	162,262	167,071	170,314	173,549	177,171
GT gross LHV eff [%]	35.56	35.63	35.76	35.91	36.17	36.29	36.41	36.53
GT LHV gross heat rate [BTU/kWh]	9,597	9,576	9,543	9,501	9,434	9,402	9,371	9,341
Compressor inlet mass flow [kpph]	3,302	3,321	3,351	3,389	3,455	3,504	3,553	3,614
Compressor inlet temperature [F]	77.9	75.5	71.7	66.9	58.7	51.9	45.1	36.33
Turbine inlet mass flow [kpph]	2,907.0	2,923.6	2,950.1	2,984.1	3,042.0	3,086.0	3,129.0	3183
Turbine inlet temperature [F]	2,413.3	2,414.0	2,415.4	2,416.7	2,418.7	2,419.9	2,420.8	2418.8
Turbine exhaust mass flow [kpph]	3,371.0	3,391.0	3,422.0	3,461.0	3,529.0	3,579.0	3,629.0	3691
Turbine exhaust temperature [F]	1,137.3	1,135.5	1,132.6	1,128.9	1,122.5	1,117.7	1,113.0	1105.4
GT fuel HHV input [kBtu/hr]	1,659,549	1,670,676	1,687,680	1,710,680	1,749,001	1,776,816	1,804,641	1,836,283
GT fuel LHV input [kBtu/hr]	1,495,610	1,505,637	1,520,962	1,541,690	1,576,225	1,601,292	1,626,369	1,654,885
Exhaust gas molecular weight	28.26	28.27	28.29	28.31	28.34	28.36	28.39	28.41
Exhaust gas N2+Ar mole percentage [%]	74.45	74.52	74.67	74.78	75.02	75.2	75.36	75.56
Exhaust gas O2 mole percentage [%]	12.47	12.48	12.51	12.52	12.55	12.58	12.61	12.65
Exhaust gas CO2 mole percentage [%]	3.66	3.67	3.67	3.68	3.7	3.71	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.41	9.33	9.15	9.02	8.73	8.52	8.31	8.07
GT fuel flow [kpph]	69.51	69.97	70.68	71.65	73.25	74.42	75.58	76.91
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.093	4.063	4.04	3.975	3.912	3.858	3.819	3.777
Total exhaust pressure loss [inch H2O]	10.12	10.21	10.36	10.54	10.86	11.1	11.34	11.65
Fogging water mass flow [kpph]	18.17	16.24	14.72	10.55	6.56	3.69	1.92	0.64

Valley Site---Wet Cooling—Off-Design Gas Turbine Summary
Table C.2-2b

Valley Comnparisons; Wet cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.43	14.43	14.43	14.43	14.43	14.43	14.43	14.43
Ambient temperature [F]	102	96.9	91	80.5	67	56.5	47.5	37.1
Ambient relative humidity [%]	19.64	22.93	24.87	36.3	50.72	66.33	79.46	91.98
Ambient wet bulb [F]	68.7	68.5	65.5	62.5	56.1	50.5	44.5	36.2
Gas temperature reaching HRSG [F]	1,134.3	1,132.5	1,129.6	1,125.9	1,119.5	1,114.7	1,110.0	1,102.4
Stack temperature [F]	220.2	220.2	220.0	220.1	219.9	219.7	219.5	219.3
Stack mass flow per HRSG [kpph]	3,371	3,391	3,422	3,461	3,529	3,579	3,629	3,691
Plant total ST gross output [kW]	155,272	155,920	156,869	157,967	158,936	159,334	159,443	159,698
Steam cycle gross eff [%]	28.42	28.31	28.19	27.92	27.44	27.03	26.62	26.2
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	88.2	87.76	87.27	86.39	85.26	84.41	83.68	82.81
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	795.3	796.8	799.0	802.2	807.2	810.6	814.0	815.8
HPT temperature before stop valve [F]	950.0	950.0	950.0	949.5	944.2	940.4	936.5	931.0
Plant HPT mass flow before stop valve [kpph]	1,076.1	1,078.2	1,081.3	1,085.9	1,095.1	1,101.7	1,108.1	1,113.3
HP superheater steam pressure [psia]	823.1	824.7	827.0	830.3	835.5	839.0	842.5	844.4
HP superheater steam temperature [F]	960.0	958.4	956.0	952.9	947.7	943.8	940.0	934.5
HP superheater steam mass flow per HRSG [kpph]	536.4	537.9	540.0	542.9	547.6	550.9	554.1	556.7
HPB pinch temperature difference [F]	35.3	35.5	35.8	36.1	36.7	37.1	37.6	38.0
IP superheater steam pressure [psia]	105.9	106.2	106.6	107.2	108.1	109	109.8	110.6
IP superheater steam temperature [F]	500.6	500.7	500.8	501	501.3	501.5	501.7	501.6
IP superheater steam mass flow per HRSG [kpph]	55.16	55.61	56.28	57.21	58.71	59.8	60.9	62.38
IPB pinch temperature difference [F]	34.87	35.11	35.46	35.95	36.72	37.29	37.86	38.61
LPB steam production rate per HRSG [kpph]	12.37	12.48	12.66	12.89	13.29	13.61	13.93	14.33
LPB pinch temperature difference [F]	62.77	63.18	63.86	64.68	66.18	67.39	68.58	70.07
Deaerator pressure [psia]	17.05	17	16.87	16.79	16.53	16.31	16.09	15.85
Deaerator temperature [F]	219.6	219.4	219	218.8	218	217.3	216.6	215.8
Condenser pressure [psia]	1.33	1.30	1.24	1.18	1.07	0.99	0.91	0.82
Condenser pressure [in Hga]	2.72	2.65	2.52	2.40	2.18	2.02	1.86	1.67
Condenser saturation temp [F]	111.60	110.70	109.00	107.30	104.10	101.40	98.74	95.15
Plant LPT exhaust mass flow [kpph]	1,186.2	1,189.2	1,193.6	1,200.1	1,212.4	1,221.1	1,229.7	1,237.9
Condenser coolant supply temp [F]	82.27	81.27	79.42	77.47	73.68	70.55	67.42	63.32
Condenser coolant discharge temp [F]	106.10	105.10	103.40	101.50	98.06	95.17	92.30	88.44
Condenser coolant mass flow [kpph]	46,401	46,401	46,401	46,401	46,401	46,401	46,401	46,401
Stack gas molecular weight	28.26	28.27	28.29	28.31	28.34	28.36	28.39	28.41
Stack gas N2+Ar mole percentage [%]	74.45	74.52	74.67	74.78	75.02	75.2	75.36	75.56
Stack gas O2 mole percentage [%]	12.47	12.48	12.51	12.52	12.55	12.58	12.61	12.65
Stack gas CO2 mole percentage [%]	3.66	3.67	3.67	3.68	3.7	3.71	3.71	3.72
Stack gas H2O mole percentage [%]	9.41	9.33	9.15	9.02	8.73	8.52	8.31	8.07
Duct burner exit temperature [F]	1,134.3	1,132.5	1,129.6	1,125.9	1,119.5	1,114.7	1,110.0	1,102.4
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Valley Site---Wet Cooling—Off-Design Steam Summary
Table C.2-2c

C.3 Coast Site Operation

Coast Comparisons; ACC; Low pressure; Low cost								
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	52.7	49.0	44.5
Plant gross output [kW]	455,731	481,877	493,407	498,818	503,213	506,839	510,532	514,792
Plant net output [kW]	441,795	467,752	479,197	484,559	488,905	492,483	496,115	500,304
Gross LHV heat rate [BTU/kWh]	6,726	6,509	6,434	6,412	6,404	6,407	6,422	6,436
Net LHV heat rate [BTU/kWh]	6,939	6,706	6,625	6,600	6,591	6,594	6,609	6,622
Plant gross elec eff [%]	50.73	52.42	53.04	53.22	53.28	53.26	53.13	53.02
Plant net elec eff [%]	49.18	50.89	51.51	51.7	51.77	51.75	51.63	51.53
PURPA eff [%]	49.18	50.89	51.51	51.7	51.77	51.75	51.63	51.53
CHP eff [%]	49.18	50.89	51.51	51.7	51.77	51.75	51.63	51.53
Power gen. eff on chargeable energy [%]	49.18	50.89	51.51	51.7	51.77	51.75	51.63	51.53
Canadian Class 43 heat rate [BTU/kWh]	7,464	7,223	7,139	7,114	7,106	7,110	7,126	7,141
Plant total fuel HHV input [kBtu/hr]	3,401,453	3,480,372	3,522,463	3,548,815	3,575,806	3,603,512	3,638,138	3,676,160
Plant total fuel LHV input [kBtu/hr]	3,065,439	3,136,562	3,174,496	3,198,244	3,222,569	3,247,538	3,278,743	3,313,009
Fuel compressor [kW]	3,732	3,819	3,865	3,894	3,923	3,954	3,992	4,033
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1852.1	1853.7	1854.4	1855.1	1856.6	1858.2	1861.3	1865.2
Air-cooled condenser fan [kW]	2981.4	2972.1	2968.2	2967.9	2968.7	2970.2	2973.3	2976.7
Cooling tower fan [kW]	0	0	0	0	0	0	0	0
Miscellaneous ST aux. [kW]	342.7	342.7	342.7	342.7	342.7	342.7	342.7	342.7
Transformer losses [kW]	2,278.7	2,409.4	2,467.0	2,494.1	2,516.1	2,534.2	2,552.7	2,574.0
All other auxiliaries [kW]	2,053.8	2,031.8	2,016.3	2,010.4	2,005.3	2,000.7	1,999.4	1,999.8
Plant total auxiliaries [kW]	11,658	11,715	11,742	11,766	11,792	11,821	11,864	11,914
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	50.27	35.84	27.1	23.57	20.57	17.96	16.71	16.06
Plant water discharge [kpph]	12.33	12.46	12.53	12.57	12.61	12.66	12.72	12.78
Plant emission - CO2 (net) [kpph]	390.8	399.9	404.7	407.8	410.9	414.1	418	422.4

Coast Site---Dry Cooling—Off-Design Plant Summary
Table C.3-1a

Coast Comparisons; ACC; Low pressure; Low cost								
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	52.7	49.0	44.5
GT gross power [kW]	160,254	165,188	167,809	169,464	171,092	172,710	174,735	176,952
GT gross LHV eff [%]	35.68	35.94	36.08	36.16	36.23	36.29	36.37	36.45
GT LHV gross heat rate [BTU/kWh]	9,564	9,494	9,459	9,436	9,418	9,402	9,382	9,361
Compressor inlet mass flow [kpph]	3,383	3,448	3,483	3,505	3,529	3,553	3,584	3,618
Compressor inlet temperature [F]	75.44	67.22	62.92	60.2	57.14	53.8	49.63	45.09
Turbine inlet mass flow [kpph]	2,978	3,036	3,067	3,086	3,107	3,129	3,156	3,186
Turbine inlet temperature [F]	2,415	2,418	2,418	2,419	2,420	2,420	2,421	2,422
Turbine exhaust mass flow [kpph]	3,454	3,521	3,557	3,580	3,604	3,629	3,660	3,695
Turbine exhaust temperature [F]	1,135	1,129	1,126	1,123	1,121	1,119	1,116	1,113
GT fuel HHV input [kBtu/hr]	1,700,726	1,740,186	1,761,232	1,774,407	1,787,903	1,801,756	1,819,069	1,838,080
GT fuel LHV input [kBtu/hr]	1,532,719	1,568,281	1,587,248	1,599,122	1,611,284	1,623,769	1,639,371	1,656,505
Exhaust gas molecular weight	28.29	28.31	28.32	28.33	28.34	28.35	28.37	28.39
Exhaust gas N2+Ar mole percentage [%]	74.64	74.81	74.87	74.94	75.02	75.11	75.24	75.37
Exhaust gas O2 mole percentage [%]	12.52	12.53	12.53	12.53	12.55	12.56	12.59	12.61
Exhaust gas CO2 mole percentage [%]	3.67	3.68	3.69	3.7	3.7	3.7	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.17	8.98	8.91	8.83	8.73	8.62	8.46	8.31
GT fuel flow [kpph]	71.23	72.88	73.77	74.32	74.88	75.46	76.19	76.98
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.226	4.107	4.037	4.008	3.982	3.956	3.938	3.924
Total exhaust pressure loss [inch H2O]	9.66	9.93	10.07	10.17	10.27	10.37	10.52	10.67
Fogging water mass flow [kpph]	18.92	11.64	7.235	5.448	3.926	2.6	1.944	1.587

Coast Site---Dry Cooling—Off-Design Gas Turbine Summary
Table C.3-1b

Coast Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	52.7	49.0	44.5
Gas temperature reaching HRSG [F]	1,132.2	1,125.9	1,122.6	1,120.4	1,118.2	1,115.8	1,112.9	1,109.7
Stack temperature [F]	239.3	230.1	225.2	223.0	220.9	218.9	217.6	216.7
Stack mass flow per HRSG [kpph]	3,454	3,521	3,557	3,580	3,604	3,629	3,660	3,695
Plant total ST gross output [kW]	135,224	151,501	157,789	159,891	161,029	161,419	161,062	160,887
Steam cycle gross eff [%]	24.2	26.36	27.04	27.17	27.14	26.98	26.67	26.38
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	86.25	85.6	85.22	85	84.78	84.55	84.25	83.9
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	790.2	795.1	797.7	799.2	800.8	802.4	803.5	804.6
HPT temperature before stop valve [F]	950.0	950.0	950.0	950.8	949.0	947.1	944.9	942.7
Plant HPT mass flow before stop valve [kpph]	1,097.0	1,104.0	1,107.6	1,109.4	1,112.5	1,115.6	1,118.2	1,120.8
HP superheater steam pressure [psia]	817.9	823.0	825.7	827.2	828.9	830.5	831.7	832.8
HP superheater steam temperature [F]	963.9	958.7	956.0	954.3	952.4	950.6	948.4	946.1
HP superheater steam mass flow per HRSG [kpph]	545.8	550.6	553.2	554.7	556.2	557.8	559.1	560.4
HPB pinch temperature difference [F]	35.43	36.07	36.41	36.61	36.82	37.03	37.31	37.62
IP superheater steam pressure [psia]	105.2	106	106.4	106.7	106.9	107.2	107.6	108
IP superheater steam temperature [F]	498.6	499.9	500.6	500.8	501.1	501.4	501.5	501.5
IP superheater steam mass flow per HRSG [kpph]	59.88	60.39	60.63	60.95	61.27	61.61	62.21	62.99
IPB pinch temperature difference [F]	35.44	35.75	35.91	36.08	36.25	36.43	36.73	37.11
LPB steam production rate per HRSG [kpph]	10.98	12.04	12.61	12.92	13.22	13.53	13.72	13.89
LPB pinch temperature difference [F]	55.12	60.44	63.31	64.78	66.25	67.71	68.46	69.02
Deaerator pressure [psia]	24.17	20.06	18.08	17.26	16.45	15.7	15.47	15.47
Deaerator temperature [F]	238.2	228.1	222.6	220.2	217.7	215.4	214.6	214.6
Condenser pressure [psia]	3.31	2.00	1.50	1.30	1.13	0.98	0.85	0.73
Condenser pressure [in Hga]	6.73	4.07	3.05	2.64	2.29	1.99	1.73	1.49
Condenser saturation temp [F]	145.3	126	115.7	110.7	105.8	101	96.27	91.55
Plant LPT exhaust mass flow [kpph]	1216.5	1224.6	1228.7	1231.1	1234.8	1238.6	1242.5	1246.5
Condenser coolant supply temp [F]	100	82	72	67	62	57	52	47
Condenser coolant discharge temp [F]	130.8	111.3	100.7	95.46	90.34	85.28	80.27	75.25
Condenser coolant mass flow [kpph]	156,846	161,993	164,966	166,540	168,164	169,833	171,586	173,383
Stack gas molecular weight	28.29	28.31	28.32	28.33	28.34	28.35	28.37	28.39
Stack gas N2+Ar mole percentage [%]	74.64	74.81	74.87	74.94	75.02	75.11	75.24	75.37
Stack gas O2 mole percentage [%]	12.52	12.53	12.53	12.53	12.55	12.56	12.59	12.61
Stack gas CO2 mole percentage [%]	3.67	3.68	3.69	3.7	3.7	3.7	3.71	3.72
Stack gas H2O mole percentage [%]	9.17	8.98	8.91	8.83	8.73	8.62	8.46	8.31
Duct burner exit temperature [F]	1,132.2	1,125.9	1,122.6	1,120.4	1,118.2	1,115.8	1,112.9	1,109.7
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Coast Site---Dry Cooling—Off-Design Steam Summary
Table C.3-1c

