SFPUC
WATER
WASTEWATER
POWER

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

1155 Market St., 4th Floor, San Francisco, CA 94103 • Tel. (415) 554-0725 • Fax (415) 554-1854 • TTY (415) 554.3488

August 14, 2006

Mr. Tim Haines
Deputy Director
California Department of Water Resources
California Energy Resources Scheduling
3310 El Camino Avenue, Suite 120
Sacramento, CA 95821-9001

Dear Mr. Haines:

This letter provides the responses to the issues raised by you and your staff when we met. I found our dialogue constructive and hope this written response to your inquiries serves to further our understanding.

1. Acquisition cost of "In-City" land

You will find attached a copy of the San Francisco Administrative Code governing the transfer of property between City Departments. The transfer of land from the Municipal Railway to the SFPUC for the use of the In-City portion of the SFERP is governed by this code. We are in the process of updating the appraisal.

The SFERP will continue to provide a reliability benefit to ratepayers even after the contract has ended. The City sees the cost of the land as a legitimate project cost.

The original basis of the power purchase agreement was a 10 year contract. A reduction in term would be for the State's convenience. The City agrees that after the term of the power purchase agreement, the land will continue to have value, either as the site of the power plant, or put to some other use.

2. Mechanical Chillers

The water usage for the mechanical chillers is a maximum of 80 gpm on a hot day; the average demand will be 24 gpm. The annual consumption by the chiller cooling tower is projected to be 17 acre-feet (5.6 million gallons).

As you requested, installation costs for various alternative methods of cooling for both sites with net output on a hot day and average day are shown on the next page.

Method of Cooling	Installation Cost	Net Output Hot Day*	Net Output Average Day**
Chillers	$4,717,000	186 MW	190.7 MW
Foggers	$2,800,000	178 MW	183.9 MW
Evaporative	$2,100,000	177 MW	183.6 MW

* San Francisco Conditions, July 24, 2006, 83 degrees, 44% humidity
** Expected conditions for 3000 operating hours, 69 degrees dry bulb, 59 degrees wet bulb

Based on a meeting at CAISO on August 4, that included: Chuck Toney, Dave Alexander, and Jaime Medina, representing CDWR; Karen Kubick, of my staff; and Larry Tobias of CAISO, an agreement was reached, that the minimum amount of power that the SFERP must produce to meet the CAISO Action Plan requirement is 48 MW per turbine, for a total of 192 MW. In order to meet the CAISO requirement, chillers will be required on all four turbines. See the attached correspondence from Karen Kubick of the SFPUC to Chuck Toney of the CDWR, dated August 8, 2006. Our current design would guarantee a total output of 190.7 MW. The SFPUC is initiating a review to optimization design to identify the modifications and associated cost with increasing the total output by 1.3 MW.

See the attachment "SFERP Chiller Economic Evaluation 1000 hours" for operational parameters under the various configurations and ambient conditions. GE no longer offers foggers as a standard option with the new SPRINT units that the SFERP will be using, due to corrosion problems. A fogger option was included in this attachment, with an effectiveness of 90% to be indicative of the utilization and spray performance (to reduce potential corrosion problems). Foggers have shown sensitivity to windy conditions causing poor distribution. Foggers could be added in the field, however, this would affect the SFERP first year warrantee.

Refer to inlet-chilling attachment, "Chiller Economics, 24 May 06," for a more complete description of the process for the 1,000 hours analysis. Also included in the attachments is "SFERP Chiller Economic Evaluation 3,000 hours" for the projected 3,000 hours of annual operation, based on CAISO and City operational modeling.

3. Water Treatment Plant

The cost for the recycled water treatment is now estimated to be $6,000,000. For the breakdown of all water demands see the attachment, "SFERP Water Balance". The attachment also includes a line diagram schematic showing all the demands and the water treatment schematic.

Based on the SFPUC rate projections potable water will cost $532/acre-feet in 2008, and $1,561/acre-feet in 2015. The estimated cost to produce recycled water for use at

the SFERP is $1,500/acre-feet, based on demand and the planned capital investment. Recycled water and potable water were the two supplies considered.

The specific requirements encouraging the use of recycled water for all non-potable demands is included in the attachment titled "Recycled Water Regulatory Requirements." Information and estimates for the recycled water design, as it has progressed since 2004, are detailed in the attachment, "Recycled Water Cost Estimates".

The current recycled water system is based on obtaining treated secondary effluent source water from the Southeast Water Pollution Control Plant outfall line, tapping in at manhole #4. The secondary effluent will be treated at the SFERP to meet full tertiary Title 22 recycled water. Additional soft costs to complete the planning and pre-design are estimated to be:

Recycled Water	
Engineering	$ 20,000
CEC - City / CH2M	$ 150,000
Total	$ 170,000

A change to the water supply system away from the use of recycled water would require amending the CEC license application. It is anticipated that both the CEC and interveners will object to a change from recycled water to potable water.

The California Energy Commission Siting Office Manager, Roger Johnson, has advised the City that the following power plant projects using recycled water have been permitted recently or are currently going through the licensing process.

Name	Nameplate MW	Generator Type Type	Acre-feet /Year Recycled Water
City of Vernon	943	Combined Cycle	6,266
Sun Valley Peaker	500	Simple Cycle	851
Walnut Peaker	500	Simple Cycle	827
Roseville Energy Center	160	Combined Cycle	NA
San Joaquin Valley EC	1,087	Combined Cycle	5,340
Tesla	1,120	Combined Cycle	5,100
Walnut Energy- Turlock	250	Combined Cycle	1,800
Don Van Raesfeld	147	Combined Cycle	1,182
East Altamont	1,100	Combined Cycle	4,600
Inland Empire	670	Combined Cycle	4,200
Magnolia-Socal Power	328	Combined Cycle	5,100
Malburg-City of Vernon	134	Combined Cycle	1,500
Palomar Escondido- Sempra	546	Combined Cycle	3,600
Los Esteros Critical Energy	180	Simple Cycle	560

(Power Plant Projects Using Recycled Water, Continued)

Name	Nameplate	Generator Type	Acre-feet /Year
MW Type	Recycled Water		
Russell City- Calpine	600	Combined Cycle	3,700
Mountain View Units 1 & 2	528	Combined Cycle	7,500
Delta Energy Center	887	Combined Cycle	5,900
Los Melonas Energy Center	555	Cogeneration	4,000
Metcalf Energy Center	600	Combined Cycle	3,900
Riverside Energy Resources	96	Simple Cycle	247

Also attached is a copy of the "CEC Energy Facility Licensing Process, Water Supply Information". You will find references on pages three and four related to the preferential use of non-potable water for cooling electric power plants. The CEC states that the California Water Code Section 13550 et. seq. provides the basis for the CEC's policy of not allowing potable water for cooling or other power plant uses. In addition in the lead to the section there is a citation to the State Water Resources Control Board Policy Order 75-58, which has been interpreted in the CEC regulatory process to mandate the use of non-potable alternatives to potable water. In several recent cases where there are no other sources of water available but potable water, the CEC has included finding a non-potable source within a fixed number of years as a licensing requirement.