Coast Comparisons; Wet cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	50.7	49.0	44.5
Plant gross output [kW]	478,703	490,653	496,682	500,408	503,928	507,439	511,721	516,248
Plant net output [kW]	465,210	477,009	482,958	486,632	490,097	493,551	497,759	502,206
Gross LHV heat rate [BTU/kWh]	6,403	6,392	6,391	6,391	6,394	6,399	6,407	6,417
Net LHV heat rate [BTU/kWh]	6,589	6,575	6,572	6,572	6,575	6,579	6,586	6,596
Plant gross elec eff [%]	53.29	53.38	53.39	53.39	53.36	53.32	53.26	53.18
Plant net elec eff [%]	51.79	51.9	51.92	51.92	51.9	51.86	51.81	51.73
PURPA eff [%]	51.79	51.9	51.92	51.92	51.9	51.86	51.81	51.73
CHP eff [%]	51.79	51.9	51.92	51.92	51.9	51.86	51.81	51.73
Power gen. eff on chargeable energy [%]	51.79	51.9	51.92	51.92	51.9	51.86	51.81	51.73
Canadian Class 43 heat rate [BTU/kWh]	7,105	7,093	7,091	7,091	7,095	7,101	7,109	7,120
Plant total fuel HHV input [kBtu/hr]	3,401,237	3,480,137	3,522,112	3,548,550	3,575,534	3,603,212	3,637,835	3,675,863
Plant total fuel LHV input [kBtu/hr]	3,065,245	3,136,350	3,174,179	3,198,005	3,222,323	3,247,268	3,278,470	3,312,741
Fuel compressor [kW]	3,732	3,818	3,864	3,893	3,923	3,953	3,991	4,033
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696.0	696.0	696.0	696.0	696.0	696.0	696.0	696.0
Boiler feedpump [kW]	1,838.2	1,844.8	1,849.2	1,851.9	1,854.5	1,857.1	1,860.3	1,863.7
CW pump [kW]	1,695.6	1,694.1	1,695.7	1,695.7	1,697.2	1,698.7	1,700.2	1,701.7
Cooling tower fan [kW]	974.1	1,002.3	1,018.8	1,027.6	1,036.7	1,046.1	1,056.0	1,066.2
Miscellaneous ST aux. [kW]	343.2	343.2	343.2	343.2	343.2	343.2	343.2	343.2
Transformer losses [kW]	2,393.5	2,453.3	2,483.4	2,502.0	2,519.6	2,537.2	2,558.6	2,581.2
All other auxiliaries [kW]	1,820.8	1,791.7	1,773.4	1,766.7	1,761.1	1,756.5	1,755.5	1,756.0
Plant total auxiliaries [kW]	11,100	11,190	11,241	11,274	11,312	11,351	11,403	11,460
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	1385.6	1246.1	1163.4	1126	1090.7	1056.5	1028.6	1003.3
Plant water discharge [kpph]	279.4	254.5	239.8	233.1	226.6	220.4	215.1	210.2
Plant emission - CO2 (net) [kpph]	390.8	399.9	404.7	407.7	410.8	414	418	422.4

Coast Site---Wet Cooling—Off-Design Plant Summary
Table C.3-2a

Coast Comparisons; Wet cooling; Low pressure; Low cost								
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	50.7	49.0	44.5
GT gross power [kW]	160204	165134	167748	169405	171033	172649	174672	176889
GT gross LHV eff [%]	35.67	35.93	36.07	36.15	36.22	36.28	36.36	36.44
GT LHV gross heat rate [BTU/kWh]	9567	9496	9461	9439	9420	9404	9385	9364
Compressor inlet mass flow [kpph]	3383	3449	3483	3505	3529	3553	3584	3618
Compressor inlet temperature [F]	75.44	67.22	62.93	60.2	57.14	53.8	49.63	45.09
Turbine inlet mass flow [kpph]	2978.2	3036	3067	3087	3107	3129	3156	3186
Turbine inlet temperature [F]	2415	2417.2	2418	2418.6	2419.3	2419.9	2420.6	2421.3
Turbine exhaust mass flow [kpph]	3454	3521	3557	3580	3604	3629	3661	3695
Turbine exhaust temperature [F]	1135.2	1128.9	1125.6	1123.4	1121.2	1118.9	1115.9	1112.7
GT fuel HHV input [kBtu/hr]	1700619	1740068	1761056	1774275	1787767	1801606	1818917	1837931
GT fuel LHV input [kBtu/hr]	1532622	1568175	1587089	1599002	1611161	1623634	1639235	1656371
Exhaust gas molecular weight	28.29	28.31	28.32	28.33	28.34	28.35	28.37	28.39
Exhaust gas N2+Ar mole percentage [%]	74.64	74.81	74.87	74.94	75.02	75.11	75.24	75.37
Exhaust gas O2 mole percentage [%]	12.52	12.53	12.53	12.54	12.55	12.56	12.59	12.61
Exhaust gas CO2 mole percentage [%]	3.66	3.68	3.69	3.69	3.7	3.7	3.71	3.72
Exhaust gas H2O mole percentage [%]	9.17	8.98	8.91	8.83	8.73	8.62	8.46	8.31
GT fuel flow [kpph]	71.23	72.88	73.76	74.31	74.88	75.46	76.18	76.98
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.197	4.08	4.01	3.982	3.955	3.93	3.913	3.899
Total exhaust pressure loss [inch H2O]	9.874	10.16	10.32	10.42	10.53	10.64	10.79	10.95
Fogging water mass flow [kpph]	18.92	11.64	7.225	5.448	3.926	2.599	1.944	1.587

Coast Site---Wet Cooling—Off-Design Gas Turbine Summary
Table C.3-2b

Coast Comparisons; Wet cooling; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Ambient temperature [F]	100	82	72	67	62	57	52	47
Ambient relative humidity [%]	17	32.7	50	58.8	67.6	76.6	81	83.1
Ambient wet bulb [F]	67.4	62.5	60.1	58.1	55.7	50.7	49.0	44.5
Gas temperature reaching HRSG [F]	1132.2	1125.9	1122.6	1120.4	1118.2	1115.9	1112.9	1109.7
Stack temperature [F]	220.6	220.8	220.9	220.9	220.8	220.7	220.5	220.4
Stack mass flow per HRSG [kpph]	3,454	3,521	3,557	3,580	3,604	3,629	3,661	3,695
Plant total ST gross output [kW]	158,295	160,385	161,186	161,598	161,862	162,142	162,377	162,471
Steam cycle gross eff [%]	28.33	27.9	27.62	27.46	27.28	27.09	26.88	26.64
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	87.97	86.44	85.61	85.19	84.78	84.38	83.98	83.57
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	793.0	798.3	801.2	802.9	804.6	806.2	808.2	810.4
HPT temperature before stop valve [F]	950.0	950.4	947.6	945.8	944.0	942.1	939.7	937.2
Plant HPT mass flow before stop valve [kpph]	1,096.2	1,103.5	1,108.9	1,112.1	1,115.3	1,118.5	1,122.4	1,126.7
HP superheater steam pressure [psia]	820.8	826.3	829.3	831.1	832.8	834.5	836.6	838.8
HP superheater steam temperature [F]	959.1	953.8	951.1	949.3	947.5	945.6	943.2	940.7
HP superheater steam mass flow per HRSG [kpph]	546.6	551.8	554.4	556.0	557.6	559.3	561.2	563.4
HPB pinch temperature difference [F]	36.3	36.93	37.27	37.47	37.68	37.89	38.15	38.43
IP superheater steam pressure [psia]	105.6	106.5	107.1	107.4	107.7	108.1	108.5	109.1
IP superheater steam temperature [F]	500.5	500.8	501	501.1	501.2	501.3	501.4	501.6
IP superheater steam mass flow per HRSG [kpph]	57.1	58.72	59.56	60.09	60.63	61.17	61.86	62.61
IPB pinch temperature difference [F]	35.34	36.17	36.6	36.87	37.15	37.42	37.77	38.15
LPB steam production rate per HRSG [kpph]	12.49	12.87	13.07	13.2	13.34	13.5	13.7	13.92
LPB pinch temperature difference [F]	63.37	64.74	65.45	65.94	66.48	67.07	67.83	68.66
Deaerator pressure [psia]	16.96	16.85	16.78	16.7	16.6	16.48	16.33	16.17
Deaerator temperature [F]	219.3	219	218.8	218.5	218.2	217.8	217.4	216.9
Condenser pressure [psia]	1.33	1.22	1.18	1.14	1.10	1.06	1.01	0.95
Condenser pressure [in Hga]	2.70	2.49	2.39	2.33	2.25	2.16	2.05	1.94
Condenser saturation temp [F]	111.4	108.6	107.2	106.2	105	103.7	102	100.1
Plant LPT exhaust mass flow [kpph]	1,210.2	1,220.7	1,227.8	1,232.1	1,236.3	1,240.6	1,246.0	1,251.7
Condenser coolant supply temp [F]	81.18	77.96	76.38	75.2	73.82	72.27	70.23	68.04
Condenser coolant discharge temp [F]	105.9	102.9	101.4	100.4	99.09	97.66	95.78	93.77
Condenser coolant mass flow [kpph]	45,609	45,609	45,609	45,609	45,609	45,609	45,609	45,609
Stack gas molecular weight	28.29	28.31	28.32	28.33	28.34	28.35	28.37	28.39
Stack gas N2+Ar mole percentage [%]	74.64	74.81	74.87	74.94	75.02	75.11	75.24	75.37
Stack gas O2 mole percentage [%]	12.52	12.53	12.53	12.54	12.55	12.56	12.59	12.61
Stack gas CO2 mole percentage [%]	3.66	3.68	3.69	3.69	3.7	3.7	3.71	3.72
Stack gas H2O mole percentage [%]	9.17	8.98	8.91	8.83	8.73	8.62	8.46	8.31
Duct burner exit temperature [F]	1,132.2	1,125.9	1,122.6	1,120.4	1,118.2	1,115.9	1,112.9	1,109.7
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Coast Site---Wet Cooling—Off-Design Steam Summary
Table C.3-2c

C.4 Mountain Site Operations

Mountain Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.4	20.8	22.7	33.4	47.8	69.3	70.4	76.6
Ambient wet bulb [F]	74.0	72.0	70.0	68.0	63.0	58.0	51.0	41.0
Plant gross output [kW]	393,243	398,663	404,783	415,494	428,508	437,519	443,711	452,302
Plant net output [kW]	381,140	386,510	392,580	403,220	416,119	425,034	431,128	440,466
Gross LHV heat rate [BTU/kWh]	6,796	6,752	6,700	6,603	6,528	6,515	6,531	6,548
Net LHV heat rate [BTU/kWh]	7,012	6,965	6,908	6,804	6,722	6,706	6,722	6,724
Plant gross elec eff [%]	50.21	50.54	50.93	51.68	52.27	52.38	52.25	52.12
Plant net elec eff [%]	48.67	49.00	49.40	50.15	50.76	50.88	50.76	50.75
PURPA eff [%]	48.67	49.00	49.40	50.15	50.76	50.88	50.76	50.75
CHP eff [%]	48.67	49.00	49.40	50.15	50.76	50.88	50.76	50.75
Power gen. eff on chargeable energy [%]	48.67	49.00	49.40	50.15	50.76	50.88	50.76	50.75
Canadian Class 43 heat rate [BTU/kWh]	7,541	7,492	7,434	7,327	7,244	7,229	7,247	7,265
Plant total fuel HHV input [kBtu/hr]	2,965,310	2,986,935	3,009,183	3,044,198	3,103,961	3,162,838	3,215,641	3,286,126
Plant total fuel LHV input [kBtu/hr]	2,672,381	2,691,869	2,711,919	2,743,476	2,797,335	2,850,396	2,897,983	2,961,505
Fuel compressor [kW]	3,253	3,277	3,302	3,340	3,406	3,470	3,528	3,605
Supercharging fan [kW]	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1,637	1,638	1,639	1,639	1,640	1,644	1,649	1,656
Air-cooled condenser fan [kW]	2,328	2,327	2,325	2,318	2,314	2,312	2,316	1,442
Cooling tower fan [kW]	0	0	0	0	0	0	0	0
Miscellaneous ST aux. [kW]	288	288	288	288	288	288	288	288
Transformer losses [kW]	1,966	1,993	2,024	2,078	2,143	2,188	2,219	2,262
All other auxiliaries [kW]	1,935	1,934	1,931	1,916	1,903	1,888	1,889	1,888
Plant total auxiliaries [kW]	10,136	10,160	10,180	10,197	10,246	10,298	10,365	9,575
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	46.59	45.31	42.67	34.42	26.18	18.5	17.55	15.55
Plant water discharge [kpph]	10.89	10.93	10.96	11.02	11.12	11.21	11.31	11.43
Plant emission - CO2 (net) [kpph]	340.7	343.2	345.8	349.8	356.7	363.4	369.5	377.6

Mountain Site---Dry Cooling—Off-Design Plant Summary
Table C.4-1a

Mountain Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.4	20.8	22.7	33.4	47.8	69.3	70.4	76.6
Ambient wet bulb [F]	74.0	72.0	70.0	68.0	63.0	58.0	51.0	41.0
GT gross power [kW]	138,086	139,521	140,939	143,123	146,894	150,601	153,733	157,848
GT gross LHV eff [%]	35.26	35.37	35.47	35.6	35.84	36.06	36.2	36.38
GT LHV gross heat rate [BTU/kWh]	9,677	9,647	9,621	9,584	9,522	9,463	9,425	9,381
Compressor inlet mass flow [kpph]	2,947	2,967	2,987	3,016	3,067	3,118	3,167	3,230
Compressor inlet temperature [F]	83	80	78	73	66	59	52	43
Turbine inlet mass flow [kpph]	2,595	2,612	2,630	2,655	2,701	2,746	2,789	2,844
Turbine inlet temperature [F]	2,410	2,412	2,413	2,414	2,416	2,418	2,420	2,421
Turbine exhaust mass flow [kpph]	3,010	3,030	3,050	3,079	3,132	3,184	3,234	3,299
Turbine exhaust temperature [F]	1,143	1,141	1,139	1,136	1,130	1,125	1,120	1,113
GT fuel HHV input [kBtu/hr]	1,482,655	1,493,468	1,504,591	1,522,099	1,551,980	1,581,419	1,607,821	1,643,063
GT fuel LHV input [kBtu/hr]	1,336,191	1,345,935	1,355,960	1,371,738	1,398,668	1,425,198	1,448,991	1,480,752
Exhaust gas molecular weight	28.20	28.22	28.23	28.24	28.28	28.31	28.35	28.39
Exhaust gas N2+Ar mole percentage [%]	73.97	74.11	74.24	74.31	74.56	74.77	75.07	75.36
Exhaust gas O2 mole percentage [%]	12.36	12.39	12.41	12.41	12.45	12.48	12.54	12.60
Exhaust gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.69	3.70	3.71	3.72
Exhaust gas H2O mole percentage [%]	10.02	9.84	9.69	9.60	9.30	9.05	8.68	8.33
GT fuel flow [kpph]	62.10	62.55	63.02	63.75	65.00	66.23	67.34	68.82
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.151	4.146	4.124	4.051	3.981	3.915	3.897	3.863
Total exhaust pressure loss [inch H2O]	9.738	9.84	9.938	10.07	10.33	10.59	10.85	11.21
Fogging water mass flow [kpph]	17.8	17.14	15.8	11.65	7.481	3.587	3.069	2.006

Mountain Site---Dry Cooling—Off-Design Gas Turbine Summary
Table C.4-1b

Mountain Comparisons; ACC; Low pressure; Low cost								
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.4	20.8	22.7	33.4	47.8	69.3	70.4	76.6
Ambient wet bulb [F]	74.0	72.0	70.0	68.0	63.0	58.0	51.0	41.0
Gas temperature reaching HRSG [F]	1,140	1,138	1,136	1,133	1,127	1,122	1,117	1,110
Stack temperature [F]	250	249	246	241	235	230	229	229
Stack mass flow per HRSG [kpph]	3,010	3,030	3,050	3,079	3,132	3,184	3,234	3,299
Plant total ST gross output [kW]	117,071	119,620	122,906	129,249	134,720	136,318	136,246	136,606
Steam cycle gross eff [%]	24	24	25	26	26	26	26	25
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0
HRSG eff [%]	86.07	85.92	85.73	85.37	84.81	84.21	83.65	82.71
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	789.7	791.2	792.7	795.2	799.2	802.5	803.7	807.6
HPT temperature before stop valve [F]	950.0	950.0	950.0	950.0	950.0	947.9	944.3	939.0
Plant HPT mass flow before stop valve [kpph]	972.9	974.8	976.7	979.9	985.0	989.9	992.9	1000.0
HP superheater steam pressure [psia]	817.3	818.8	820.4	823.0	827.2	830.6	831.9	835.9
HP superheater steam temperature [F]	966.3	964.6	962.8	960.2	955.6	951.3	947.8	942.5
HP superheater steam mass flow per HRSG [kpph]	483.5	484.8	486.2	488.4	492.0	494.9	496.5	500.0
HPB pinch temperature difference [F]	35.5	35.7	35.9	36.2	36.8	37.3	37.8	38.4
IP superheater steam pressure [psia]	105.3	105.5	105.8	106.1	106.8	107.5	108.2	109.2
IP superheater steam temperature [F]	498.3	498.5	498.9	499.7	500.6	501.3	501.3	501.4
IP superheater steam mass flow per HRSG [kpph]	51.3	51.5	51.7	51.7	52.3	52.9	54.0	55.4
IPB pinch temperature difference [F]	35.7	35.8	35.9	36.0	36.3	36.7	37.3	38.1
LPB steam production rate per HRSG [kpph]	9.7	10.0	10.2	10.8	11.6	12.1	12.4	12.7
LPB pinch temperature difference [F]	54.7	55.9	57.4	60.5	64.7	67.8	68.7	69.9
Deaerator pressure [psia]	24.3	23.4	22.2	19.7	17.1	15.5	15.5	15.5
Deaerator temperature [F]	238.5	236.5	233.6	227.2	219.8	214.6	214.6	214.6
Condenser pressure [psia]	4.97	4.55	4.02	3.05	2.14	1.53	1.23	1.11
Condenser pressure [in Hga]	10.11	9.26	8.18	6.21	4.36	3.12	2.51	2.25
Condenser saturation temp [F]	162.0	158.3	153.1	142.1	128.6	116.5	108.9	105.1
Plant LPT exhaust mass flow [kpph]	1075.2	1077.6	1079.9	1083.1	1089.3	1095.5	1100.7	1110.7
Condenser coolant supply temp [F]	109.0	105.5	100.7	90.3	77.0	64.5	56.5	45.5
Condenser coolant discharge temp [F]	147.1	143.3	138.1	126.8	112.8	100.0	91.9	88.6
Condenser coolant mass flow [kpph]	110,628	111,379	112,374	114,449	117,339	120,177	122,213	101,947
Stack gas molecular weight	28.2	28.22	28.23	28.24	28.28	28.31	28.35	28.39
Stack gas N2+Ar mole percentage [%]	73.97	74.11	74.24	74.31	74.56	74.77	75.07	75.36
Stack gas O2 mole percentage [%]	12.36	12.39	12.41	12.41	12.45	12.48	12.54	12.6
Stack gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.69	3.7	3.71	3.72
Stack gas H2O mole percentage [%]	10.02	9.84	9.69	9.6	9.3	9.05	8.68	8.33
Duct burner exit temperature [F]	1139.7	1137.7	1135.6	1132.5	1127	1121.6	1116.5	1109.7
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0

Mountain Site---Dry Cooling—Off-Design Steam Summary
Table C.4-1c

Mountain Comparisons; Wet cooling; Low pressure; Low cost									
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.43	20.82	22.72	29	33.37	47.82	69.34	70.42	76.62
Ambient wet bulb [F]	74.0	72.0	70.0	70.1	68.0	63.0	58.0	51.0	41.0
Plant gross output [kW]	416,454	420,055	423,482	424,896	428,642	437,061	445,104	451,471	460,100
Plant net output [kW]	404,046	407,598	410,979	412,378	416,072	424,366	432,288	438,539	447,014
Gross LHV heat rate [BTU/kWh]	6,416	6,407	6,403	6,403	6,399	6,399	6,402	6,418	6,435
Net LHV heat rate [BTU/kWh]	6,613	6,603	6,597	6,597	6,592	6,590	6,592	6,607	6,624
Plant gross elec eff [%]	53.19	53.26	53.3	53.3	53.32	53.33	53.3	53.17	53.03
Plant net elec eff [%]	51.60	51.68	51.72	51.73	51.76	51.78	51.76	51.65	51.52
PURPA eff [%]	51.60	51.68	51.72	51.73	51.76	51.78	51.76	51.65	51.52
CHP eff [%]	51.60	51.68	51.72	51.73	51.76	51.78	51.76	51.65	51.52
Power gen. eff on chargeable energy [%]	51.60	51.68	51.72	51.73	51.76	51.78	51.76	51.65	51.52
Canadian Class 43 heat rate [BTU/kWh]	7,119	7,110	7,104	7,104	7,101	7,100	7,104	7,121	7,141
Plant total fuel HHV input [kBtu/hr]	2,964,768	2,986,380	3,008,612	3,018,644	3,043,609	3,103,279	3,162,060	3,214,900	3,285,347
Plant total fuel LHV input [kBtu/hr]	2,671,892	2,691,370	2,711,405	2,720,446	2,742,944	2,796,720	2,849,695	2,897,315	2,960,803
Fuel compressor [kW]	3,253	3,277	3,301	3,312	3,339	3,405	3,469	3,527	3,605
Supercharging fan [kW]	0	0	0	0	0	0	0	0	0
Electric chiller [kW]	0	0	0	0	0	0	0	0	0
Miscellaneous GT aux. [kW]	696	696	696	696	696	696	696	696	696
Boiler feedpump [kW]	1629.4	1631.1	1632.8	1634	1636.1	1642.2	1648.1	1652.8	1659.1
CW pump [kW]	1722.5	1722.5	1722.5	1722.5	1722.5	1725.6	1727.2	1730.4	1735.1
Cooling tower fan [kW]	1002.8	1008.8	1016.9	1024	1033.8	1057.5	1081.1	1098.1	1121.8
Miscellaneous ST aux. [kW]	303.5	303.5	303.5	303.5	303.5	303.5	303.5	303.5	303.5
Transformer losses [kW]	2082.3	2100.3	2117.4	2124.5	2143.2	2185.3	2225.5	2257.4	2300.5
All other auxiliaries [kW]	1719.2	1717.9	1713.2	1702.3	1695.7	1679.8	1665	1665.8	1664.9
Plant total auxiliaries [kW]	10,326	10,356	10,386	10,394	10,427	10,510	10,590	10,674	10,785
GT fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
DB fuel HHV/LHV ratio	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Plant water consumption [kpph]	1297.1	1279.4	1250.6	1210.4	1173.5	1086.6	1002.7	969.2	914.4
Plant water discharge [kpph]	261	257.8	252.6	245.5	238.9	223.2	208.1	201.7	191.2
Plant emission - CO2 (net) [kpph]	340.7	343.1	345.7	346.8	349.7	356.6	363.3	369.4	377.5

Mountain Site---Wet Cooling—Off-Design Plant Summary
Table C.4-2a

Mountain Comparisons; Wet cooling; Low pressure; Low cost									
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.43	20.82	22.72	29	33.37	47.82	69.34	70.42	76.62
Ambient wet bulb [F]	74.0	72.0	70.0	70.1	68.0	63.0	58.0	51.0	41.0
GT gross power [kW]	137,960	139,394	140,809	141,412	142,989	146,749	150,448	153,577	157,687
GT gross LHV eff [%]	35.24	35.35	35.44	35.47	35.58	35.81	36.03	36.17	36.35
GT LHV gross heat rate [BTU/kWh]	9,684	9,654	9,628	9,619	9,591	9,529	9,471	9,433	9,388
Compressor inlet mass flow [kpph]	2,948	2,968	2,988	2,995	3,016	3,068	3,119	3,167	3,231
Compressor inlet temperature [F]	82.56	80.2	77.52	76.42	73.42	66.35	59.48	52.27	42.8
Turbine inlet mass flow [kpph]	2,595.4	2,612.8	2,630.3	2,636.5	2,655.8	2,701.5	2,746.2	2,789.1	2,844.9
Turbine inlet temperature [F]	2,409.5	2,410.7	2,411.8	2,411.9	2,413.0	2,415.3	2,417.0	2,418.8	2,420.4
Turbine exhaust mass flow [kpph]	3,010.0	3,030.0	3,051.0	3,058.0	3,080.0	3,133.0	3,185.0	3,235.0	3,299.0
Turbine exhaust temperature [F]	1,142.8	1,140.7	1,138.6	1,137.8	1,135.5	1,130.0	1,124.6	1,119.5	1,112.8
GT fuel HHV input [kBtu/hr]	1,482,384	1,493,190	1,504,306	1,509,322	1,521,804	1,551,639	1,581,030	1,607,450	1,642,674
GT fuel LHV input [kBtu/hr]	1,335,946	1,345,685	1,355,703	1,360,223	1,371,472	1,398,360	1,424,847	1,448,657	1,480,401
Exhaust gas molecular weight	28.2	28.22	28.23	28.23	28.24	28.28	28.31	28.35	28.39
Exhaust gas N2+Ar mole percentage [%]	73.97	74.11	74.24	74.2	74.31	74.56	74.77	75.07	75.36
Exhaust gas O2 mole percentage [%]	12.36	12.39	12.41	12.4	12.42	12.46	12.49	12.55	12.6
Exhaust gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.67	3.68	3.7	3.71	3.72
Exhaust gas H2O mole percentage [%]	10.01	9.84	9.68	9.74	9.6	9.3	9.04	8.68	8.32
GT fuel flow [kpph]	62.09	62.54	63	63.21	63.74	64.99	66.22	67.32	68.8
Combustor steam injection [kpph]	0	0	0	0	0	0	0	0	0
Combustor water injection [kpph]	0	0	0	0	0	0	0	0	0
Inlet filter pressure loss [inch H2O]	4.068	4.062	4.042	3.999	3.97	3.902	3.838	3.821	3.788
Total exhaust pressure loss [inch H2O]	10.3	10.41	10.52	10.55	10.67	10.96	11.24	11.52	11.89
Fogging water mass flow [kpph]	17.79	17.14	15.8	13.4	11.64	7.483	3.579	3.07	1.997

Mountain Site---Wet Cooling—Off-Design Gas Turbine Summary
Table C.4-2b

Mountain Comparisons; Wet cooling; Low pressure; Low cost									
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Ambient pressure [psia]	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08
Ambient temperature [F]	109	105.5	100.7	96	90.3	77	64.5	56.5	45.5
Ambient relative humidity [%]	20.43	20.82	22.72	29	33.37	47.82	69.34	70.42	76.62
Ambient wet bulb [F]	74.0	72.0	70.0	70.1	68.0	63.0	58.0	51.0	41.0
Gas temperature reaching HRSG [F]	1,139.8	1,137.7	1,135.6	1,134.8	1,132.5	1,127.0	1,121.6	1,116.5	1,109.8
Stack temperature [F]	219.0	218.9	218.8	219.0	219.0	218.8	218.8	218.3	217.9
Stack mass flow per HRSG [kpph]	3,010.0	3,030.0	3,051.0	3,058.0	3,080.0	3,133.0	3,185.0	3,235.0	3,299.0
Plant total ST gross output [kW]	140,533	141,267	141,865	142,073	142,665	143,563	144,209	144,316	144,726
Steam cycle gross eff [%]	28.73	28.69	28.58	28.44	28.3	27.86	27.41	27.01	26.53
Net process heat output [kBtu/hr]	0	0	0	0	0	0	0	0	0
HRSG eff [%]	88.93	88.63	88.23	87.82	87.35	86.24	85.21	84.57	83.67
Plant duct burner fuel flow [kpph]	0	0	0	0	0	0	0	0	0
Plant fuel HHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0	0
Plant fuel LHV to duct burner(s) [kBtu/hr]	0	0	0	0	0	0	0	0	0
HPT pressure before stop valve [psia]	795.8	797.4	799.1	800.1	801.9	806.5	810.8	814.2	818.7
HPT temperature before stop valve [F]	950.0	950.0	950.0	950.0	949.4	944.9	940.5	936.4	931.1
Plant HPT mass flow before stop valve [kpph]	973.5	975.5	977.5	978.8	981.3	988.8	996.1	1,002.0	1,010.0
HP superheater steam pressure [psia]	823.7	825.4	827.1	828.1	830.0	834.7	839.2	842.7	847.4
HP superheater steam temperature [F]	958.9	957.2	955.5	954.8	952.9	948.4	944.0	939.9	934.6
HP superheater steam mass flow per HRSG [kp	485.5	486.9	488.3	489.1	490.7	494.4	498.0	501.0	505.0
HPB pinch temperature difference [F]	35.4	35.6	35.8	35.9	36.1	36.6	37.1	37.6	38.2
IP superheater steam pressure [psia]	106.0	106.3	106.6	106.8	107.1	108.0	109.0	109.7	110.9
IP superheater steam temperature [F]	500.4	500.5	500.6	500.6	500.7	501.0	501.3	501.5	501.8
IP superheater steam mass flow per HRSG [kpp	48.3	48.7	49.2	49.4	49.9	51.0	52.1	53.1	54.5
IPB pinch temperature difference [F]	35.0	35.3	35.5	35.7	35.9	36.6	37.3	37.8	38.6
LPB steam production rate per HRSG [kpph]	11.2	11.3	11.5	11.5	11.6	11.9	12.3	12.6	13.0
LPB pinch temperature difference [F]	62.4	62.8	63.3	63.4	64.0	65.3	66.5	67.9	69.6
Deaerator pressure [psia]	17.0	16.9	16.8	16.9	16.8	16.6	16.4	16.1	15.7
Deaerator temperature [F]	219.4	219.1	218.9	219.0	218.7	218.1	217.5	216.5	215.5
Condenser pressure [psia]	1.32	1.27	1.23	1.23	1.19	1.09	1.01	0.92	0.81
Condenser pressure [in Hga]	2.68	2.59	2.50	2.50	2.41	2.23	2.06	1.87	1.65
Condenser saturation temp [F]	111.1	109.9	108.8	108.7	107.5	104.8	102.1	98.8	94.9
Plant LPT exhaust mass flow [kpph]	1,069.9	1,072.7	1,075.7	1,077.3	1,080.8	1,090.6	1,100.1	1,108.1	1,118.8
Condenser coolant supply temp [F]	85.67	84.4	83.12	83.05	81.69	78.54	75.52	71.79	67.24
Condenser coolant discharge temp [F]	106.5	105.3	104.1	104	102.8	99.83	97.03	93.54	89.3
Condenser coolant mass flow [kpph]	47,732	47,732	47,732	47,732	47,732	47,732	47,732	47,732	47,732
Stack gas molecular weight	28.2	28.22	28.23	28.23	28.24	28.28	28.31	28.35	28.39
Stack gas N2+Ar mole percentage [%]	73.97	74.11	74.24	74.2	74.31	74.56	74.77	75.07	75.36
Stack gas O2 mole percentage [%]	12.36	12.39	12.41	12.4	12.42	12.46	12.49	12.55	12.6
Stack gas CO2 mole percentage [%]	3.65	3.66	3.66	3.67	3.67	3.68	3.7	3.71	3.72
Stack gas H2O mole percentage [%]	10.01	9.84	9.68	9.74	9.6	9.3	9.04	8.68	8.32
Duct burner exit temperature [F]	1,139.8	1,137.7	1,135.6	1,134.8	1,132.5	1,127.0	1,121.6	1,116.5	1,109.8
Exhaust DT across main duct burner [F]	0	0	0	0	0	0	0	0	0
Exhaust DT across HPB2 burner [F]	0	0	0	0	0	0	0	0	0

Mountain Site---Wet Cooling—Off-Design Steam Summary
Table C.4-2c

APPENDIX D

HOURLY OPERATING DATA FOR ALL SITES, PLANTS, AND WATER SOURCES

D.1 Desert Site
D.2 Valley Site
D.3 Coast Site
D.4 Mountain Site

D.1 Desert Site

Desert

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
27	0	543,101	0	3,410	0	49	0	54	0
28	0	538,939	0	3,403	0	49	0	54	0
29	0	535,017	0	3,397	0	49	0	54	0
30	0	531,322	0	3,390	0	49	0	54	0
31	0	527,846	0	3,384	0	49	0	54	0
32	0	524,579	0	3,377	0	49	0	54	0
33	1	521,510	521,510	3,371	3,371	49	3	54	3
34	0	518,630	521,510	3,365	3,371	49	3	54	3
35	1	515,930	1,037,440	3,359	6,730	49	6	55	7
36	1	513,400	1,550,840	3,353	10,084	49	9	55	10
37	2	511,032	2,572,904	3,347	16,779	49	15	55	16
38	3	508,816	4,099,352	3,342	26,803	49	24	55	26
39	5	506,744	6,633,074	3,336	43,483	49	38	56	43
40	6	504,809	9,661,926	3,330	63,464	49	56	56	63
41	8	503,000	13,685,927	3,325	90,060	49	80	57	90
42	11	501,311	19,200,353	3,319	126,568	49	112	57	128
43	15	499,735	26,696,371	3,313	176,267	49	157	57	180
44	18	498,262	35,665,084	3,308	235,807	50	210	58	242
45	23	496,886	47,093,466	3,302	311,758	50	279	58	323
46	12	495,600	53,040,669	3,297	351,319	50	315	59	365
47	49	494,397	77,266,132	3,291	512,590	50	461	59	539
48	61	493,270	107,355,616	3,286	713,022	50	644	60	757
49	71	492,213	142,302,730	3,280	945,924	50	857	60	1,014
50	82	491,219	182,582,667	3,275	1,214,462	50	1,104	61	1,312
51	92	490,282	227,688,589	3,269	1,515,246	50	1,382	61	1,650
52	102	489,396	277,606,979	3,264	1,848,169	50	1,691	62	2,027
53	110	488,556	331,348,106	3,258	2,206,603	51	2,025	62	2,438
54	118	487,755	388,903,242	3,253	2,590,461	51	2,384	63	2,882
55	126	486,990	450,263,953	3,248	2,999,654	51	2,768	63	3,361
56	133	486,254	514,935,696	3,242	3,430,853	51	3,175	64	3,870
57	140	485,542	582,911,622	3,237	3,883,978	51	3,604	64	4,410
58	146	484,851	653,699,857	3,231	4,355,721	51	4,052	65	4,979
59	152	484,175	727,294,459	3,226	4,846,014	51	4,520	65	5,575
60	157	483,510	803,205,577	3,220	5,351,568	51	5,005	66	6,196
61	161	482,853	880,944,864	3,215	5,869,111	52	5,504	67	6,839
62	165	482,198	960,507,595	3,209	6,398,596	52	6,016	67	7,503
63	169	481,544	1,041,888,462	3,203	6,939,976	52	6,542	68	8,188
64	172	480,885	1,124,600,667	3,198	7,490,006	52	7,078	68	8,891
65	174	480,219	1,208,158,785	3,192	8,045,457	52	7,623	69	9,608
66	176	479,543	1,292,558,353	3,187	8,606,305	52	8,174	69	10,339
67	177	478,854	1,377,315,483	3,181	9,169,343	52	8,731	70	11,080
68	178	478,149	1,462,425,997	3,175	9,734,557	53	9,292	70	11,831
69	178	477,426	1,547,407,804	3,170	10,298,764	53	9,854	71	12,588
70	178	476,682	1,632,257,267	3,164	10,861,962	53	10,418	71	13,351
71	177	475,916	1,716,494,469	3,158	11,420,991	53	10,980	72	14,115
72	176	475,126	1,800,116,666	3,153	11,975,859	53	11,540	72	14,880