The cost of using potable water in lieu of recycled water over a seven-year period is estimated at $942,000 or over a ten-year period is estimated at $1,400,000. Switching to use of potable water will require CEC reconsideration. The effort of amending the application and re-scoping would not exceed $500,000. The issue of a back-up water supply would definitely be an issue of concern.

The San Francisco Public Utilities Commission is moving to an aggressive policy whereby the use of potable water for a major industrial water use (cooling and process water) will not be allowed within the service area. This is a requirement for all of the 2,400,000 customers of the Hetch Hetchy system. All customers are required to utilize non-potable water.

4. SFO Back-up power capability

There were many back-up power scenarios initially reviewed and the current configuration was selected as the least expensive option that still achieved the objectives.

The basis of the back-up power design is to supply power directly to the San Francisco International Airport (SFIA) electrical distribution system in the event that the grid normally supplying power to the SFIA and region is out of service.

The SFIA is a designated "Regional Emergency Center". Similar to the New Orleans Airport, in the event of a disaster in the Bay Area, the SFIA would take on numerous additional emergency functions (hospital, shelter, triage center etc.) in order to serve the region. Due to this emergency requirement, the SFIA stipulated that power would have to be supplied within 30 minutes of a regional grid outage. When the grid goes down the SFIA no longer can maintain the Explosive Detection System (EDS). No bags could be screened for explosives and all baggage carousels would stop, causing all baggage handling to cease. This would prevent all passengers from departing and arriving. The SFIA would be immobilized. Disaster rescue support would not be able to fly into the SFIA to provide support in the Bay Area.

The Airport has made it clear that in order for the SFERP to maintain site control, the project must be compliant with the Federal Aviation Administration (FAA) regulations, providing for an "Airport purpose", see the attached letter from John Martin SFIA Director to Susan Leal SFPUC General Manager, dated May 5, 2005. The Airport benefit realized will ensure that during and after an emergency the SFIA will function to support the region. A direct connection to the Airport's power grid has been included in the SFERP to provide back-up power in the event of a regional outage. It is intended that this intertie would only be used in the event of an area wide outage of the PG&E grid. The Airport and SFPUC Commissions approved a memorandum of understanding (MOU), April 30, 2004, allowing the SFERP to be sited at the airport. The MOU, which is provided as an attachment, stipulates that the SFPUC recognizes the FAA requirements and the intent to use the SFERP to supply emergency backup electric service to the Airport.

During the alternatives analysis phase, it was determined that PG&E, in cooperation with CAISO, could not guarantee response in time to allow for the transmission of energy through the PG&E grid within the allotted 30 minute minimum time frame, and that the preferred alternative would allow the Airport to be isolated from the PG&E system. Without system isolation, PG&E would require a minimum of 4 hours when there is a grid outage. PG&E would not provide a guaranteed time frame for response, see attached PG&E Supplemental Facilities Study, November 9, 2004 (Section 5.1.1). The Airport rejected all concepts that required dependence upon PG&E that would make the Airport reliant upon PG&E's undefined regional priorities in times of an electrical emergency. The Airport required a direct connection to meet the FAA requirement of an "Airport purpose," and to provide the regional benefit stipulated above.

The preferred lowest cost project alternative allows the Airport to be isolated from the PG&E system, and the Airport requirements could be realized. This will enable the

SFERP to continue to provide a reliability benefit to ratepayers even after the contract with CDWR has ended.

To supply electricity directly to SFIA the basic PG&E interconnection design had to be modified as follows:

- Black start capability needed to be added, which included a diesel generator and dedicated black start gas compressor
- Addition of switches at the PG&E ring bus switchyard
- Confirmation of a new high voltage underground transmission line to new step-down transformer in abandoned North Access Road location
- New switchgear adjacent to transformer
- Interconnection with existing switchgear and SFIA distribution system
- Protective switches and relays

The cost for the backup power is detailed below:

SFERP Backup power option cost

		Cost
Diesel emergency generator	$	378,000
Dedicated black start gas compressor	$	370,000
SFIA High Voltage Intertie	$	4,500,000
Total	$	5,248,000

Included in the high voltage electrical intertie (above) is the cost for the switchyard, additional underground ducting, step-down transformer, switchgear XA, and interconnection to SFIA substations BA and CA. The cost estimate was based on the XA substation located in the United Airline parking lot. There may be a small increase for the relocation to the abandoned North Access Road location. It should also be noted that in the previous cost estimate submitted to CDWR, the cost for the black start generator and gas compressor were erroneously carried in the itemized equipment section as well as a separate line item for the SFIA interconnection. $5,200,000 is the corrected cost estimate.

Construction at the SFIA will be much easier than construction within the boundaries of San Francisco because all the facilities will be constructed within the Airport campus and are under the Airport's control. The SFERP will have complete site control of a two-acre site for the SFERP power plant during the project. Additional project benefits include availability of a wide variety of property for staging, availability of utility as-builts, the Airport's ability to provide the project permits and rights to access, and ability to construct linears in the roadways. See attachment, "SFIA Site Electrical Single Line Diagram."

5. Additional Fuel Compressor

The basic issue at hand is a comparison of a configuration using three compressors versus four compressors. The difference in cost between the two options is $10,000. The selection was based on efficiency and reduced affect on parasitic load.

Considering the four-compressor option, the cost of a single, 1400 hp compressor to supply the fuel demanded by a single LM6000 is $520,000. The cost of four compressors (one being considered spare) would be $2,080,000.

For the three-compressor option, the cost of a single, 2,250 hp compressor to supply the fuel demand of one and a half LM6000s is $690,000. The cost for 3 compressors (one spare) would be $2,070,000.

It is expected that the installation cost variation between the two configurations would be less than 5% of the equipment price. Based on cost alone there does not appear to be any difference between the two approaches. Performance under normal operating conditions with the three turbines at full load is expected to be essentially the same for both configurations.

Expected power production in megawatts (MW) for the 4-unit configuration when three compressors are operating is 3.05 MW, and for the 3-unit configuration when 2 units are operating is 3.27 MW.

The big difference in operation would occur when only two LM6000 units are operating. Under this scenario, for the three-compressor configuration two compressors would have to be operating and would recycle 33% of their output at a significant power penalty (higher parasitic load). For the four-compressor configuration, when only two LM6000 units (assuming one unit is off-line) are operating there will be only two compressors operating for no additional parasitic penalty.

Since the costs are essentially the same for the two different compressor configurations and there is operational flexibility for using four compressors, with each rated to supply one LM6000, the four-compressor configuration was selected as the best option.

For SFIA, the main units (one active and one spare) would be similar to the 4-unit in-City configuration with a slightly lower power requirement of 0.99 MW (versus 1.02 MW) due to higher inlet pressure (5 psig). The black start compressor is rated at 3.24 million standard cubic feet per day (MSCFD) with an outlet pressure of 225 psig. Power consumption for the 200 hp motor is approximately 128 kW.

6. Capitalized development costs

The schedule for development and distribution is shown below:

Receipt Date	Amount
January 1, 2003 (payment received)	$2,666,667
January 1, 2004 (payment received)	2,666,667
January 1, 2005 (payment received)	2,266,667
January 1, 2007	1,666,667
January 1, 2008	1,333,333
January 1, 2009	1,333,333
January 1, 2010	1,333,333
Total	$13,266,667

Development fund payments of $7,600,000 have been received. A total of $9,266,668 is secured by a letter of credit. The balance of the development funding, $3,999,999, is not secured. The City has funded costs beyond the development funding received in order to keep the project on schedule.

The City intends to request the balance of the KRCD funds from CDWR. We would appreciate the State's assistance to facilitate this recovery.

The proforma package submitted to the State included the breakdown for development costs ($20,214,939) and EPC design ($5,330,000) for a total of $25,544,939. Recovery of the prefinancing capitalized development costs and the Phase 1 EPC costs totaling $16,278,271, has been included in the proforma for cost recovery.

If you have any questions regarding this response and the attachments, please contact myself, or Karen Kubick at 415-934-5735. The City feels that the SFERP as proposed meets the CAISO minimum requirements of capacity and location, at a minimum cost. We look forward to working with you as we move from the development phase into design and construction.

Sincerely,

Barbara Hale
Assistant General Manager, Power Enterprise
San Francisco Public Utilities Commission

cc: Chuck Toney, CDWR
Dave Alexander, CDWR
Jaime Medina, EPG
Jim Henneforth, PGEP
Tony Irons, SFPUC
John Martin, SFIA
Ernie Eavies, SFIA
Baljit Boparai, SFIA
Dorothy Shimke, SFIA
Karen Kubick, SFPUC Power Enterprise
Theresa Mueller, City Attorney
Jeanne Sole, City Attorney
Gene Varanini, CPA
Russell Stepp, SFPUC Power Enterprise
Steve Brock, PB Power
✓Roger Johnson, CEC
Larry Tobias, CAISO

Attachment List:

1) Interdepartmental Transfer of Real Property
2) CAISO SFPUC Correspondence Karen Kubick to Chuck Toney, August, 8, 2006
3) SFERP Chiller Economic Evaluation 1000 Hours
4) Chiller Economics May 24, 2006
5) SFERP Chiller Economic Evaluation 3000 Hours
6) SFERP Water Balance
7) Recycled Water Regulatory Requirements
8) Recycled Water Cost Estimates
9) CEC Energy Facility Licensing Process, Water Supply Information
10) Correspondence John Martin SFIA Director to Susan Leal SFPUC General Manager, May 5, 2005
11) Memorandum of Understanding, executed April 30, 2004 between the Airport Commission and the San Francisco Public Utilities Commission
12) PG&E Supplemental Facilities Study, November 9, 2004
13) SFIA Site Electrical Single Line Diagram

Attachment

#1

Interdepartmental Transfer of Real Property

SF ADMINISTRATIVE CODE, ARTICLE 23
INTERDEPARTMENTAL TRANSFER OF REAL PROPERTY

SEC. 23.12. TRANSFER AUTHORIZED; GROUNDS FOR TRANSFER.

Whenever any Real Property belonging to the City is no longer used advantageously by the department under whose jurisdiction it is, or when any such Real Property can be more advantageously used by a department other than the department under whose jurisdiction it is, the Real Property may be transferred to the jurisdiction of the department which can more advantageously use the same in accordance with the provisions of this Article. (Formerly Sec. 23.9; added by Ord. No. 7919 (1939), Sec. 1; amended and renumbered by Ord. 15-01, File No. 001965, App. 2/2/2001. Former Sec. 23.12 was renumbered as 23.15 by Ord. 15-01.)

SEC. 23.14. DIRECTOR OF PROPERTY'S REPORT.

Within 30 days after the receipt of the request required by the preceding Section, the Director of Property shall prepare a report for the Mayor and the requesting department of the estimated fair market value of the Real Property, the character of the improvements thereon and an evaluation as to whether, in the opinion of the Director of Property, the Real Property can be advantageously used by the requesting department for the purposes specified in the request. (Formerly Sec. 23.11; added by Ord. No. 7919 (1939), Sec. 3; amended and renumbered by Ord. 15-01, File No. 001965, App. 2/2/2001. Former Sec. 23.14 was renumbered as 23.17 by Ord. 15-01.)

SEC. 23.20. PAYMENT.