Table D.1-1; Desert Site---Dry---p.1

Desert

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
73	174	474,310	1,882,646,588	3,147	12,523,431	53	12,095	73	15,643
74	171	473,466	1,963,609,328	3,141	13,060,586	53	12,642	74	16,398
75	169	472,594	2,043,477,738	3,136	13,590,495	53	13,184	74	17,150
76	165	471,692	2,121,306,977	3,130	14,106,920	54	13,714	75	17,889
77	161	470,760	2,197,099,362	3,124	14,609,907	54	14,233	75	18,616
78	157	469,797	2,270,857,477	3,118	15,099,503	54	14,740	76	19,331
79	151	468,802	2,341,646,613	3,113	15,569,528	54	15,229	76	20,023
80	146	467,776	2,409,941,895	3,107	16,023,161	54	15,703	77	20,697
81	123	466,718	2,467,348,202	3,101	16,404,634	54	16,103	78	21,269
82	174	465,629	2,548,367,566	3,096	16,943,297	54	16,671	78	22,085
83	174	464,508	2,629,191,974	3,090	17,480,981	55	17,240	79	22,906
84	173	463,357	2,709,352,779	3,085	18,014,607	55	17,807	79	23,730
85	172	462,177	2,788,847,190	3,079	18,544,192	55	18,373	80	24,554
86	170	460,968	2,867,211,715	3,073	19,066,679	55	18,933	81	25,376
87	167	459,731	2,943,986,865	3,068	19,579,030	55	19,485	81	26,189
88	163	458,469	3,018,717,339	3,063	20,078,223	55	20,026	82	26,989
89	161	457,183	3,092,323,739	3,057	20,570,424	55	20,561	82	27,786
90	155	455,874	3,162,984,149	3,052	21,043,456	56	21,078	83	28,560
91	152	454,544	3,232,074,871	3,047	21,506,532	56	21,586	84	29,324
92	146	453,197	3,298,241,586	3,041	21,950,570	56	22,076	85	30,065
93	142	451,833	3,362,401,934	3,036	22,381,716	56	22,554	85	30,792
94	136	450,457	3,423,664,106	3,031	22,793,960	56	23,013	86	31,494
95	130	449,071	3,482,043,295	3,026	23,187,373	56	23,453	87	32,171
96	124	447,677	3,537,555,256	3,021	23,562,028	57	23,874	88	32,823
97	119	446,280	3,590,662,536	3,017	23,921,010	57	24,280	88	33,454
98	112	444,882	3,640,489,303	3,012	24,258,356	57	24,664	89	34,055
99	106	443,487	3,687,498,960	3,008	24,577,152	57	25,028	90	34,628
100	100	442,100	3,731,708,960	3,003	24,877,463	57	25,373	91	35,175
101	94	440,724	3,773,137,010	2,999	25,159,355	58	25,698	92	35,694
102	87	439,363	3,811,361,627	2,995	25,419,897	58	26,001	93	36,180
103	82	438,023	3,847,279,508	2,991	25,665,140	58	26,287	94	36,643
104	76	436,707	3,880,469,258	2,987	25,892,149	58	26,553	95	37,076
105	70	435,421	3,910,948,738	2,983	26,100,983	59	26,800	96	37,481
106	65	434,170	3,939,169,777	2,980	26,294,674	59	27,030	97	37,861
107	59	432,959	3,964,714,332	2,977	26,470,294	59	27,240	99	38,210
108	55	431,793	3,988,462,941	2,974	26,633,838	60	27,437	100	38,539
109	51	430,679	4,010,427,545	2,971	26,785,342	60	27,620	101	38,849
110	46	429,621	4,030,190,126	2,968	26,921,870	60	27,787	103	39,132
111	43	428,628	4,048,621,109	2,966	27,049,391	61	27,943	104	39,400
112	39	427,703	4,065,301,540	2,963	27,164,964	61	28,086	105	39,646
113	40	426,855	4,082,375,758	2,961	27,283,422	61	28,233	107	39,903
114	12	426,090	4,087,488,843	2,960	27,318,940	62	28,278	109	39,981
115	10	425,415	4,091,742,997	2,958	27,348,524	62	28,315	110	40,047
116	7	424,837	4,094,716,858	2,957	27,369,224	63	28,341	112	40,094
117	1	424,364	4,095,056,349	2,956	27,371,590	63	28,344	114	40,100
118	1	424,002	4,095,395,551	2,956	27,373,954	64	28,347	116	40,105
119	1	423,760	4,095,734,559	2,956	27,376,319	64	28,350	118	40,111
120	1	423,646	4,096,073,475	2,956	27,378,684	65	28,354	120	40,117
121	1	423,667	4,096,412,409	2,956	27,381,049	65	28,357	122	40,122
122	0	423,833	4,096,412,409	2,957	27,381,049	66	28,357	124	40,122

Table D-1; Desert Site; Dry---p.2

Desert						Freshwater				Saline Water				Brackish Water			
Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
27	0	510,040	0	3,410	0	182	0	1,347	0	171	0	1,347	0	157	0	1,347	0
28	0	509,316	0	3,403	0	184	0	1,358	0	172	0	1,358	0	158	0	1,358	0
29	0	508,597	0	3,396	0	185	0	1,369	0	173	0	1,369	0	160	0	1,369	0
30	0	507,882	0	3,390	0	187	0	1,380	0	175	0	1,380	0	161	0	1,380	0
31	0	507,170	0	3,383	0	188	0	1,392	0	176	0	1,392	0	162	0	1,392	0
32	0	506,462	0	3,377	0	190	0	1,404	0	178	0	1,404	0	164	0	1,404	0
33	1	505,756	505,756	3,371	3,371	192	12	1,416	85	179	11	1,416	85	165	10	1,416	85
34	0	505,052	505,756	3,364	3,371	193	12	1,428	85	181	11	1,428	85	167	10	1,428	85
35	1	504,350	1,010,106	3,358	6,729	195	23	1,441	171	182	22	1,441	171	168	20	1,441	171
36	1	503,648	1,513,754	3,352	10,081	197	35	1,454	259	184	33	1,454	259	170	30	1,454	259
37	2	502,948	2,519,649	3,346	16,774	198	59	1,467	435	186	55	1,467	435	171	51	1,467	435
38	3	502,247	4,026,389	3,340	26,795	200	95	1,480	701	187	89	1,480	701	173	82	1,480	701
39	5	501,545	6,534,117	3,335	43,468	202	155	1,493	1,149	189	145	1,493	1,149	174	134	1,493	1,149
40	6	500,843	9,539,177	3,329	63,442	204	229	1,507	1,692	191	214	1,507	1,692	176	197	1,507	1,692
41	8	500,140	13,540,298	3,323	90,027	206	328	1,521	2,422	192	306	1,521	2,422	177	282	1,521	2,422
42	11	499,435	19,034,087	3,317	126,519	207	464	1,534	3,434	194	434	1,534	3,434	179	400	1,534	3,434
43	15	498,729	26,515,018	3,312	176,196	209	653	1,548	4,827	196	610	1,548	4,827	180	562	1,548	4,827
44	18	498,020	35,479,376	3,306	235,708	211	881	1,562	6,514	197	824	1,562	6,514	182	759	1,562	6,514
45	23	497,309	46,917,472	3,301	311,623	213	1,175	1,576	8,689	199	1,098	1,576	8,689	183	1,012	1,576	8,689
46	12	496,594	52,876,605	3,295	351,164	215	1,329	1,590	9,834	201	1,243	1,590	9,834	185	1,145	1,590	9,834
47	49	495,877	77,174,591	3,290	512,353	217	1,966	1,604	14,549	203	1,839	1,604	14,549	187	1,694	1,604	14,549
48	61	495,157	107,379,161	3,284	712,680	219	2,766	1,618	20,470	204	2,587	1,618	20,470	188	2,383	1,618	20,470
49	71	494,433	142,483,907	3,279	945,457	220	3,705	1,632	27,421	206	3,464	1,632	27,421	190	3,192	1,632	27,421
50	82	493,706	182,967,763	3,273	1,213,849	222	4,798	1,646	35,519	208	4,487	1,646	35,519	191	4,134	1,646	35,519
51	92	492,974	228,321,397	3,268	1,514,467	224	6,035	1,660	44,682	210	5,643	1,660	44,682	193	5,199	1,660	44,682
52	102	492,239	278,529,781	3,262	1,847,203	226	7,418	1,674	54,926	211	6,936	1,674	54,926	195	6,390	1,674	54,926
53	110	491,500	332,594,756	3,257	2,205,433	228	8,921	1,688	66,066	213	8,342	1,688	66,066	196	7,685	1,688	66,066
54	118	490,756	390,504,005	3,251	2,589,070	230	10,547	1,702	78,115	215	9,862	1,702	78,115	198	9,086	1,702	78,115
55	126	490,009	452,245,098	3,246	2,998,025	231	12,297	1,716	91,086	216	11,498	1,716	91,086	199	10,593	1,716	91,086
56	133	489,257	517,316,243	3,240	3,428,971	233	14,158	1,730	104,888	218	13,239	1,730	104,888	201	12,197	1,730	104,888
57	140	488,500	585,706,311	3,235	3,881,829	235	16,133	1,743	119,533	220	15,086	1,743	119,533	203	13,898	1,743	119,533
58	146	487,740	656,916,338	3,229	4,353,292	237	18,208	1,757	134,926	222	17,026	1,757	134,926	204	15,686	1,757	134,926
59	152	486,975	730,936,545	3,224	4,843,291	239	20,386	1,771	151,077	223	19,062	1,771	151,077	206	17,562	1,771	151,077
60	157	486,206	807,270,874	3,218	5,348,541	241	22,651	1,785	167,887	225	21,181	1,785	167,887	207	19,514	1,785	167,887
61	161	485,433	885,425,521	3,213	5,865,772	242	24,992	1,798	185,257	227	23,369	1,798	185,257	209	21,530	1,798	185,257
62	165	484,655	965,393,619	3,207	6,394,937	244	27,408	1,812	203,192	228	25,629	1,812	203,192	210	23,612	1,812	203,192
63	169	483,874	1,047,168,269	3,201	6,935,989	246	29,901	1,825	221,698	230	27,960	1,825	221,698	212	25,760	1,825	221,698
64	172	483,088	1,130,259,459	3,196	7,485,686	248	32,457	1,838	240,670	232	30,350	1,838	240,670	213	27,961	1,838	240,670
65	174	482,299	1,214,179,524	3,190	8,040,800	249	35,060	1,852	260,002	233	32,784	1,852	260,002	215	30,204	1,852	260,002
66	176	481,507	1,298,924,677	3,185	8,601,308	251	37,712	1,865	279,695	235	35,264	1,865	279,695	216	32,488	1,865	279,695
67	177	480,711	1,384,010,438	3,179	9,164,004	253	40,397	1,878	299,640	236	37,774	1,878	299,640	218	34,801	1,878	299,640
68	178	479,911	1,469,434,651	3,173	9,728,876	255	43,115	1,891	319,837	238	40,316	1,891	319,837	219	37,143	1,891	319,837
69	178	479,109	1,554,716,086	3,168	10,292,742	256	45,852	1,904	340,173	240	42,876	1,904	340,173	221	39,501	1,904	340,173
70	178	478,304	1,639,854,268	3,162	10,855,599	258	48,607	1,917	360,646	241	45,452	1,917	360,646	222	41,875	1,917	360,646
71	177	477,497	1,724,371,276	3,156	11,414,290	260	51,365	1,930	381,142	243	48,030	1,930	381,142	224	44,250	1,930	381,142
72	176	476,688	1,808,268,358	3,151	11,968,825	261	54,124	1,943	401,657	244	50,611	1,943	401,657	225	46,627	1,943	401,657
73	174	475,877	1,891,070,951	3,145	12,516,068	263	56,870	1,955	422,071	246	53,178	1,955	422,071	227	48,993	1,955	422,071
74	171	475,065	1,972,306,992	3,139	13,052,902	265	59,586	1,968	442,264	247	55,718	1,968	442,264	228	51,332	1,968	442,264

Table D.1-2; Desert Site---Wet Cooling—p. 1

Desert						Freshwater				Saline Water				Brackish Water			
Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
75	169	474,251	2,052,455,433	3,134	13,582,495	266	62,286	1,981	462,349	249	58,243	1,981	462,349	229	53,659	1,981	462,349
76	165	473,437	2,130,572,546	3,128	14,098,612	268	64,940	1,993	482,084	251	60,724	1,993	482,084	231	55,945	1,993	482,084
77	161	472,623	2,206,664,810	3,122	14,601,301	270	67,544	2,006	501,461	252	63,160	2,006	501,461	232	58,189	2,006	501,461
78	157	471,809	2,280,738,771	3,117	15,090,607	271	70,100	2,019	520,476	254	65,549	2,019	520,476	234	60,390	2,019	520,476
79	151	470,995	2,351,859,055	3,111	15,560,356	273	72,573	2,031	538,877	255	67,861	2,031	538,877	235	62,521	2,031	538,877
80	146	470,183	2,420,505,772	3,105	16,013,722	275	74,978	2,044	556,779	257	70,111	2,044	556,779	237	64,593	2,044	556,779
81	123	469,372	2,478,238,577	3,100	16,394,971	276	77,017	2,056	571,953	258	72,017	2,056	571,953	238	66,349	2,056	571,953
82	174	468,564	2,559,768,711	3,094	16,933,319	278	79,917	2,069	593,549	260	74,729	2,069	593,549	239	68,848	2,069	593,549
83	174	467,758	2,641,158,656	3,088	17,470,690	280	82,836	2,081	615,277	261	77,458	2,081	615,277	241	71,362	2,081	615,277
84	173	466,956	2,721,942,032	3,083	18,004,007	281	85,754	2,094	637,010	263	80,187	2,094	637,010	242	73,876	2,094	637,010
85	172	466,157	2,802,121,114	3,077	18,533,285	283	88,673	2,106	658,748	264	82,916	2,106	658,748	244	76,390	2,106	658,748
86	170	465,363	2,881,232,906	3,072	19,055,471	284	91,574	2,119	680,363	266	85,629	2,119	680,363	245	78,890	2,119	680,363
87	167	464,575	2,958,816,876	3,066	19,567,527	286	94,441	2,132	701,724	268	88,310	2,132	701,724	247	81,360	2,132	701,724
88	163	463,792	3,034,414,916	3,061	20,066,433	288	97,256	2,145	722,699	269	90,942	2,145	722,699	248	83,785	2,145	722,699
89	161	463,015	3,108,960,354	3,055	20,558,351	290	100,053	2,158	743,541	271	93,557	2,158	743,541	249	86,194	2,158	743,541
90	155	462,246	3,180,608,455	3,050	21,031,113	291	102,761	2,171	763,728	272	96,090	2,171	763,728	251	88,527	2,171	763,728
91	152	461,484	3,250,754,086	3,045	21,493,924	293	105,432	2,184	783,645	274	98,588	2,184	783,645	252	90,829	2,184	783,645
92	146	460,732	3,318,020,911	3,040	21,937,710	295	108,014	2,197	802,892	276	101,002	2,197	802,892	254	93,052	2,197	802,892
93	142	459,988	3,383,339,262	3,035	22,368,610	296	110,539	2,211	821,727	277	103,363	2,211	821,727	255	95,228	2,211	821,727
94	136	459,255	3,445,797,985	3,029	22,780,620	298	112,972	2,224	839,877	279	105,638	2,224	839,877	257	97,324	2,224	839,877
95	130	458,533	3,505,407,315	3,025	23,173,809	300	115,312	2,238	857,335	281	107,827	2,238	857,335	258	99,340	2,238	857,335
96	124	457,823	3,562,177,388	3,020	23,548,251	302	117,558	2,252	874,091	282	109,926	2,252	874,091	260	101,275	2,252	874,091
97	119	457,126	3,616,575,356	3,015	23,907,030	304	119,726	2,267	890,274	284	111,954	2,267	890,274	262	103,143	2,267	890,274
98	112	456,442	3,667,696,862	3,010	24,244,185	306	121,780	2,281	905,603	286	113,874	2,281	905,603	263	104,912	2,281	905,603
99	106	455,773	3,716,008,777	3,006	24,562,800	307	123,735	2,296	920,205	288	115,703	2,296	920,205	265	106,596	2,296	920,205
100	100	455,119	3,761,520,677	3,001	24,862,941	309	125,592	2,311	934,071	289	117,439	2,311	934,071	267	108,196	2,311	934,071
101	94	454,482	3,804,241,949	2,997	25,144,673	311	127,349	2,326	947,193	291	119,082	2,326	947,193	268	109,709	2,326	947,193
102	87	453,862	3,843,727,910	2,993	25,405,068	314	128,985	2,342	959,419	293	120,612	2,342	959,419	270	111,119	2,342	959,419
103	82	453,260	3,880,895,228	2,989	25,650,173	316	130,538	2,358	971,023	295	122,064	2,358	971,023	272	112,457	2,358	971,023
104	76	452,678	3,915,298,734	2,985	25,877,054	318	131,987	2,375	981,852	297	123,419	2,375	981,852	274	113,705	2,375	981,852
105	70	452,116	3,946,946,845	2,982	26,085,769	320	133,331	2,392	991,898	299	124,675	2,392	991,898	276	114,862	2,392	991,898
106	65	451,576	3,976,299,253	2,978	26,279,351	322	134,587	2,409	1,001,295	301	125,850	2,409	1,001,295	278	115,945	2,409	1,001,295
107	59	451,058	4,002,911,657	2,975	26,454,871	324	135,736	2,427	1,009,886	303	126,924	2,427	1,009,886	280	116,934	2,427	1,009,886
108	55	450,564	4,027,692,653	2,972	26,618,323	327	136,814	2,445	1,017,956	306	127,932	2,445	1,017,956	282	117,863	2,445	1,017,956
109	51	450,094	4,050,647,457	2,969	26,769,741	329	137,822	2,464	1,025,497	308	128,874	2,464	1,025,497	284	118,731	2,464	1,025,497
110	46	449,651	4,071,331,392	2,966	26,906,193	332	138,737	2,484	1,032,352	310	129,731	2,484	1,032,352	286	119,520	2,484	1,032,352
111	43	449,234	4,090,648,473	2,964	27,033,641	334	139,600	2,504	1,038,811	313	130,537	2,504	1,038,811	288	120,263	2,504	1,038,811
112	39	448,846	4,108,153,484	2,962	27,149,149	337	140,388	2,524	1,044,718	315	131,274	2,524	1,044,718	290	120,943	2,524	1,044,718
113	40	448,488	4,126,093,001	2,960	27,267,541	340	141,203	2,545	1,050,827	318	132,037	2,545	1,050,827	293	121,645	2,545	1,050,827
114	12	448,160	4,131,470,923	2,958	27,303,039	342	141,450	2,567	1,052,675	320	132,267	2,567	1,052,675	295	121,857	2,567	1,052,675
115	10	447,864	4,135,949,567	2,957	27,332,606	345	141,657	2,590	1,054,229	323	132,461	2,590	1,054,229	298	122,036	2,590	1,054,229
116	7	447,602	4,139,082,781	2,956	27,353,295	348	141,804	2,613	1,055,326	326	132,598	2,613	1,055,326	300	122,162	2,613	1,055,326
117	0.8	447,374	4,139,440,680	2,955	27,355,659	351	141,820	2,637	1,055,453	329	132,614	2,637	1,055,453	303	122,176	2,637	1,055,453
118	0.8	447,182	4,139,798,426	2,954	27,358,023	355	141,837	2,662	1,055,580	332	132,630	2,662	1,055,580	305	122,191	2,662	1,055,580
119	0.8	447,027	4,140,156,048	2,954	27,360,386	358	141,855	2,687	1,055,709	335	132,646	2,687	1,055,709	308	122,206	2,687	1,055,709
120	0.8	446,911	4,140,513,577	2,954	27,362,749	361	141,872	2,714	1,055,840	338	132,662	2,714	1,055,840	311	122,221	2,714	1,055,840
121	0.8	446,835	4,140,871,045	2,955	27,365,113	365	141,889	2,741	1,055,971	341	132,678	2,741	1,055,971	314	122,236	2,741	1,055,971
122	0	446,801	4,140,871,045	2,956	27,365,113	368	141,889	2,769	1,055,971	344	132,678	2,769	1,055,971	317	122,236	2,769	1,055,971

Table D.1-2; Desert Site---Wet Cooling—p. 2

D.2 Valley Site

Central Valley

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
17	0	504,093	0	3,418	0	47	0	48	0
18	0	504,188	50,786	3,413	344	47	0	48	0
19	0	504,211	101,574	3,408	687	47	1	48	1
20	0	504,165	152,356	3,403	1,030	47	1	48	1
21	0	504,053	203,127	3,398	1,372	47	1	48	1
22	0	503,880	253,880	3,392	1,714	47	1	48	1
23	0	503,649	304,609	3,387	2,055	47	2	48	2
24	0	503,363	355,308	3,382	2,395	47	2	47	2
25	0	503,025	405,973	3,376	2,736	47	2	47	2
26	0	502,638	456,598	3,371	3,075	47	3	47	3
27	0	502,206	505,273	3,365	3,401	47	3	47	3
28	1	501,731	870,468	3,360	5,847	47	5	48	5
29	1	501,217	1,228,978	3,355	8,246	47	7	48	7
30	1	500,665	1,659,803	3,349	11,128	47	9	48	9
31	1	500,080	2,331,094	3,344	15,617	47	13	48	13
32	2	499,463	3,506,231	3,338	23,470	47	20	48	20
33	4	498,817	5,543,846	3,333	37,083	47	31	48	32
34	7	498,144	8,891,835	3,327	59,444	47	50	48	51
35	10	497,448	14,075,425	3,321	94,054	47	80	48	81
36	15	496,729	21,679,344	3,316	144,813	47	123	48	126
37	21	495,991	32,324,181	3,310	215,858	47	184	49	189
38	29	495,235	46,636,992	3,305	311,369	47	267	49	273
39	38	494,463	65,216,220	3,299	435,335	47	374	49	384
40	47	493,678	88,591,011	3,294	591,283	48	509	49	525
41	58	492,881	117,174,982	3,288	781,972	48	674	50	698
42	69	492,074	151,214,520	3,283	1,009,045	48	872	50	906
43	80	491,259	190,731,660	3,277	1,272,651	48	1,102	50	1,149
44	91	490,437	235,461,622	3,272	1,571,027	48	1,364	51	1,426
45	101	489,610	284,785,052	3,266	1,900,044	48	1,653	51	1,735
46	108	488,779	337,655,021	3,261	2,252,725	48	1,965	51	2,069
47	112	487,945	392,518,843	3,255	2,618,715	48	2,289	52	2,419
48	123	487,110	452,265,908	3,250	3,017,294	48	2,643	52	2,804
49	140	486,275	520,189,089	3,244	3,470,434	48	3,048	53	3,247
50	154	485,441	594,878,070	3,239	3,968,732	48	3,495	53	3,738
51	165	484,609	675,064,951	3,233	4,503,734	49	3,976	54	4,272
52	175	483,780	759,618,114	3,228	5,067,893	49	4,486	54	4,840
53	182	482,955	847,534,778	3,223	5,654,521	49	5,018	55	5,438
54	187	482,134	937,933,579	3,217	6,257,737	49	5,568	55	6,061
55	191	481,318	1,030,047,175	3,212	6,872,421	49	6,131	56	6,702
56	194	480,507	1,123,214,865	3,207	7,494,162	49	6,703	56	7,359
57	195	479,703	1,216,875,251	3,201	8,119,211	49	7,280	57	8,027
58	196	478,905	1,310,558,924	3,196	8,744,433	49	7,860	58	8,704
59	195	478,114	1,403,881,199	3,191	9,367,257	50	8,441	58	9,387
60	194	477,330	1,496,534,869	3,186	9,985,629	50	9,021	59	10,073
61	193	476,553	1,588,283,014	3,181	10,597,963	50	9,597	60	10,762
62	191	475,783	1,678,951,838	3,175	11,203,098	50	10,170	60	11,451

Table D-2; Valley Site; Dry---p. 1

Central Valley

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater			
						Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
63	188	475,021	1,768,423,547	3,170	11,800,241	50	10,737	61	12,141
64	186	474,265	1,856,629,266	3,165	12,388,932	50	11,300	62	12,829
65	184	473,516	1,943,541,988	3,160	12,968,987	51	11,857	62	13,517
66	181	472,773	2,029,169,560	3,155	13,540,456	51	12,409	63	14,204
67	179	472,036	2,113,547,703	3,150	14,103,577	51	12,955	64	14,890
68	177	471,305	2,196,733,059	3,145	14,658,725	51	13,497	65	15,575
69	174	470,579	2,278,796,278	3,140	15,206,373	51	14,034	66	16,261
70	172	469,857	2,359,815,119	3,136	15,747,039	52	14,567	66	16,947
71	171	469,139	2,439,867,591	3,131	16,281,246	52	15,097	67	17,634
72	169	468,423	2,519,025,114	3,126	16,809,473	52	15,623	68	18,323
73	167	467,710	2,597,345,708	3,121	17,332,109	52	16,147	69	19,015
74	166	466,997	2,674,867,202	3,116	17,849,411	52	16,668	70	19,708
75	165	466,284	2,751,600,480	3,112	18,361,456	53	17,187	71	20,404
76	163	465,569	2,827,522,740	3,107	18,868,098	53	17,703	71	21,103
77	161	464,852	2,902,570,792	3,102	19,368,923	53	18,216	72	21,803
78	160	464,131	2,976,634,382	3,097	19,863,204	53	18,726	73	22,503
79	157	463,404	3,049,549,554	3,093	20,349,854	53	19,230	74	23,201
80	155	462,671	3,121,092,044	3,088	20,827,388	54	19,727	75	23,897
81	151	461,929	3,190,970,731	3,084	21,293,872	54	20,216	76	24,585
82	147	461,176	3,258,821,124	3,079	21,746,884	54	20,693	77	25,262
83	142	460,412	3,324,198,923	3,075	22,183,468	54	21,156	78	25,924
84	136	459,634	3,386,573,639	3,070	22,600,090	55	21,600	79	26,563
85	128	458,840	3,445,322,299	3,066	22,992,597	55	22,020	79	27,174
86	119	458,028	3,499,723,242	3,061	23,356,168	55	22,412	80	27,747
87	108	457,196	3,548,950,025	3,057	23,685,278	55	22,768	81	28,272
88	109	456,342	3,598,592,008	3,052	24,017,301	55	23,130	82	28,809
89	102	455,463	3,644,943,647	3,048	24,327,466	56	23,470	83	29,317
90	96	454,558	3,688,573,371	3,043	24,619,574	56	23,792	84	29,802
91	91	453,623	3,729,856,701	3,039	24,896,141	56	24,098	85	30,266
92	87	452,656	3,769,059,475	3,035	25,158,951	56	24,391	86	30,713
93	83	451,655	3,806,351,551	3,030	25,409,143	57	24,671	87	31,143
94	79	450,616	3,841,820,427	3,026	25,647,308	57	24,939	88	31,558
95	75	449,538	3,875,484,778	3,021	25,873,571	57	25,195	89	31,956
96	71	448,416	3,907,307,903	3,017	26,087,683	57	25,438	90	32,337
97	67	447,249	3,937,211,070	3,013	26,289,110	57	25,668	90	32,700
98	62	446,033	3,965,086,752	3,008	26,477,120	58	25,885	91	33,043
99	58	444,764	3,990,811,735	3,004	26,650,865	58	26,085	92	33,363
100	53	443,440	4,014,260,083	3,000	26,809,476	58	26,269	93	33,659
101	48	442,057	4,035,315,937	2,995	26,952,139	58	26,436	94	33,927
102	42	440,612	4,053,886,130	2,991	27,078,189	58	26,584	95	34,167
103	36	439,102	4,069,912,585	2,986	27,187,185	59	26,712	96	34,376
104	31	437,522	4,083,384,468	2,982	27,279,002	59	26,821	96	34,554
105	25	435,869	4,094,350,060	2,977	27,353,910	59	26,910	97	34,701
106	20	434,140	4,102,928,315	2,973	27,412,654	59	26,980	98	34,817
107	15	432,330	4,109,320,057	2,969	27,456,542	59	27,033	99	34,905
108	10	430,436	4,113,818,772	2,964	27,487,521	60	27,070	99	34,967
109	7	428,453	4,116,820,935	2,959	27,508,258	60	27,095	100	35,009
110	6	426,378	4,119,188,398	2,955	27,524,665	60	27,115	101	35,043
111	5	424,205	4,121,203,374	2,950	27,538,679	60	27,132	102	35,072
112	3	421,932	4,122,574,654	2,946	27,548,253	60	27,144	102	35,092
113	1	419,554	4,122,994,207	2,941	27,551,194	60	27,148	103	35,098

Table D-2; Valley Site; Dry---p.2

Central Valley

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal	Reclaimed Water Plant Wastewater gpm	Reclaimed Water Plant Wastewater kgal	Reclaimed Water Plant MU Water gpm	Reclaimed Water Plant MU Water kgal	Saline Water Plant Wastewater gpm	Saline Water Plant Wastewater kgal	Saline Water Plant MU Water gpm	Saline Water Plant MU Water kgal	Brackish Water Plant Wastewater gpm	Brackish Water Plant Wastewater kgal	Brackish Water Plant MU Water gpm	Brackish Water Plant MU Water kgal
17	0	516,249	0	3,418	0	167	0	1,278	0	103	0	1,278	0	156	0	1,278	0	144	0	1,278	0
18	0	515,340	51,909	3,413	344	169	1	1,287	8	104	1	1,287	8	158	1	1,287	8	145	1	1,287	8
19	0	514,444	103,728	3,408	687	170	2	1,295	16	106	1	1,295	16	159	2	1,295	16	147	2	1,295	16
20	0	513,561	155,457	3,403	1,030	172	3	1,304	23	107	2	1,304	23	161	3	1,304	23	148	3	1,304	23
21	0	512,691	207,098	3,398	1,372	174	4	1,313	31	108	3	1,313	31	163	4	1,313	31	150	4	1,313	31
22	0	511,833	258,652	3,392	1,714	176	5	1,322	39	109	3	1,322	39	164	5	1,322	39	151	4	1,322	39
23	0	510,986	310,119	3,387	2,055	177	6	1,331	47	110	4	1,331	47	166	6	1,331	47	153	5	1,331	47
24	0	510,150	361,502	3,382	2,396	179	7	1,340	56	111	5	1,340	56	167	7	1,340	56	154	6	1,340	56
25	0	509,324	412,802	3,376	2,736	180	8	1,349	64	112	5	1,349	64	169	8	1,349	64	155	7	1,349	64
26	0	508,509	464,018	3,371	3,075	182	10	1,359	72	113	6	1,359	72	170	9	1,359	72	157	8	1,359	72
27	0	507,703	513,226	3,366	3,401	184	11	1,368	80	114	7	1,368	80	172	10	1,368	80	158	9	1,368	80
28	1	506,906	882,187	3,360	5,847	185	19	1,378	140	115	12	1,378	140	173	17	1,378	140	160	16	1,378	140
29	1	506,118	1,244,203	3,355	8,247	187	27	1,387	200	116	17	1,387	200	175	25	1,387	200	161	23	1,387	200
30	1	505,338	1,679,049	3,349	11,129	188	36	1,397	272	116	23	1,397	272	176	34	1,397	272	162	31	1,397	272
31	1	504,565	2,356,361	3,344	15,617	190	52	1,406	385	117	32	1,406	385	177	48	1,406	385	163	45	1,406	385
32	2	503,801	3,541,703	3,338	23,471	191	79	1,416	585	118	49	1,416	585	179	74	1,416	585	165	68	1,416	585
33	4	503,042	5,596,579	3,333	37,085	193	126	1,426	934	119	78	1,426	934	180	118	1,426	934	166	108	1,426	934
34	7	502,291	8,972,437	3,327	59,445	194	204	1,436	1,513	120	126	1,436	1,513	181	191	1,436	1,513	167	176	1,436	1,513
35	10	501,545	14,198,728	3,322	94,057	196	326	1,446	2,417	121	202	1,446	2,417	183	305	1,446	2,417	168	281	1,446	2,417
36	15	500,806	21,865,054	3,316	144,818	197	507	1,456	3,754	122	314	1,456	3,754	184	474	1,456	3,754	170	437	1,456	3,754
37	21	500,071	32,597,473	3,310	215,865	198	763	1,466	5,642	123	472	1,466	5,642	185	713	1,466	5,642	171	657	1,466	5,642
38	29	499,342	47,028,990	3,305	311,378	200	1,109	1,476	8,201	124	687	1,476	8,201	187	1,037	1,476	8,201	172	955	1,476	8,201
39	38	498,617	65,764,308	3,299	435,347	201	1,563	1,486	11,552	125	967	1,486	11,552	188	1,461	1,486	11,552	173	1,346	1,486	11,552
40	47	497,897	89,338,852	3,294	591,300	203	2,138	1,497	15,803	125	1,324	1,497	15,803	189	1,999	1,497	15,803	175	1,842	1,497	15,803
41	58	497,180	118,172,152	3,288	781,993	204	2,848	1,507	21,047	126	1,763	1,507	21,047	191	2,663	1,507	21,047	176	2,454	1,507	21,047
42	69	496,468	152,515,599	3,283	1,009,072	205	3,701	1,518	27,346	127	2,291	1,518	27,346	192	3,460	1,518	27,346	177	3,188	1,518	27,346
43	80	495,758	192,394,642	3,277	1,272,684	207	4,699	1,528	34,721	128	2,909	1,528	34,721	193	4,394	1,528	34,721	178	4,048	1,528	34,721
44	91	495,051	237,545,463	3,272	1,571,066	208	5,838	1,539	43,141	129	3,614	1,539	43,141	195	5,459	1,539	43,141	179	5,029	1,539	43,141
45	101	494,348	287,346,186	3,266	1,900,092	210	7,105	1,549	52,506	130	4,398	1,549	52,506	196	6,644	1,549	52,506	181	6,121	1,549	52,506
46	108	493,646	340,742,659	3,261	2,252,781	211	8,474	1,560	62,632	131	5,246	1,560	62,632	197	7,924	1,560	62,632	182	7,300	1,560	62,632
47	112	492,947	396,168,868	3,255	2,618,779	212	9,907	1,571	73,231	131	6,133	1,571	73,231	199	9,264	1,571	73,231	183	8,535	1,571	73,231
48	123	492,249	456,546,273	3,250	3,017,367	214	11,481	1,582	84,873	132	7,107	1,582	84,873	200	10,735	1,582	84,873	184	9,890	1,582	84,873
49	140	491,553	525,206,703	3,244	3,470,517	215	13,284	1,593	98,224	133	8,224	1,593	98,224	201	12,422	1,593	98,224	185	11,444	1,593	98,224
50	154	490,859	600,729,209	3,239	3,968,826	217	15,284	1,604	113,031	134	9,462	1,604	113,031	203	14,292	1,604	113,031	187	13,167	1,604	113,031
51	165	490,165	681,835,429	3,233	4,503,839	218	17,449	1,615	129,066	135	10,802	1,615	129,066	204	16,316	1,615	129,066	188	15,032	1,615	129,066
52	175	489,473	767,383,509	3,228	5,068,011	219	19,751	1,626	146,121	136	12,226	1,626	146,121	205	18,468	1,626	146,121	189	17,015	1,626	146,121
53	182	488,781	856,360,732	3,223	5,654,652	221	22,163	1,638	164,007	137	13,720	1,638	164,007	207	20,724	1,638	164,007	190	19,093	1,638	164,007
54	187	488,089	947,876,170	3,217	6,257,882	222	24,665	1,649	182,557	138	15,268	1,649	182,557	208	23,063	1,649	182,557	192	21,248	1,649	182,557
55	191	487,398	1,041,153,370	3,212	6,872,579	224	27,234	1,660	201,621	139	16,859	1,660	201,621	209	25,465	1,660	201,621	193	23,462	1,660	201,621
56	194	486,707	1,135,523,050	3,207	7,494,334	225	29,854	1,672	221,069	139	18,481	1,672	221,069	211	27,916	1,672	221,069	194	25,719	1,672	221,069
57	195	486,015	1,230,415,839	3,201	8,119,397	227	32,510	1,683	240,788	140	20,125	1,683	240,788	212	30,399	1,683	240,788	195	28,007	1,683	240,788
58	196	485,323	1,325,355,020	3,196	8,744,633	228	35,188	1,695	260,680	141	21,782	1,695	260,680	213	32,902	1,695	260,680	197	30,314	1,695	260,680
59	195	484,631	1,419,949,308	3,191	9,367,470	230	37,877	1,706	280,664	142	23,447	1,706	280,664	215	35,417	1,706	280,664	198	32,630	1,706	280,664
60	194	483,938	1,513,885,648	3,186	9,985,856	231	40,568	1,718	300,673	143	25,113	1,718	300,673	216	37,934	1,718	300,673	199	34,949	1,718	300,673
61	193	483,244	1,606,922,027	3,181	10,598,205	233	43,255	1,730	320,655	144	26,776	1,730	320,655	217	40,446	1,730	320,655	200	37,264	1,730	320,655