Transfers of Real Property pursuant to this Article shall be paid for at the current fair market value as determined by the Director of Property, unless otherwise directed by the Board of Supervisors by resolution, provided that the Public Utilities Commission shall be paid at least the historical cost of such Real Property. (Formerly Sec. 23.17; added by Ord. No. 7919 (1939), Sec. 8; amended and renumbered by Ord. 15-01, File No. 001965, App. 2/2/2001. Former Sec. 23.20 was renumbered as 23.27 by Ord. 15-01.

Attachment

#2

CAISO SFPUC Correspondence
Karen Kubick to Chuck Toney,
August, 8, 2006

SFPUC
WATER
WASTEWATER
POWER

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

1155 Market St., 4th Floor, San Francisco, CA 94103 • Tel. (415) 554-0725 • Fax (415) 554-1854 • TTY (415) 554.3488

August 8, 2006

Mr. Chuck Toney
California Department of Water Resources
California Energy Resources Scheduling
3310 El Camino Avenue, Suite 120
Sacramento, CA 95821-9001

RE: CAISO Action Plan Minimum Power Requirement for the SFERP

Dear Chuck:

This letter is intended to confirm the agreement reached in our August 4, 2006 meeting with CAISO in Folsom, California.

The meeting included yourself, Dave Alexander, and Jaime Medina, representing CDWR; Larry Tobias of the CAISO; and myself representing SFPUC. At the meeting, we confirmed that CAISO will require a minimum of 48 MW for each of the four turbines. A total output of 192 MW will be required to fulfill the CAISO Action Plan minimum objectives.

The SFPUC proposal utilizes chillers to maximize the SFERP output. No other method of cooling will meet the CAISO requirement.

Our current design would guarantee a total output of 190.7 MW. The SFPUC is initiating a review to optimization design to identify the modifications and associated cost with increasing the total output by 1.3 MW.

Sincerely,

Karen Kubick

Karen Kubick
Manager of Infrastructure, Power Enterprise
San Francisco Public Utilities Commission

cc: Tim Haines, CDWR
Dave Alexander, CDWR
Jaime Medina, EPG
Jim Henneforth, PGEP
Tony Irons, SFPUC
Barbara Hale, SFPUC Power Enterprise
Theresa Mueller, City Attorney
Jeanne Sole, City Attorney
Gene Varanini, CPA
Russell Stepp, SFPUC Power Enterprise
Steve Brock, PB Power
Larry Tobias, CAISO
Barry Flynn, Flynn Consultants

Attachment

#3

SFERP Chiller Economic Evaluation
1000 Hours

Ecomonic evaluations for various considerations with inlet cooling

Energy sales revenue / cost reduction produced

Chiller economics evaluation for 1 year operation of 1,000 hours.

Energy sale revenue increase with chillers	**$ 973,602**	
Heat rate difference cost savings:	**$ 137,044**	
	$ 1,110,647	Total
	$ 4.25	Years to payback

Evaporator economics evaluation for 1 year operation of 1,000 hours.

Energy sale revenue increase with evaporative cooling	**$ 606,982**	
Heat rate difference cost savings:	**$ 90,563**	
	$ 697,544	Total
	$ 3.01	Years to payback

Fogger economics evaluation for 1 year operation of 1,000 hours.

Energy sale revenue increase with evaporative cooling	**$ 616,415**	
Heat rate difference cost savings:	**$ 98,286**	
	$ 714,702	Total
	$ 3.92	Years to payback

Additional revenue from capacity payments

	Chillers	Evap	Foggers	
Capacity payment based on design conditions	**$ 3,123,155**	**$ 1,716,800**	**$ 1,773,640**	
	1.1	**0.9**	**1.1**	Years to payback
Capacity payment based on ISO conditions	**$ 771,255**	**$ 512,140**	**$ 535,340**	
	2.5	**1.7**	**2.2**	Years to payback

Installed $/kW

	Basis	
	ISO	**Design**
Chillers	**$ 887.00**	**$ 219.04**
Evaporator	**$ 594.56**	**$ 177.36**
Fogger	**$ 758.40**	**$ 228.91**

SFERP Chiller Economic Evaluation 1,000 Hours

PB Power
11 Jul 06

SFPUC ERP chiller economica evaluation performance data compilation

Case #	**100**	**101**	**102**	**103**	**104**	**105**
Ambient Conditions						
Dry Bulb, °F	59.0	74.0	80.0	83.0	90.0	100.0
Wet Bulb, °F	51.5	60.9	62.2	63.0	62.8	69.1
RH, %	60.0	47.0	36.1	32.1	20.0	20.0
Gen kW						
With chillers	**50,621**	**50,608**	**50,608**	**50,451**	**49,814**	**48,095**
With evap cooler	**49,820**	**48,349**	**47,628**	**47,263**	**47,153**	**45,582**
With foggers	**49,890**	**48,089**	**47,756**	**47,597**	**47,417**	**45,731**
Without chillers	**48,937**	**46,164**	**44,668**	**43,780**	**41,711**	**38,684**
Gen kW (delta from chill)						
With evap cooler	(801)	(2,259)	(2,980)	(3,188)	(2,661)	(2,513)
With foggers	(731)	(2,519)	(2,852)	(2,854)	(2,397)	(2,364)
Without chillers	(1,684)	(4,444)	(5,940)	(6,671)	(8,103)	(9,411)
Both Plants						
With evap cooler	(3,204)	(9,036)	(11,920)	(12,752)	(10,644)	(10,052)
With foggers	(2,924)	(10,076)	(11,408)	(11,416)	(9,588)	(9,456)
Without chillers	(6,736)	(17,776)	(23,760)	(26,684)	(32,412)	(37,644)
Plants parasitic, kW						
With Chillers	11,387	11,960	12,191	12,191	12,191	12,191
Without Chillers	9,970	9,970	9,970	9,970	9,970	9,970
With Foggers	10,090	10,090	10,090	10,090	10,090	10,090
Total plant output, kW						
With chillers	191,097	190,472	190,241	189,613	187,065	180,189
With evap cooler	189,310	183,426	180,542	179,082	178,642	172,358
With foggers	189,470	182,266	180,934	180,298	179,578	172,834
Without chillers	185,778	174,686	168,702	165,150	156,874	144,766
Total plant output change relative to Chillers, kW						
With evap cooler	(1,787)	(7,046)	(9,699)	(10,531)	(8,423)	(7,831)
With foggers	(1,627)	(8,206)	(9,307)	(9,315)	(7,487)	(7,355)
Without chillers	(5,319)	(15,786)	(21,539)	(24,463)	(30,191)	(35,423)
Total plant output change relative to no inlet cooling, kW						
With evap cooler	3,532	8,740	11,840	13,932	21,768	27,592
With foggers	3,692	7,580	12,232	15,148	22,704	28,068
With chillers	5,319	15,786	21,539	24,463	30,191	35,423
Total plant heat rate, Btu/kWH (HHV)						
With chillers	9,989	10,022	10,036	10,043	10,069	10,145
With evap cooler	9,935	10,007	10,028	10,039	10,047	10,121
With foggers	9,932	10,002	10,014	10,024	10,035	10,105
Without chillers	9,991	10,122	10,218	10,273	10,417	10,619