Table D.2-2; Valley Site---Wet Cooling---p. 1

Central Valley

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal	Reclaimed Water Plant Wastewater gpm	Reclaimed Water Plant Wastewater kgal	Reclaimed Water Plant MU Water gpm	Reclaimed Water Plant MU Water kgal	Saline Water Plant Wastewater gpm	Saline Water Plant Wastewater kgal	Saline Water Plant MU Water gpm	Saline Water Plant MU Water kgal	Brackish Water Plant Wastewater gpm	Brackish Water Plant Wastewater kgal	Brackish Water Plant MU Water gpm	Brackish Water Plant MU Water kgal
62	191	482,550	1,698,880,320	3,176	11,203,353	234	45,931	1,742	340,568	145	28,433	1,742	340,568	219	42,949	1,742	340,568	202	39,569	1,742	340,568
63	188	481,854	1,789,639,143	3,170	11,800,510	236	48,594	1,753	360,383	146	30,081	1,753	360,383	220	45,438	1,753	360,383	203	41,863	1,753	360,383
64	186	481,157	1,879,126,740	3,165	12,389,215	237	51,240	1,765	380,082	147	31,719	1,765	380,082	222	47,912	1,765	380,082	204	44,142	1,765	380,082
65	184	480,459	1,967,313,887	3,160	12,969,284	239	53,868	1,777	399,654	148	33,346	1,777	399,654	223	50,370	1,777	399,654	206	46,406	1,777	399,654
66	181	479,759	2,054,206,812	3,155	13,540,767	240	56,478	1,789	419,096	149	34,962	1,789	419,096	225	52,810	1,789	419,096	207	48,655	1,789	419,096
67	179	479,058	2,139,840,144	3,150	14,103,901	242	59,070	1,801	438,414	150	36,566	1,801	438,414	226	55,234	1,801	438,414	208	50,888	1,801	438,414
68	177	478,355	2,224,269,886	3,145	14,659,063	243	61,646	1,813	457,616	151	38,161	1,813	457,616	227	57,643	1,813	457,616	210	53,108	1,813	457,616
69	174	477,651	2,307,566,404	3,140	15,206,724	245	64,208	1,825	476,715	152	39,747	1,825	476,715	229	60,038	1,825	476,715	211	55,314	1,825	476,715
70	172	476,945	2,389,807,442	3,136	15,747,404	246	66,757	1,837	495,725	153	41,325	1,837	495,725	230	62,422	1,837	495,725	212	57,510	1,837	495,725
71	171	476,237	2,471,071,166	3,131	16,281,625	248	69,296	1,850	514,661	154	42,897	1,850	514,661	232	64,796	1,850	514,661	214	59,698	1,850	514,661
72	169	475,528	2,551,429,225	3,126	16,809,865	250	71,826	1,862	533,539	154	44,463	1,862	533,539	233	67,162	1,862	533,539	215	61,877	1,862	533,539
73	167	474,816	2,630,939,846	3,121	17,332,515	251	74,350	1,874	552,368	155	46,025	1,874	552,368	235	69,521	1,874	552,368	216	64,051	1,874	552,368
74	166	474,103	2,709,640,942	3,116	17,849,831	253	76,867	1,886	571,155	156	47,583	1,886	571,155	236	71,875	1,886	571,155	218	66,220	1,886	571,155
75	165	473,388	2,787,543,263	3,112	18,361,890	254	79,379	1,899	589,901	157	49,138	1,899	589,901	238	74,224	1,899	589,901	219	68,384	1,899	589,901
76	163	472,671	2,864,623,563	3,107	18,868,547	256	81,883	1,911	608,599	158	50,688	1,911	608,599	239	76,566	1,911	608,599	221	70,541	1,911	608,599
77	161	471,952	2,940,817,794	3,102	19,369,386	258	84,379	1,923	627,228	159	52,233	1,923	627,228	241	78,899	1,923	627,228	222	72,691	1,923	627,228
78	160	471,231	3,016,014,342	3,098	19,863,680	259	86,861	1,936	645,761	160	53,770	1,936	645,761	242	81,220	1,936	645,761	223	74,829	1,936	645,761
79	157	470,508	3,090,047,273	3,093	20,350,345	261	89,323	1,948	664,151	161	55,294	1,948	664,151	244	83,523	1,948	664,151	225	76,951	1,948	664,151
80	155	469,784	3,162,689,626	3,088	20,827,892	263	91,759	1,960	682,339	162	56,802	1,960	682,339	245	85,800	1,960	682,339	226	79,049	1,960	682,339
81	151	469,058	3,233,646,726	3,084	21,294,390	264	94,156	1,973	700,244	164	58,286	1,973	700,244	247	88,042	1,973	700,244	228	81,115	1,973	700,244
82	147	468,330	3,302,549,533	3,079	21,747,416	266	96,503	1,985	717,769	165	59,738	1,985	717,769	249	90,236	1,985	717,769	229	83,136	1,985	717,769
83	142	467,600	3,368,948,019	3,075	22,184,014	267	98,781	1,998	734,788	166	61,149	1,998	734,788	250	92,366	1,998	734,788	230	85,099	1,998	734,788
84	136	466,869	3,432,304,579	3,070	22,600,649	269	100,973	2,010	751,154	167	62,505	2,010	751,154	252	94,415	2,010	751,154	232	86,987	2,010	751,154
85	128	466,136	3,491,987,471	3,066	22,993,168	271	103,053	2,022	766,691	168	63,793	2,022	766,691	253	96,360	2,022	766,691	233	88,779	2,022	766,691
86	119	465,402	3,547,264,294	3,061	23,356,751	272	104,994	2,035	781,192	169	64,995	2,035	781,192	255	98,175	2,035	781,192	235	90,451	2,035	781,192
87	108	464,667	3,597,295,489	3,057	23,685,872	274	106,765	2,047	794,418	170	66,091	2,047	794,418	256	99,831	2,047	794,418	236	91,977	2,047	794,418
88	109	463,930	3,647,762,976	3,052	24,017,907	276	108,564	2,060	807,862	171	67,205	2,060	807,862	258	101,514	2,060	807,862	238	93,527	2,060	807,862
89	102	463,193	3,694,901,235	3,048	24,328,081	277	110,258	2,072	820,514	172	68,253	2,072	820,514	259	103,098	2,072	820,514	239	94,986	2,072	820,514
90	96	462,454	3,739,288,877	3,043	24,620,199	279	111,865	2,085	832,519	173	69,248	2,085	832,519	261	104,600	2,085	832,519	240	96,370	2,085	832,519
91	91	461,715	3,781,308,624	3,039	24,896,777	281	113,398	2,097	843,969	174	70,197	2,097	843,969	262	106,033	2,097	843,969	242	97,691	2,097	843,969
92	87	460,974	3,821,231,818	3,035	25,159,596	282	114,865	2,109	854,930	175	71,105	2,109	854,930	264	107,405	2,109	854,930	243	98,955	2,109	854,930
93	83	460,234	3,859,232,237	3,030	25,409,797	284	116,271	2,122	865,440	176	71,976	2,122	865,440	266	108,720	2,122	865,440	245	100,167	2,122	865,440
94	79	459,493	3,895,399,794	3,026	25,647,971	286	117,620	2,134	875,518	177	72,810	2,134	875,518	267	109,982	2,134	875,518	246	101,329	2,134	875,518
95	75	458,752	3,929,754,135	3,022	25,874,242	287	118,911	2,146	885,162	178	73,609	2,146	885,162	269	111,188	2,146	885,162	247	102,440	2,146	885,162
96	71	458,011	3,962,258,133	3,017	26,088,362	289	120,141	2,158	894,353	179	74,371	2,158	894,353	270	112,338	2,158	894,353	249	103,500	2,158	894,353
97	67	457,270	3,992,831,278	3,013	26,289,797	290	121,306	2,171	903,061	180	75,092	2,171	903,061	272	113,428	2,171	903,061	250	104,504	2,171	903,061
98	62	456,529	4,021,362,956	3,008	26,477,814	292	122,401	2,183	911,246	181	75,770	2,183	911,246	273	114,452	2,183	911,246	252	105,447	2,183	911,246
99	58	455,789	4,047,725,627	3,004	26,651,566	294	123,420	2,195	918,864	182	76,400	2,195	918,864	275	115,404	2,195	918,864	253	106,325	2,195	918,864
100	53	455,050	4,071,787,891	3,000	26,810,183	295	124,356	2,207	925,867	183	76,980	2,207	925,867	276	116,280	2,207	925,867	254	107,131	2,207	925,867
101	48	454,312	4,093,427,455	2,995	26,952,852	297	125,204	2,219	932,209	184	77,505	2,219	932,209	277	117,073	2,219	932,209	256	107,862	2,219	932,209
102	42	453,575	4,112,543,986	2,991	27,078,907	298	125,958	2,231	937,851	185	77,972	2,231	937,851	279	117,778	2,231	937,851	257	108,512	2,231	937,851
103	36	452,840	4,129,071,864	2,986	27,187,908	300	126,615	2,243	942,763	186	78,378	2,243	942,763	280	118,392	2,243	942,763	258	109,077	2,243	942,763
104	31	452,107	4,142,992,828	2,982	27,279,729	301	127,171	2,255	946,930	186	78,723	2,255	946,930	282	118,912	2,255	946,930	260	109,557	2,255	946,930
105	25	451,376	4,154,348,523	2,978	27,354,640	303	127,628	2,267	950,351	187	79,006	2,267	950,351	283	119,339	2,267	950,351	261	109,950	2,267	950,351
106	20	450,647	4,163,252,936	2,973	27,413,387	304	127,989	2,279	953,053	188	79,229	2,279	953,053	284	119,677	2,279	953,053	262	110,261	2,279	953,053
107	15	449,920	4,169,904,741	2,969	27,457,277	306	128,260	2,290	955,084	189	79,397	2,290	955,084	286	119,930	2,290	955,084	263	110,494	2,290	955,084
108	10	449,197	4,174,599,541	2,964	27,488,257	307	128,452	2,302	956,528	190	79,516	2,302	956,528	287	120,110	2,302	956,528	264	110,660	2,302	956,528
109	7	448,477	4,177,742,013	2,960	27,508,995	308	128,582	2,313	957,501	191	79,596	2,313	957,501	288	120,231	2,313	957,501	266	110,772	2,313	957,501
110	6	447,761	4,180,228,207	2,955	27,525,403	310	128,685	2,325	958,275	192	79,660	2,325	958,275	290	120,328	2,325	958,275	267	110,861	2,325	958,275
111	5	447,048	4,182,351,687	2,950	27,539,418	311	128,774	2,336	958,941	192	79,715	2,336	958,941	291	120,411	2,336	958,941	268	110,937	2,336	958,941
112	3	446,340	4,183,802,293	2,946	27,548,991	312	128,834	2,348	959,399	193	79,752	2,348	959,399	292	120,468	2,348	959,399	269	110,990	2,348	959,399
113	1	445,637	4,184,247,929	2,941	27,551,933	313	128,853	2,359	959,540	194	79,764	2,359	959,540	293	120,485	2,359	959,540	270	111,006	2,359	959,540

Table D.2-2; Valley Site; Wet Cooling----p. 2

D.3 Coast Site

Coast

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
27	0	529,247	0	3,500	0	50	0	59	0
28	0	526,882	26,344	3,488	174	50	0	58	0
29	0	524,651	84,056	3,477	557	49	0	58	1
30	0	522,547	261,722	3,466	1,735	49	1	57	2
31	1	520,563	548,031	3,455	3,635	49	3	56	4
32	1	518,693	921,490	3,444	6,115	49	5	56	6
33	1	516,930	1,314,357	3,434	8,725	49	7	55	8
34	1	515,267	1,851,384	3,424	12,294	49	10	54	12
35	1	513,700	2,240,884	3,414	14,883	49	13	54	14
36	1	512,220	2,698,867	3,405	17,927	48	15	53	17
37	2	510,824	3,591,172	3,395	23,858	48	20	53	23
38	4	509,504	5,421,857	3,386	36,024	48	31	53	34
39	7	508,256	8,832,124	3,377	58,684	48	50	52	55
40	11	507,073	14,599,380	3,368	96,996	48	83	52	91
41	18	505,952	23,636,421	3,360	157,009	48	134	52	146
42	26	504,885	36,990,704	3,352	245,659	48	210	51	228
43	37	503,870	55,843,682	3,343	370,760	48	318	51	343
44	51	502,900	81,510,184	3,336	540,998	48	465	51	500
45	68	501,971	115,437,814	3,328	765,923	48	659	51	707
46	87	501,078	159,206,350	3,320	1,055,947	48	909	51	975
47	111	500,218	214,527,125	3,313	1,422,337	48	1,227	51	1,314
48	36	499,386	232,587,029	3,306	1,541,888	48	1,331	51	1,425
49	125	498,577	294,684,821	3,299	1,952,749	48	1,688	51	1,809
50	204	497,789	396,105,297	3,292	2,623,454	48	2,274	51	2,438
51	274	497,016	532,183,441	3,285	3,522,928	48	3,062	52	3,287
52	335	496,257	698,277,621	3,279	4,620,311	48	4,026	52	4,330
53	386	495,506	889,768,010	3,272	5,884,950	48	5,141	52	5,542
54	429	494,762	1,102,055,367	3,266	7,286,388	48	6,381	53	6,896
55	463	494,020	1,330,560,168	3,260	8,794,358	48	7,720	53	8,368
56	487	493,277	1,570,722,050	3,254	10,378,768	48	9,133	53	9,929
57	502	492,532	1,817,999,560	3,249	12,009,698	48	10,594	54	11,555
58	508	491,780	2,067,870,178	3,243	13,657,391	49	12,076	54	13,216
59	505	491,020	2,315,830,606	3,237	15,292,242	49	13,553	55	14,884
60	493	490,250	2,557,397,285	3,232	16,884,796	49	14,999	56	16,530
61	471	489,466	2,788,107,137	3,227	18,405,737	49	16,386	56	18,124
62	441	488,667	3,003,518,498	3,222	19,825,883	49	17,688	57	19,633
63	360	487,851	3,179,175,006	3,217	20,984,066	49	18,755	58	20,882

Table D.3-1; Coast Site; Dry Cooling—p. 1

Coast (cont.)						Freshwater			
		Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
64	321	487,016	3,335,398,665	3,212	22,014,311	50	19,710	59	22,010
65	285	486,161	3,473,924,012	3,207	22,928,077	50	20,561	59	23,025
66	252	485,284	3,596,200,612	3,202	23,734,933	50	21,317	60	23,937
67	222	484,383	3,703,608,802	3,198	24,443,972	50	21,985	61	24,750
68	194	483,458	3,797,459,968	3,193	25,063,823	50	22,573	62	25,474
69	169	482,507	3,878,996,807	3,189	25,602,653	51	23,086	63	26,113
70	146	481,529	3,949,393,570	3,184	26,068,170	51	23,533	64	26,674
71	126	480,525	4,009,756,295	3,180	26,467,631	51	23,919	65	27,165
72	107	479,493	4,061,123,050	3,176	26,807,839	51	24,249	66	27,590
73	91	478,432	4,104,464,177	3,172	27,095,152	52	24,530	67	27,955
74	76	477,344	4,140,682,554	3,167	27,335,484	52	24,767	68	28,265
75	63	476,226	4,170,613,870	3,163	27,534,310	52	24,964	69	28,527
76	51	475,080	4,195,026,936	3,159	27,696,666	52	25,125	71	28,744
77	41	473,906	4,214,624,009	3,156	27,827,153	53	25,256	72	28,922
78	33	472,704	4,230,041,162	3,152	27,929,942	53	25,360	73	29,065
79	25	471,474	4,241,848,673	3,148	28,008,774	53	25,440	74	29,176
80	19	470,217	4,250,551,465	3,144	28,066,961	54	25,500	75	29,259
81	13	468,935	4,256,589,570	3,140	28,107,394	54	25,542	76	29,318
82	8	467,627	4,260,338,636	3,136	28,132,538	54	25,568	78	29,356
83	12	466,295	4,265,714,588	3,133	28,168,653	55	25,605	79	29,410
84	10	464,940	4,270,594,055	3,129	28,201,489	55	25,640	80	29,461
85	9	463,563	4,274,787,830	3,125	28,229,760	55	25,670	81	29,505
86	8	462,167	4,278,369,997	3,121	28,253,952	55	25,696	82	29,543
87	7	460,753	4,281,409,669	3,117	28,274,518	56	25,718	84	29,576
88	6	459,322	4,283,971,019	3,114	28,291,881	56	25,736	85	29,605
89	5	457,877	4,286,113,311	3,110	28,306,431	56	25,752	86	29,629
90	4	456,420	4,287,890,945	3,106	28,318,528	57	25,765	87	29,649
91	3	454,953	4,289,353,488	3,102	28,328,501	57	25,776	88	29,666
92	3	453,478	4,290,545,726	3,098	28,336,647	57	25,785	89	29,680
93	2	451,999	4,291,507,706	3,094	28,343,233	57	25,793	90	29,692
94	2	450,518	4,292,274,784	3,090	28,348,495	58	25,799	91	29,701
95	1	449,037	4,292,877,679	3,086	28,352,639	58	25,803	92	29,708
96	1	447,561	4,293,342,525	3,082	28,355,840	58	25,807	93	29,714
97	1	446,091	4,293,690,923	3,078	28,358,244	58	25,810	94	29,719
98	1	444,632	4,293,939,998	3,074	28,359,966	59	25,812	95	29,722
99	0	443,187	4,294,102,454	3,070	28,361,091	59	25,813	96	29,724
100	0	441,760	4,294,146,870	3,066	28,361,400	59	25,813	97	29,725
101	0	440,354	4,294,164,484	3,061	28,361,522	59	25,813	98	29,725
102	0	438,974	4,294,168,874	3,057	28,361,553	59	25,813	98	29,725

Table D.3-1; Coast Site; Dry Cooling---p. 2

Coast

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater				Reclaimed Water			
						Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
27	0	524,453	0	3,499	0	165	0	1,660	0	371	0	1,866	0
28	0	523,143	26,157	3,487	174	165	0	1,663	5	372	1	1,869	6
29	0	521,856	83,561	3,476	557	166	2	1,666	16	373	4	1,873	18
30	0	520,590	260,562	3,465	1,735	166	5	1,669	50	374	11	1,876	56
31	1	519,347	546,203	3,454	3,635	167	10	1,672	105	375	24	1,880	118
32	1	518,125	919,252	3,444	6,114	167	18	1,676	178	376	40	1,885	200
33	1	516,924	1,312,114	3,433	8,724	167	25	1,680	254	377	57	1,889	286
34	1	515,744	1,849,639	3,423	12,292	168	36	1,684	360	378	81	1,894	404
35	1	514,585	2,239,810	3,414	14,880	168	43	1,689	436	379	98	1,899	491
36	1	513,446	2,698,889	3,404	17,924	169	53	1,693	527	380	118	1,904	593
37	2	512,328	3,593,822	3,395	23,854	169	70	1,698	705	381	158	1,910	793
38	4	511,230	5,430,708	3,386	36,018	170	107	1,704	1,072	382	241	1,916	1,206
39	7	510,151	8,853,690	3,377	58,676	171	176	1,709	1,761	384	395	1,922	1,980
40	11	509,091	14,643,898	3,368	96,982	171	292	1,715	2,931	385	658	1,929	3,297
41	18	508,051	23,718,434	3,360	156,989	172	476	1,721	4,776	386	1,072	1,936	5,372
42	26	507,029	37,129,414	3,351	245,630	172	750	1,728	7,518	388	1,688	1,944	8,456
43	37	506,025	56,063,051	3,343	370,718	173	1,139	1,735	11,413	390	2,562	1,951	12,837
44	51	505,040	81,838,779	3,335	540,939	174	1,671	1,742	16,748	391	3,760	1,959	18,837
45	68	504,072	115,908,427	3,328	765,843	175	2,379	1,750	23,843	393	5,354	1,968	26,817
46	87	503,121	159,855,421	3,320	1,055,840	175	3,299	1,757	33,053	395	7,422	1,977	37,177
47	111	502,188	215,394,033	3,313	1,422,197	176	4,468	1,766	44,768	397	10,053	1,986	50,354
48	36	501,271	233,522,108	3,305	1,541,737	177	4,852	1,774	48,618	398	10,918	1,995	54,684
49	125	500,370	295,843,184	3,298	1,952,563	178	6,182	1,783	61,941	400	13,910	2,005	69,669
50	204	499,485	397,609,270	3,292	2,623,211	179	8,368	1,792	83,847	402	18,829	2,016	94,309
51	274	498,616	534,125,254	3,285	3,522,608	180	11,321	1,801	113,440	404	25,473	2,026	127,593
52	335	497,761	700,723,001	3,278	4,619,899	181	14,951	1,811	149,812	407	33,639	2,037	168,503
53	386	496,922	892,760,414	3,272	5,884,431	182	19,164	1,821	192,044	409	43,119	2,049	216,002
54	429	496,097	1,105,620,543	3,266	7,285,752	183	23,868	1,832	239,201	411	53,704	2,060	269,040
55	463	495,285	1,334,710,714	3,260	8,793,594	184	28,968	1,843	290,336	413	65,179	2,072	326,551
56	487	494,487	1,575,461,706	3,254	10,377,869	185	34,368	1,854	344,483	416	77,329	2,085	387,448
57	502	493,702	1,823,326,959	3,248	12,008,661	186	39,970	1,865	400,662	418	89,932	2,097	450,629
58	508	492,930	2,073,781,819	3,243	13,656,212	187	45,673	1,877	457,872	421	102,764	2,111	514,969
59	505	492,170	2,322,322,825	3,237	15,290,922	188	51,376	1,889	515,096	424	115,596	2,124	579,323
60	493	491,422	2,564,467,035	3,232	16,883,338	189	56,976	1,901	571,295	426	128,196	2,138	642,522
61	471	490,685	2,795,751,388	3,226	18,404,145	191	62,366	1,913	625,409	429	140,325	2,152	703,376
62	441	489,959	3,011,732,112	3,221	19,824,166	192	67,440	1,926	676,357	432	151,742	2,166	760,667
63	360	489,243	3,187,889,784	3,216	20,982,247	193	71,612	1,939	718,256	434	161,128	2,181	807,781
64	321	488,537	3,344,601,331	3,211	22,012,399	194	75,353	1,953	755,841	437	169,545	2,196	850,042

Table D.3-2; Coast Site; Wet Cooling—p. 1

ɔast (cont.)

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater				Reclaimed Water			
						Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
65	285	487,841	3,483,605,374	3,207	22,926,084	196	78,699	1,966	789,459	440	177,073	2,211	887,843
66	252	487,154	3,606,353,165	3,202	23,732,867	197	81,677	1,980	819,398	443	183,774	2,227	921,505
67	222	486,475	3,714,225,212	3,197	24,441,842	198	84,316	1,994	845,933	446	189,711	2,242	951,339
68	194	485,804	3,808,531,839	3,193	25,061,637	200	86,642	2,009	869,331	449	194,945	2,258	977,645
69	169	485,140	3,890,513,723	3,188	25,600,418	201	88,681	2,023	889,846	452	199,533	2,275	1,000,709
70	146	484,484	3,961,342,402	3,184	26,065,894	203	90,457	2,038	907,724	456	203,530	2,291	1,020,807
71	126	483,834	4,022,120,776	3,180	26,465,319	204	91,994	2,053	923,198	459	206,988	2,308	1,038,203
72	107	483,190	4,073,883,569	3,175	26,805,497	205	93,314	2,068	936,492	462	209,958	2,325	1,053,147
73	91	482,551	4,117,597,795	3,171	27,092,785	207	94,438	2,084	947,817	465	212,487	2,342	1,065,877
74	76	481,917	4,154,163,184	3,167	27,333,096	208	95,386	2,099	957,373	469	214,620	2,359	1,076,618
75	63	481,288	4,184,412,608	3,163	27,531,905	210	96,177	2,115	965,347	472	216,400	2,377	1,085,581
76	51	480,662	4,209,112,487	3,159	27,694,247	211	96,829	2,130	971,915	475	217,865	2,394	1,092,964
77	41	480,039	4,228,963,178	3,155	27,824,723	213	97,356	2,146	977,240	479	219,053	2,412	1,098,949
78	33	479,419	4,244,599,353	3,151	27,927,504	214	97,776	2,162	981,471	482	219,996	2,430	1,103,704
79	25	478,801	4,256,590,369	3,147	28,006,329	216	98,100	2,178	984,744	485	220,725	2,448	1,107,382
80	19	478,185	4,265,440,627	3,144	28,064,511	217	98,341	2,194	987,181	489	221,268	2,466	1,110,120
81	13	477,570	4,271,589,917	3,140	28,104,941	219	98,510	2,210	988,889	492	221,649	2,484	1,112,039
82	8	476,954	4,275,413,766	3,136	28,130,083	220	98,616	2,226	989,959	496	221,887	2,502	1,113,242
83	12	476,339	4,280,905,521	3,132	28,166,195	222	98,770	2,243	991,511	499	222,232	2,520	1,114,985
84	10	475,723	4,285,898,153	3,129	28,199,029	223	98,910	2,259	992,933	503	222,549	2,538	1,116,583
85	9	475,105	4,290,196,341	3,125	28,227,298	225	99,032	2,275	994,168	506	222,823	2,556	1,117,971
86	8	474,485	4,293,873,980	3,121	28,251,488	226	99,138	2,291	995,233	509	223,060	2,574	1,119,168
87	7	473,862	4,297,000,137	3,117	28,272,053	228	99,228	2,307	996,146	513	223,263	2,592	1,120,193
88	6	473,236	4,299,639,076	3,113	28,289,415	229	99,304	2,322	996,923	516	223,436	2,609	1,121,066
89	5	472,606	4,301,850,282	3,110	28,303,964	231	99,369	2,338	997,580	519	223,582	2,627	1,121,804
90	4	471,971	4,303,688,484	3,106	28,316,061	232	99,424	2,354	998,130	523	223,704	2,644	1,122,422
91	3	471,331	4,305,203,679	3,102	28,326,033	234	99,469	2,369	998,587	526	223,805	2,661	1,122,935
92	3	470,685	4,306,441,156	3,098	28,334,178	235	99,506	2,384	998,963	529	223,889	2,678	1,123,358
93	2	470,033	4,307,441,516	3,094	28,340,763	237	99,536	2,399	999,269	532	223,957	2,695	1,123,702
94	2	469,373	4,308,240,697	3,090	28,346,025	238	99,560	2,414	999,516	536	224,011	2,712	1,123,979
95	1	468,705	4,308,869,999	3,086	28,350,169	239	99,580	2,429	999,711	539	224,055	2,728	1,124,199
96	1	468,028	4,309,356,103	3,082	28,353,370	241	99,595	2,443	999,864	542	224,089	2,744	1,124,370
97	1	467,342	4,309,721,098	3,078	28,355,774	242	99,606	2,457	999,979	545	224,114	2,759	1,124,499
98	1	466,646	4,309,982,505	3,074	28,357,496	243	99,614	2,470	1,000,062	548	224,132	2,774	1,124,592
99	0	465,939	4,310,153,301	3,070	28,358,621	245	99,619	2,483	1,000,116	550	224,145	2,789	1,124,653
100	0	465,221	4,310,200,076	3,065	28,358,930	246	99,621	2,496	1,000,131	553	224,148	2,803	1,124,670
101	0	464,490	4,310,218,655	3,061	28,359,052	247	99,622	2,508	1,000,137	556	224,149	2,817	1,124,677
102	0	463,746	4,310,223,293	3,056	28,359,083	248	99,622	2,520	1,000,139	558	224,150	2,830	1,124,679

Table D.3-2; Coast Site; Wet Cooling—p. 2

D.4 Mountain Site

Mountain

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
17	2	481,095	962,190	3,032	6,064	45	5	37	4
18	3	479,004	2,399,203	3,035	15,170	45	13	39	11
19	3	476,976	3,830,132	3,038	24,284	45	22	40	19
20	3	475,009	5,255,159	3,040	33,403	46	30	41	26
21	3	473,101	6,674,462	3,041	42,527	46	38	42	34
22	7	471,250	9,973,213	3,042	63,821	46	58	43	52
23	9	469,455	14,198,309	3,042	91,203	46	83	44	76
24	9	467,714	18,407,737	3,042	118,584	47	108	45	100
25	11	466,026	23,534,021	3,042	152,042	47	139	46	130
26	11	464,388	28,642,291	3,041	185,489	47	170	47	161
27	12	462,800	34,195,890	3,039	221,960	47	204	47	195
28	13	461,259	40,192,259	3,037	261,444	47	241	48	232
29	15	459,765	47,088,728	3,035	306,970	47	283	48	276
30	16	458,315	54,421,760	3,032	355,490	47	329	49	323
31	19	456,907	63,103,002	3,030	413,052	48	383	49	379
32	21	455,542	72,669,381	3,026	476,604	48	443	50	442
33	24	454,216	83,570,572	3,023	549,152	48	512	50	514
34	28	452,929	96,252,589	3,019	633,684	48	592	50	598
35	32	451,679	110,706,320	3,015	730,162	48	684	51	696
36	37	450,465	127,373,510	3,011	841,557	48	790	51	809
37	42	449,284	146,243,447	3,006	967,816	48	911	51	937
38	50	448,137	168,650,277	3,001	1,117,890	48	1,055	51	1,091
39	57	447,020	194,130,433	2,997	1,288,696	48	1,219	51	1,267
40	66	445,934	223,562,070	2,992	1,486,139	48	1,410	52	1,472
41	84	444,876	260,931,661	2,986	1,736,994	48	1,652	52	1,733
42	52	443,846	284,011,627	2,981	1,892,008	48	1,802	52	1,895
43	84	442,841	321,210,255	2,976	2,141,959	48	2,045	52	2,157
44	111	441,861	370,256,788	2,970	2,471,635	48	2,365	52	2,505
45	135	440,904	429,778,801	2,964	2,871,831	48	2,756	52	2,929
46	156	439,969	498,413,951	2,959	3,333,389	48	3,207	52	3,419
47	172	439,055	573,931,367	2,953	3,841,294	48	3,704	53	3,962
48	187	438,160	655,867,296	2,947	4,392,402	48	4,246	53	4,554
49	198	437,284	742,449,444	2,941	4,974,768	48	4,819	53	5,182
50	206	436,424	832,352,814	2,935	5,579,450	48	5,416	53	5,837
51	213	435,580	925,131,458	2,929	6,203,421	48	6,034	53	6,516
52	216	434,751	1,019,037,779	2,924	6,834,904	48	6,661	53	7,208
53	218	433,936	1,113,635,816	2,918	7,470,945	48	7,295	54	7,909
54	218	433,133	1,208,058,752	2,912	8,105,701	48	7,929	54	8,612
55	216	432,341	1,301,444,342	2,906	8,733,366	49	8,557	54	9,312
56	213	431,559	1,393,366,352	2,900	9,351,069	49	9,178	54	10,005
57	209	430,786	1,483,400,569	2,894	9,955,959	49	9,788	55	10,689
58	204	430,021	1,571,124,775	2,888	10,545,204	49	10,384	55	11,360
59	198	429,262	1,656,118,716	2,883	11,115,990	49	10,964	55	12,016
60	191	428,510	1,737,964,088	2,877	11,665,519	49	11,524	56	12,652
61	184	427,762	1,816,672,299	2,872	12,193,883	49	12,064	56	13,269
62	178	427,018	1,892,681,495	2,866	12,704,038	49	12,588	56	13,870
63	171	426,277	1,965,574,797	2,861	13,193,203	49	13,092	57	14,452
64	164	425,537	2,035,362,869	2,855	13,661,467	49	13,577	57	15,014
65	159	424,798	2,102,905,784	2,850	14,114,619	49	14,048	58	15,564
66	153	424,059	2,167,786,844	2,845	14,549,879	49	14,502	58	16,098

Table D.4-1; Mountain Site; Dry—p. 1

Mountain (cont.)

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater Plant Wastewater gpm	Freshwater Plant Wastewater kgal	Freshwater Plant MU Water gpm	Freshwater Plant MU Water kgal
67	149	423,319	2,230,861,393	2,840	14,973,004	50	14,946	59	16,623
68	146	422,577	2,292,557,637	2,835	15,386,881	50	15,382	59	17,142
69	144	421,832	2,353,301,442	2,830	15,794,385	50	15,813	60	17,659
70	144	421,083	2,413,937,416	2,825	16,201,198	50	16,245	61	18,182
71	146	420,330	2,475,305,547	2,820	16,612,977	50	16,685	61	18,718
72	149	419,571	2,537,821,576	2,816	17,032,532	50	17,136	62	19,271
73	156	418,805	2,603,155,206	2,811	17,471,096	51	17,609	63	19,856
74	164	418,033	2,671,712,589	2,807	17,931,430	51	18,108	63	20,479
75	175	417,252	2,744,731,753	2,803	18,421,888	51	18,642	64	21,152
76	132	416,463	2,799,704,893	2,798	18,791,278	51	19,047	65	21,666
77	169	415,664	2,869,952,192	2,794	19,263,514	51	19,568	66	22,332
78	158	414,856	2,935,499,369	2,790	19,704,378	52	20,056	67	22,963
79	149	414,036	2,997,190,680	2,786	20,119,543	52	20,518	67	23,565
80	140	413,204	3,055,039,246	2,782	20,509,093	52	20,955	68	24,139
81	131	412,360	3,109,058,413	2,779	20,873,106	52	21,364	69	24,683
82	123	411,503	3,159,673,281	2,775	21,214,436	52	21,751	70	25,200
83	115	410,632	3,206,895,984	2,771	21,533,149	53	22,114	71	25,691
84	106	409,747	3,250,329,169	2,768	21,826,542	53	22,450	72	26,149
85	100	408,847	3,291,213,854	2,764	22,102,978	53	22,769	73	26,587
86	92	407,931	3,328,743,511	2,761	22,356,982	53	23,063	74	26,995
87	85	406,999	3,363,338,429	2,758	22,591,371	54	23,336	75	27,378
88	79	406,050	3,395,416,396	2,754	22,808,950	54	23,591	76	27,738
89	72	405,084	3,424,582,447	2,751	23,007,009	54	23,825	77	28,071
90	67	404,100	3,451,657,143	2,748	23,191,092	54	24,043	78	28,384
91	61	403,097	3,476,246,086	2,744	23,358,489	55	24,243	79	28,674
92	56	402,076	3,498,762,340	2,741	23,511,980	55	24,427	80	28,943
93	50	401,035	3,518,814,092	2,738	23,648,861	55	24,592	81	29,186
94	47	399,974	3,537,612,879	2,734	23,777,372	55	24,748	82	29,417
95	41	398,893	3,553,967,490	2,731	23,889,341	56	24,885	83	29,622
96	38	397,791	3,569,083,545	2,728	23,992,987	56	25,012	84	29,813
97	34	396,668	3,582,570,242	2,724	24,085,606	56	25,126	85	29,987
98	31	395,523	3,594,831,442	2,721	24,169,944	56	25,231	86	30,146
99	28	394,356	3,605,873,397	2,717	24,246,020	56	25,326	87	30,292
100	25	393,166	3,615,702,547	2,713	24,313,852	57	25,411	88	30,424
101	25	391,954	3,625,501,389	2,710	24,381,590	57	25,496	89	30,557
102	25	390,718	3,635,269,344	2,706	24,449,230	57	25,582	89	30,691
103	24	389,459	3,644,616,365	2,702	24,514,067	57	25,664	90	30,821
104	22	388,176	3,653,156,248	2,697	24,573,408	57	25,740	91	30,941
105	21	386,870	3,661,280,510	2,693	24,629,961	58	25,813	92	31,057
106	18	385,538	3,668,220,202	2,688	24,678,352	58	25,875	92	31,157
107	18	384,183	3,675,135,489	2,684	24,726,658	58	25,938	93	31,257
108	16	382,802	3,681,260,319	2,679	24,769,517	58	25,993	94	31,347
109	15	381,396	3,686,981,260	2,673	24,809,619	58	26,046	94	31,432
110	13	379,965	3,691,920,804	2,668	24,844,303	58	26,091	94	31,505
111	12	378,508	3,696,462,904	2,662	24,876,250	58	26,133	95	31,573
112	11	377,026	3,700,610,190	2,656	24,905,469	58	26,172	95	31,636
113	10	375,518	3,704,365,368	2,650	24,931,967	58	26,207	95	31,693
114	9	373,984	3,707,731,221	2,643	24,955,756	58	26,238	95	31,745
115	7	372,423	3,710,338,185	2,636	24,974,208	58	26,263	95	31,785
116	7	370,837	3,712,934,044	2,629	24,992,609	58	26,287	95	31,825
117	22	369,224	3,721,056,975	2,621	25,050,268	58	26,365	95	31,951