SFERP Chiller Economic Evaluation 1,000 Hours						PB Power 11 Jul 06
GT Heat rate (LHV)						
With chillers	8,478	8,477	8,477	8,481	8,495	8,537
With evap cooler	8,494	8,541	8,551	8,556	8,562	8,606
With foggers	8,492	8,533	8,540	8,547	8,554	8,594
Without chillers	8,533	8,614	8,677	8,712	8,804	8,924
GT Heat rate (HHV)						
With chillers	9,394	9,393	9,393	9,397	9,412	9,459
With evap cooler	9,411	9,463	9,475	9,480	9,487	9,535
With foggers	9,409	9,455	9,462	9,470	9,478	9,522
Without chillers	9,455	9,544	9,614	9,653	9,755	9,888
GT Heat rate difference relative to chillers						
With evap cooler	18	71	82	83	74	76
With foggers	16	62	70	73	65	63
Without chillers	61	152	222	256	342	429
GT Heat rate difference relative to no inlet cooling						
With evap cooler	(43)	(81)	(140)	(173)	(268)	(352)
With foggers	(45)	(90)	(152)	(183)	(277)	(366)
With chillers	(61)	(152)	(222)	(256)	(342)	(429)

Attachment

#4

Chiller Economics May 24, 2006

PB Power
a division of
Parsons Brinckerhoff
Quade & Douglas, Inc.

303 Second Street
Suite 700 North
San Francisco, CA 94107 USA
415-281-8700
Fax: 415-281-8707

24 May 2006

SFPUC Electric Reliability Project

Evaluation of chiller systems contribution to plant operations

Executive Summary

Although the SFPUC ERP is not based on the commercial value of the in-city and SFIA plants with respect to the value of power plants in the energy supply field, this paper undertook the task to provide an overview of some economic considerations in establishing the benefits for energy export, improved heat rates, and increased capacity achieved by the project due to the inclusion of turbine inlet air chilling systems.

In the absence of an operating profiles based on expected dispatching for the two ERP plants and the need to establish the economic contribution, three different approaches were undertaken to develop a sense of the economic value that the chiller systems afford the project. The first basic approach was to determine the kW-h of additional energy to be exported due to the inclusion of the chiller systems at both sites as well as determine the fuel savings for improved heat rate. First an ambient temperature profile was developed for an assumed operating year of 1,000 hours occurring in 2008. As a result of operating with chillers the increased energy delivered would have a value of $973,600 and the increased fuel efficiency would have a value of $137,000 for a total value of $1,111,000. When compared to the installed cost of the chiller systems, this represents a payback time on the order of 4.3 years.

If capacity payments are included for the additional capacity available, then there is the potential revenue of $3,123,200 or $771,300 for capacity payments based on design conditions (80°F and 36% RH) or ISO conditions respectively. These payments would reduce the payback periods to 1.1 or 2.5 years respectively.

The last approach sought to establish the value of the additional available kW for export by valuing the kW the same as the LDs, 3,000 per kW, which will be imposed on the DB contractor for failure to meet their kW parasitic loads. Using that value for kWs the value of additional kW capacity was calculated to be $64,617,000 or $15,957,000 for capacity determined at design conditions or ISO respectively. These values would imply that the chiller systems provide a great value at an installed cost of $4,717,000.

Background

The GE LM6000PC SPRINTS are aero derivative gas turbines whose power output is very sensitive to the inlet ambient air conditions. Turbine inlet air cooling for the project was proposed to be achieved through the utilization of chiller systems (inlet cooling coils were already provided with the Williams units). These systems provide chilled water that is pumped through finned coils in the turbine air inlet housing. Air is cooled as it passes over the coils. For the LM6000PC SPRINT the optimum temperature to be attained through cooling is 48°F at the turbine inlet bellmouth. Often this temperature is below the ambient dew point which results in moisture condensing out of the air stream as it passes over the coils. This condensing of moisture requires some additional cooling load which the chiller system needs to provide. However, because the chiller system can cool the air stream below the ambient dew point (which is always lower than the ambient wet bulb) the inlet air can be cooled to temperatures lower than that which is achievable through fogging or evaporative cooling thus enabling greater MW output for export from the turbines.

Discussion

This paper details approaches utilized to evaluate the economics of including combustion turbine inlet air chilling and presenting the economic results. Without inlet air cooling and for the range of ambient temperatures from 48°F to 80°F, the loss in generator output per turbine is ~190kW/°F of ambient air temperature increase. For the four units this equates to ~760kW/°F for the ERP. This sensitivity to inlet air temperature can be offset by the addition of a chiller system which cools the turbine inlet air to ~48°F for ambient temperatures below 80°F. Above 80°F the chillers will cool the turbine inlet air to the low-mid 50s but not necessarily all the way to 48°F. The chiller system loads (both sites) only increase ~38kW/°F with each degree increase in ambient temperature for the range from 59°F to 80°F clearly demonstrating a significant increase in plant output through inlet air chilling. It should be noted that about of 15% of the chilling load is due to condensing moisture in the inlet combustion air in order to cool the air to 48°F which is below the dew point. An additional benefit of chillers is the leveling of available power to export under a wide variety of ambient temperatures from 30°F to 90°F. The variation in maximum MW available would be on the order of 5.4 MW (2.2 MW increase when the chiller systems are off at low ambient temperatures to a 3.2 MW for decrease in CT output due to high ambient temperatures). This spread represents a variation of only 2.8% in net plant output and would facilitate the scheduler's ability to forecast the power available for delivery the following day since the plant show little sensitivity to ambient temperature variations. To go from 90°F ambient to 100°F ambient only results in a decrease of plant output of 7 MW to 180.2 MW net. Without chillers, the plant output on a 100°F day would be only 144.8 MW or 35 MW net less than with chillers (Almost the equivalent of one unit being off-line.)