Table D.4-1; Mountain Site; Dry—p. 2

Mountain

Ambient DB, F	Observed hours	Plant Net Output kw	Cum Plant Net Output kwh	Plant Total Fuel LHV Input MBTU/hr	Cum Plant Total Fuel LHV Input MBTU	Freshwater				Reclaimed Water			
						Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal	Plant Wastewater gpm	Plant Wastewater kgal	Plant MU Water gpm	Plant MU Water kgal
17	2	453,072	906,144	3,065	6,130	157	19	1,153	138	97	12	1,153	138
18	3	453,686	2,267,202	3,065	15,326	159	47	1,169	349	98	29	1,169	349
19	3	454,213	3,629,840	3,065	24,522	161	76	1,185	562	100	47	1,185	562
20	3	454,655	4,993,805	3,065	33,716	163	106	1,200	778	101	65	1,200	778
21	3	455,016	6,358,854	3,064	42,908	165	135	1,215	997	102	84	1,215	997
22	7	455,300	9,545,956	3,062	64,345	167	206	1,228	1,513	103	127	1,228	1,513
23	9	455,510	13,645,546	3,061	91,892	169	297	1,242	2,183	104	184	1,242	2,183
24	9	455,649	17,746,388	3,059	119,421	170	388	1,255	2,861	105	240	1,255	2,861
25	11	455,721	22,759,314	3,056	153,041	172	502	1,267	3,697	106	311	1,267	3,697
26	11	455,728	27,772,319	3,054	186,632	173	616	1,279	4,541	107	382	1,279	4,541
27	12	455,673	33,240,400	3,051	223,241	175	742	1,290	5,469	108	460	1,290	5,469
28	13	455,561	39,162,691	3,047	262,857	176	880	1,301	6,484	109	545	1,301	6,484
29	15	455,393	45,993,586	3,044	308,516	178	1,040	1,311	7,664	110	644	1,311	7,664
30	16	455,173	53,276,350	3,040	357,159	179	1,212	1,322	8,933	111	750	1,322	8,933
31	19	454,903	61,919,503	3,036	414,846	181	1,418	1,332	10,451	112	878	1,332	10,451
32	21	454,586	71,465,811	3,032	478,517	182	1,647	1,341	12,141	113	1,019	1,341	12,141
33	24	454,225	82,367,216	3,028	551,178	183	1,910	1,350	14,085	113	1,183	1,350	14,085
34	28	453,823	95,074,255	3,023	635,820	184	2,220	1,359	16,369	114	1,374	1,359	16,369
35	32	453,381	109,582,462	3,018	732,401	185	2,576	1,368	18,996	115	1,595	1,368	18,996
36	37	452,904	126,339,900	3,013	843,890	187	2,990	1,377	22,052	115	1,851	1,377	22,052
37	42	452,392	145,340,363	3,008	970,231	188	3,463	1,385	25,542	116	2,144	1,385	25,542
38	50	451,849	167,932,792	3,003	1,120,378	189	4,030	1,393	29,722	117	2,494	1,393	29,722
39	57	451,276	193,655,516	2,998	1,291,241	190	4,679	1,401	34,514	118	2,897	1,401	34,514
40	66	450,676	223,400,136	2,992	1,488,724	191	5,435	1,409	40,094	118	3,365	1,409	40,094
41	84	450,051	261,204,450	2,987	1,739,600	192	6,403	1,417	47,235	119	3,964	1,417	47,235
42	52	449,404	284,573,450	2,981	1,894,613	193	7,005	1,425	51,680	120	4,337	1,425	51,680
43	84	448,736	322,267,239	2,975	2,144,540	194	7,983	1,432	58,899	120	4,942	1,432	58,899
44	111	448,049	372,000,627	2,970	2,474,162	195	9,283	1,440	68,488	121	5,746	1,440	68,488
45	135	447,345	432,392,151	2,964	2,874,271	196	10,871	1,447	80,211	121	6,730	1,447	80,211
46	156	446,626	502,065,759	2,958	3,335,708	197	12,716	1,455	93,829	122	7,872	1,455	93,829
47	172	445,894	578,759,444	2,952	3,843,461	198	14,761	1,462	108,921	123	9,138	1,462	108,921
48	187	445,150	662,002,459	2,946	4,394,391	199	16,995	1,470	125,413	123	10,521	1,470	125,413
49	198	444,396	749,992,915	2,940	4,976,559	200	19,373	1,477	142,965	124	11,993	1,477	142,965
50	206	443,634	841,381,596	2,934	5,581,030	201	21,859	1,485	161,320	125	13,532	1,485	161,320
51	213	442,866	935,711,998	2,928	6,204,782	202	24,443	1,493	180,396	125	15,131	1,493	180,396
52	216	442,092	1,031,203,822	2,923	6,836,044	203	27,076	1,500	199,840	126	16,761	1,500	199,840
53	218	441,314	1,127,410,250	2,917	7,471,868	204	29,748	1,508	219,565	126	18,415	1,508	219,565
54	218	440,533	1,223,446,529	2,911	8,106,415	205	32,433	1,516	239,393	127	20,077	1,516	239,393
55	216	439,752	1,318,432,860	2,905	8,733,881	206	35,107	1,524	259,142	128	21,732	1,524	259,142
56	213	438,970	1,411,933,368	2,899	9,351,400	207	37,757	1,532	278,719	128	23,373	1,532	278,719
57	209	438,188	1,503,514,757	2,893	9,956,122	208	40,371	1,540	298,030	129	24,991	1,540	298,030
58	204	437,409	1,592,746,281	2,888	10,545,215	210	42,936	1,548	316,981	130	26,579	1,548	316,981
59	198	436,633	1,679,199,697	2,882	11,115,864	211	45,438	1,557	335,474	130	28,128	1,557	335,474
60	191	435,861	1,762,449,214	2,876	11,665,273	212	47,865	1,565	353,411	131	29,631	1,565	353,411
61	184	435,094	1,842,506,524	2,871	12,193,532	213	50,216	1,574	370,786	132	31,086	1,574	370,786
62	178	434,332	1,919,817,695	2,866	12,703,595	214	52,502	1,583	387,689	133	32,501	1,583	387,689
63	171	433,577	1,993,959,379	2,860	13,192,679	215	54,710	1,592	404,019	133	33,868	1,592	404,019
64	164	432,829	2,064,943,298	2,855	13,660,873	216	56,840	1,601	419,770	134	35,187	1,601	419,770
65	159	432,088	2,133,645,300	2,850	14,113,962	218	58,916	1,610	435,130	135	36,472	1,610	435,130
66	153	431,355	2,199,642,688	2,844	14,549,166	219	60,926	1,619	449,996	135	37,716	1,619	449,996

Table D.4-2; Mountain Site; Wet—p. 1

Mountain (cont.)

						Freshwater				Reclaimed Water			
Ambient	Observed	Plant Net Output	Cum Plant Net Output	Plant Total Fuel LHV Input	Cum Plant Total Fuel LHV Input	Plant Wastewater	Plant Wastewater	Plant MU Water	Plant MU Water	Plant Wastewater	Plant Wastewater	Plant MU Water	Plant MU Water
DB, F	hours	kw	kwh	MBTU/hr	MBTU	gpm	kgal	gpm	kgal	gpm	kgal	gpm	kgal
67	149	430,632	2,263,806,784	2,839	14,972,238	220	62,893	1,629	464,560	136	38,934	1,629	464,560
68	146	429,917	2,326,574,600	2,834	15,386,065	221	64,833	1,639	478,916	137	40,134	1,639	478,916
69	144	429,211	2,388,380,976	2,830	15,793,518	223	66,757	1,649	493,161	138	41,325	1,649	493,161
70	144	428,515	2,450,087,130	2,825	16,200,279	224	68,692	1,659	507,493	139	42,523	1,659	507,493
71	146	427,829	2,512,550,136	2,820	16,612,001	225	70,665	1,669	522,115	139	43,745	1,669	522,115
72	149	427,153	2,576,195,876	2,815	17,031,493	227	72,692	1,680	537,130	140	45,000	1,680	537,130
73	156	426,486	2,642,727,768	2,811	17,469,983	228	74,826	1,690	552,949	141	46,321	1,690	552,949
74	164	425,830	2,712,563,955	2,806	17,930,229	229	77,083	1,701	569,686	142	47,718	1,701	569,686
75	175	425,184	2,786,971,214	2,802	18,420,580	231	79,507	1,712	587,660	143	49,219	1,712	587,660
76	132	424,548	2,843,011,569	2,798	18,789,879	232	81,346	1,723	601,305	144	50,357	1,723	601,305
77	169	423,922	2,914,654,328	2,794	19,261,984	234	83,716	1,734	618,888	145	51,824	1,734	618,888
78	158	423,305	2,981,536,455	2,789	19,702,708	235	85,945	1,745	635,435	146	53,204	1,745	635,435
79	149	422,697	3,044,518,261	2,785	20,117,726	237	88,060	1,757	651,142	146	54,514	1,757	651,142
80	140	422,098	3,103,611,912	2,781	20,507,119	238	90,060	1,769	665,997	147	55,752	1,769	665,997
81	131	421,507	3,158,829,279	2,777	20,870,971	240	91,944	1,780	679,990	148	56,918	1,780	679,990
82	123	420,924	3,210,602,873	2,774	21,212,132	241	93,723	1,792	693,217	149	58,019	1,792	693,217
83	115	420,348	3,258,942,850	2,770	21,530,671	243	95,398	1,804	705,665	150	59,056	1,804	705,665
84	106	419,778	3,303,439,348	2,766	21,823,889	244	96,951	1,816	717,216	151	60,017	1,816	717,216
85	100	419,215	3,345,360,828	2,763	22,100,146	246	98,425	1,828	728,186	152	60,930	1,828	728,186
86	92	418,656	3,383,877,214	2,759	22,353,972	247	99,791	1,841	738,347	153	61,776	1,841	738,347
87	85	418,102	3,419,415,899	2,755	22,588,184	249	101,060	1,853	747,797	154	62,561	1,853	747,797
88	79	417,551	3,452,402,452	2,752	22,805,587	250	102,248	1,865	756,638	155	63,296	1,865	756,638
89	72	417,003	3,482,426,652	2,748	23,003,477	252	103,337	1,878	764,750	156	63,971	1,878	764,750
90	67	416,456	3,510,329,174	2,745	23,187,394	254	104,356	1,890	772,348	157	64,602	1,890	772,348
91	61	415,909	3,535,699,596	2,742	23,354,633	255	105,291	1,903	779,312	158	65,180	1,903	779,312
92	56	415,361	3,558,959,788	2,738	23,507,972	257	106,154	1,915	785,747	159	65,715	1,915	785,747
93	50	414,810	3,579,700,307	2,735	23,644,713	258	106,929	1,928	791,529	160	66,195	1,928	791,529
94	47	414,257	3,599,170,372	2,731	23,773,090	260	107,662	1,940	797,000	161	66,649	1,940	797,000
95	41	413,698	3,616,131,997	2,728	23,884,938	262	108,306	1,952	801,803	162	67,047	1,952	801,803
96	38	413,133	3,631,831,063	2,725	23,988,472	263	108,906	1,965	806,282	163	67,418	1,965	806,282
97	34	412,561	3,645,858,126	2,721	24,080,990	265	109,446	1,977	810,315	164	67,753	1,977	810,315
98	31	411,979	3,658,629,465	2,718	24,165,237	266	109,941	1,989	814,014	165	68,059	1,989	814,014
99	28	411,386	3,670,148,264	2,714	24,241,232	268	110,391	2,001	817,376	166	68,338	2,001	817,376
100	25	410,780	3,680,417,764	2,711	24,308,994	269	110,795	2,013	820,396	167	68,588	2,013	820,396
101	25	410,160	3,690,671,761	2,707	24,376,665	271	111,202	2,025	823,433	168	68,840	2,025	823,433
102	25	409,523	3,700,909,848	2,703	24,444,242	272	111,610	2,036	826,487	169	69,093	2,036	826,487
103	24	408,869	3,710,722,703	2,699	24,509,025	274	112,004	2,048	829,435	170	69,337	2,048	829,435
104	22	408,194	3,719,702,977	2,695	24,568,322	275	112,368	2,059	832,153	170	69,562	2,059	832,153
105	21	407,497	3,728,260,424	2,691	24,624,839	277	112,716	2,070	834,760	171	69,777	2,070	834,760
106	18	406,776	3,735,582,400	2,687	24,673,206	278	113,016	2,080	837,007	172	69,963	2,080	837,007
107	18	406,029	3,742,890,922	2,683	24,721,497	279	113,318	2,090	839,265	173	70,150	2,090	839,265
108	16	405,253	3,749,374,970	2,678	24,764,350	281	113,587	2,100	841,281	174	70,317	2,100	841,281
109	15	404,446	3,755,441,662	2,674	24,804,455	282	113,841	2,110	843,180	174	70,474	2,110	843,180
110	13	403,606	3,760,688,540	2,669	24,839,150	283	114,062	2,119	844,833	175	70,610	2,119	844,833
111	12	402,730	3,765,521,303	2,664	24,871,117	284	114,266	2,128	846,366	176	70,737	2,128	846,366
112	11	401,816	3,769,941,283	2,659	24,900,362	285	114,455	2,137	847,776	177	70,854	2,137	847,776
113	10	400,862	3,773,949,900	2,653	24,926,894	286	114,627	2,145	849,063	177	70,960	2,145	849,063
114	9	399,864	3,777,548,675	2,648	24,950,722	287	114,782	2,152	850,225	178	71,056	2,152	850,225
115	7	398,820	3,780,340,415	2,642	24,969,213	288	114,903	2,159	851,132	178	71,131	2,159	851,132
116	7	397,727	3,783,124,507	2,635	24,987,660	289	115,024	2,166	852,041	179	71,206	2,166	852,041
117	22	396,583	3,791,849,342	2,629	25,045,496	290	115,407	2,172	854,908	179	71,443	2,172	854,908

Table D.4-2; Mountain Site; Wet—p. 2

APPENDIX E

WASTE WATER TREATMENT OPTIONS SUMMARY

Op Factor 80%	Wet Cooling Towers				Air Cooled Condensers			
	Coast	Mountain	Central Valley	Desert	Coast	Mountain	Central Valley	Desert
Power Output, MWh/year	3,448,179	3,033,479	3,347,398	3,312,697	3,435,335	2,976,846	3,298,395	3,277,130
Total Fuel LHV Input, MBTU/year	22,687,266	20,036,397	22,041,546	21,892,090	22,689,242	20,040,214	22,040,955	21,904,839
Freshwater								
Plant Make-up, AF/year	2,455	2,099	2,356	2,593	73.0	78.4	86.2	98.5
Plant Wastewater, AF/year	245	283	316	348	63.4	64.7	66.7	69.6
Treatment Technology	None	Evap/Crys	Evap/Crys	Evap/Crys	None	Evap/Crys	Evap/Crys	Evap/Crys
Treatment Power Requirement, kw	60	818	923	1,016	13	176	204	235
Evap Ponds, acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating & Maintenance Staff	1.00	3.11	3.11	3.11	1.00	3.11	3.11	3.11
Total Operating Cost, $/year (1)	$180,000	$750,000	$810,000	$860,000	$120,000	$410,000	$410,000	$420,000
Installed Equipment Cost (2,3)	$2,000,000	$4,600,000	$4,900,000	$5,200,000	$1,000,000	$2,200,000	$2,300,000	$2,500,000
Reclaimed Water								
Plant Make-up, AF/year	2,140	2,624	2,945					
Plant Wastewater, AF/year	427	219	245					
Treatment Technology	None	Evap/Crys	HERO/Crys					
Power Requirement, kw	78	1,003	1,075					
Evap Ponds, acres	0.0	0.0	0.0					
Operating & Maintenance Staff	1.00	3.11	3.11					
Total Operating Cost, $/year	$420,000	$1,020,000	$1,110,000					
Installed Equipment Cost	$2,200,000	$5,100,000	$5,500,000					
Saline Water								
Plant Make-up, AF/year			2,945	3,241				
Plant Wastewater, AF/year			370	407				
Treatment Technology			HERO/Crys	HERO/Crys				
Power Requirement, kw			2,778	3,057				
Evap Ponds, acres			0.0	0.0				
Operating & Maintenance Staff			5.21	5.21				
Total Operating Cost, $/year			$3,240,000	$3,520,000				
Installed Equipment Cost			$9,200,000	$9,800,000				
Brackish Water								
Plant Make-up, AF/year			2,945	3,241				
Plant Wastewater, AF/year			341	375				
Treatment Technology			HERO/Crys	HERO/Crys				
Power Requirement, kw			1,189	1,309				
Evap Ponds, acres			0.0	0.0				
Operating & Maintenance Staff			5.21	5.21				
Total Operating Cost, $/year			$1,590,000	$1,880,000				
Installed Equipment Cost			$6,800,000	$7,200,000				

Notes.....

1. Does not incude cost of water or capital recovery (water treatment equipment).
2. Does not include pipeline.
3. Includes 15% contingency

Table E.1
Waste Water Treatment Options