Without the benefit of an established dispatch criteria or scenarios upon which to base an economic evaluation, the following assumptions were made to reflect a possible year of operation. The operating year would be 2008 establishing the basis for the pricing/cost estimates. Total hours of operation would be 1,000 hours of which 200 hours would represent RMR dispatch. Under the RMR scenario it was also assumed that these hours would occur during the average hottest hours of the year. The remaining hours of operation were then assumed to occur at the seasonal average ambient temperature. For only 1,000 hours of annual operation, the ambient temperatures would most certainly fall above the average; therefore, using the average would represent a conservative approach. If additional operating time were added to the analysis, then using the seasonal average would be a reasonably good operational point selection for assessing the chiller benefit.

Three different approaches were pursued:

1. Basic approach was to determine $/yr of energy sales revenue and fuel savings generated by using the chillers.
2. Same as the basic approach but adding revenue from capacity payments for the value of a greater export MW capability.
3. The last approach was to simply utilize the kW value criteria as included in DB-108 and determine the added capacity value based on the LD value of a kW.

Basic Approach

The ASHRAE tables were used to determine the ambient conditions for hottest 200 hours which are essentially the hours at or above the 2% design temperature and humidity. Additional ASHRAE points were selected to define the distribution above the 2% design point up to including some time at 100°F. For the selected temperatures and relative humidities, the turbine performance was calculated based on the performance of chiller systems which were sized for the 1% condition (plant design hot day). At each condition, the total chiller system kW was determined separate from the remaining plant parasitic loads. This allows a point by point comparison of operation with and without chillers for the net export of MW as well as establishing the net plant heat rate for the various points.

The chiller system kW and chilling ton demands are presented in Table 1 to illustrate the impact of ambient temperature on the parasitic kW load for the chiller system. Revenue from the sale of the additional energy available and fuel savings (better heat rates with chillers) through the use of chillers is summarized in Table 2. Estimated total installed cost of the two chiller systems are as follows:

In-city site - $2,726,000

SFIA site - $1,991,000

Total both sites - $4,717,000

For the basic approach, the total revenue and heat rate savings were projected to be $1,111,000 for operation of 1,000 hours in 2008 and would represent a payback period of 4.3 years.

Basic Approach with Capacity Payments included

In addition to the revenue realized through energy sales and efficiency gains, there is expected to be extra revenue received due to the increased capacity made available. Table 3 shows that this revenue is calculated to be $3,123,155 for capacity payment based on design conditions. If this revenue is combined with the previously determined energy and efficiency revenue gains, the total cost benefit of the chiller systems is calculated to be $4,233,802 for the operating year 2008 and would represent a payback period of 1.1 years. If the capacity payment is based on ISO conditions, then the capacity payment would be $771,255. With this revenue combined with the previously determined energy and efficiency revenue gains, the total cost benefit of the chiller systems is calculated to be $1,881,902 and would represent a payback period of 2.5 years.

Liquidated Damages value of kW increases

Another approach to valuing the chiller systems is to assign a value due to the increased kW exported at the design condition to the Liquidated Damages value as established in the DB-108 bid request. The results on shown in Table 4 with the values of $64,617,000 and $15,957,000 representing the LD values of the kW increases at design conditions and ISO conditions. Although this does not represent a revenue stream to be directly received, it could be construed to represent the value of the kW increases over the life of the plant.

Dry Bulb, °F	59.0	74.0	80.0	83.0	90.0	100.0
Wet Bulb, °F	56.3	60.9	62.2	63.0	62.8	69.1
RH, %	60.0	47.0	36.1	32.1	20.0	20.0
Tons/CTG	465	731	810	810	810	810
Annual hours	810	88	44	35	16	8
% of year	50%	1%	0.5%	0.4%	0.18%	0.09%
Chiller kW						
In-City	560	985	1151	1151	1151	1151
SFIA	235	383	448	448	448	448
Chiller System kW						
In-City	1008	1433	1599	1599	1599	1599
SFIA	409	557	622	622	622	622
Total Parasitic with chillers, kW						
In-City	8,454	8,879	9,045	9,045	9,045	9,045
SFIA	2,933	3,081	3,146	3,146	3,146	3,146
Both Plants	11,387	11,960	12,191	12,191	12,191	12,191

Table 1 - Chiller KW evaluation points

Assumptions

1 Market costs are based on projected for 2008
2 Operation will be during hottest time of year.
3 Price of natural gas is $ 8.00 MBtu (HHV)
4 Price of energy is time dependent

Energy sale revenue increase with chillers

Ambient							
Dry Bulb, °F		59.0	74.0	80.0	83.0	90.0	100.0
Wet Bulb, °F		56.3	60.9	62.2	63.0	62.8	69.1
RH, %		60.0	47.0	36.1	32.1	20.0	20.0
Operating hours		810	88	44	35	16	8
kW net increase		5,319	15,786	21,539	24,463	30,191	35,423
MW-H		4,308	1,383	943	857	476	279
Period energy price,	$/MW-H	$ 98	$ 140	$ 140	$ 140	$ 140	$ 140
Energy sale revenue		$ 22,174	$193,600	$ 132,077	$ 120,006	$66,647	$39,098

Total energy sale revenue **$ 973,602**

Heat rate difference cost savings:

Heat rate difference,	Btu/kWH	61	152	222	256	342	429
Total plant net output	kW	191,097	190,472	190,241	189,613	187,065	180,189
Energy savings,	MBtu	9,432	2,533	1,846	1,701	1,010	609
Cost of energy savings		$ 75,454	$ 20,262	$ 14,772	$ 13,604	$ 8,079	$ 4,873

Total HR fuel savings **$ 137,044**

Table 2 - Revenue from chiller system for 1 year operation of 1,000 hours.

Capacity Payment Basis:
For 2008, FERC state-wide capacity value of $65/kW-Yr for simple cycle facilities. Location of ERP would result in a local value of $145.00 per kW-Yr based on similar difference in NY between state and NYC.

Capacity payment based on design conditions
(One time payment valuation)

kW increase	21,539.0
Capacity value	$ 145.00
Capacity payment	**$3,123,155**

Total value added for one year operation and lifetime capacity increase: **$ 4,233,802**

Capacity payment based on ISO conditions
(One time payment valuation)

kW increase	5,319.0
Capacity value	$ 145.00
Capacity payment	**$ 771,255**

Total value added for one year operation and lifetime capacity increase: **$ 1,881,902**

Table 3 – Capacity payment increase due to chiller systems

For the DB contract the value of a kW in capacity is set at $ 3,000 per kW

On that basis the value of the added capacity is calculated as follows:

	kW added	Value
For design condition	21,539	**$64,617,000**
For ISO condition	5,319	**$15,957,000**

Table 4 - Equal benefit capacity approach

Attachment

#5

SFERP Chiller Economic Evaluation
3000 Hours

Ecomonic evaluations for various considerations with inlet cooling

(3,000 hour scenario)

Energy sales revenue / cost reduction produced

Chiller economics evaluation for 1 year operation of 3,000 hours.

Energy sale revenue increase with chillers	**$ 3,833,850**	
Heat rate difference cost savings:	**$ 560,719**	
	$ 4,394,570	Total
	$ 1.07	Years to payback

Evaporator economics evaluation for 1 year operation of 3,000 hours.

Energy sale revenue increase with evaporative cooling	**$ 1,648,424**	
Heat rate difference cost savings:	**$ 310,158**	
	$ 1,958,582	Total
	$ 1.07	Years to payback

Fogger economics evaluation for 1 year operation of 3,000 hours.

Energy sale revenue increase with evaporative cooling	**$ 1,728,871**	
Heat rate difference cost savings:	**$ 315,358**	
	$ 2,044,229	Total
	$ 1.37	Years to payback

Additional revenue from capacity payments

	Chillers	Evap	Foggers	
Capacity payment based on design conditions	**$ 3,123,155**	**$ 1,716,800**	**$ 1,773,640**	
	0.6	**0.6**	**0.7**	Years to payback
Capacity payment based on ISO conditions	**$ 1,651,115**	**$ 512,140**	**$ 535,340**	
	0.8	**0.8**	**1.1**	Years to payback

Installed $/kW

	Basis	
	ISO	**Design**
Chillers	**$ 887.00**	**$ 219.04**
Evaporator	**$ 594.56**	**$ 177.36**
Fogger	**$ 758.40**	**$ 228.91**

Note:
ISO ambient is 59 deg F with 60% relative humidity
Design ambient of 80 deg F with 36% relative humidity

SFERP Chiller Economics Evaluation 3,000 Hours

PB Power
11 Jul 06

SFPUC ERP chiller economica evaluation performance data compilation for 3,000 hour scenario

Case #	**100**	**101**	**102**	**103**	**104**	**105**
Ambient Conditions						
Dry Bulb, °F	69.0	74.0	80.0	83.0	90.0	100.0
Wet Bulb, °F	59.0	60.9	62.2	63.0	62.8	69.1
RH, %	55.5	47.0	36.1	32.1	20.0	20.0
Gen kW						
With chillers	**50,608**	**50,608**	**50,608**	**50,451**	**49,814**	**48,095**
With evap cooler	**48,383**	**48,349**	**47,628**	**47,263**	**47,153**	**45,582**
With foggers	**48,489**	**48,089**	**47,756**	**47,597**	**47,417**	**45,731**
Without chillers	**47,183**	**46,164**	**44,668**	**43,780**	**41,711**	**38,684**
Gen kW (delta from chill)						
With evap cooler	(2,225)	(2,259)	(2,980)	(3,188)	(2,661)	(2,513)
With foggers	(2,119)	(2,519)	(2,852)	(2,854)	(2,397)	(2,364)
Without chillers	(3,425)	(4,444)	(5,940)	(6,671)	(8,103)	(9,411)
Both Plants						
With evap cooler	(8,900)	(9,036)	(11,920)	(12,752)	(10,644)	(10,052)
With foggers	(8,476)	(10,076)	(11,408)	(11,416)	(9,588)	(9,456)
Without chillers	(13,700)	(17,776)	(23,760)	(26,684)	(32,412)	(37,644)
Plants parasitic, kW						
With Chillers	11,750	11,960	12,191	12,191	12,191	12,191
Without Chillers	9,970	9,970	9,970	9,970	9,970	9,970
With Foggers	10,090	10,090	10,090	10,090	10,090	10,090
Total plant output, kW						
With chillers	190,682	190,472	190,241	189,613	187,065	180,189
With evap cooler	183,562	183,426	180,542	179,082	178,642	172,358
With foggers	183,866	182,266	180,934	180,298	179,578	172,834
Without chillers	178,762	174,686	168,702	165,150	156,874	144,766
Total plant output change relative to Chillers, kW						
With evap cooler	(7,120)	(7,046)	(9,699)	(10,531)	(8,423)	(7,831)
With foggers	(6,816)	(8,206)	(9,307)	(9,315)	(7,487)	(7,355)
Without chillers	(11,920)	(15,786)	(21,539)	(24,463)	(30,191)	(35,423)
Total plant output change relative to no inlet cooling, kW						
With evap cooler	4,800	8,740	11,840	13,932	21,768	27,592
With foggers	5,104	7,580	12,232	15,148	22,704	28,068
With chillers	11,920	15,786	21,539	24,463	30,191	35,423
Total plant heat rate, Btu/kWH (HHV)						
With chillers	10,009	10,022	10,036	10,043	10,069	10,145
With evap cooler	9,989	10,007	10,028	10,039	10,047	10,121
With foggers	9,984	10,002	10,014	10,024	10,035	10,105
Without chillers	10,071	10,122	10,218	10,273	10,417	10,619

SFERP Chiller Economics Evaluation 3,000 Hours						PB Power 11 Jul 06
GT Heat rate (LHV)						
With chillers	8,477	8,477	8,477	8,481	8,495	8,537
With evap cooler	8,526	8,541	8,551	8,556	8,562	8,606
With foggers	8,522	8,533	8,540	8,547	8,554	8,594
Without chillers	8,582	8,614	8,677	8,712	8,804	8,924
GT Heat rate (HHV)						
With chillers	9,393	9,393	9,393	9,397	9,412	9,459
With evap cooler	9,447	9,463	9,475	9,480	9,487	9,535
With foggers	9,442	9,455	9,462	9,470	9,478	9,522
Without chillers	9,509	9,544	9,614	9,653	9,755	9,888
GT Heat rate difference relative to chillers						
With evap cooler	54	71	82	83	74	76
With foggers	50	62	70	73	65	63
Without chillers	116	152	222	256	342	429
GT Heat rate difference relative to no inlet cooling						
With evap cooler	(62)	(81)	(140)	(173)	(268)	(352)
With foggers	(66)	(90)	(152)	(183)	(277)	(366)
With chillers	(116)	(152)	(222)	(256)	(342)	(429)

Attachment

#6

SFERP Water Balance

Water treatment attachment

Water Balance:

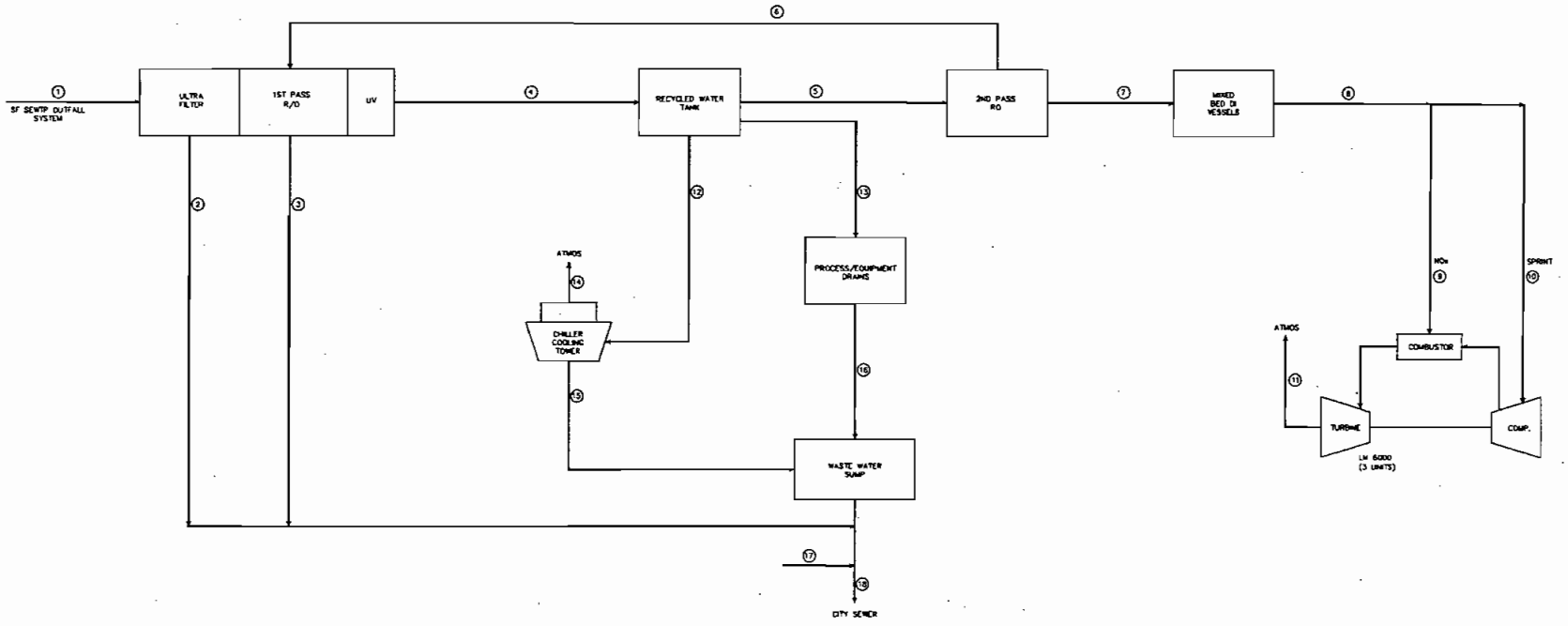
SFPUC Electric Reliability Project - Water Balance

Rev G

Point No	From	To	Average Water Use (3 CTG's in Operation) GPM	% Based on Inflow	% Based on Consumption	Maximum Water Use (3 CTG's in Operation) GPM	% Based on Inflow	% Based on Consumption
1	SF SEWTP Outfall system	Ultra Filter Inlet	318	100%		409	100%	
2	Ultra Filter Reject	Plant Waste Water Sump	32	10%		41	10%	
3	RO Reject	Plant Waste Water Sump	95	30%		119	29%	
4	UV	Recycled water tank	221	69%		278	68%	
5	Reclaimed water tank	2nd Pass RO Inlet	195	61%		194	47%	
6	2nd Pass RO reject	1st Pass RO Inlet	29	9%		29	7%	
7	RO Product	Mixed Bed DI Vessel Inlet	166	52%		165	40%	
8	Mixed Bed DI Vessel (DI Water)	CTG NOx & SPRINT Injection	166	52%	90%	165	40%	72%
9	DI Water	CTG NOx Injection	141	44%	76%	140	34%	61%
10	DI Water	CTG SPRINT Injection	25	8%	14%	25	6%	11%
11	DI Water Evaporation	Atmosphere	166	52%	90%	165	40%	72%
12	Recycled Water Tank	Cooling Tower Makeup	24	7%	13%	80	20%	35%
13	Recycled water tank	Plant / equipment drains	2	1%		4	1%	
14	Cooling Tower Evaporation	Atmosphere	19	6%	10%	64	16%	28%
15	Cooling Tower Blowdown	Plant Waste Water Sump	5	1%		16	4%	
16	Plant / equipment drains	Plant Waste Water Sump	2	1%		4	1%	
17	Domestic	Plant wastewater system	2	1%		4	1%	
18	Plant wastewater system	City Sanitary Sewer	135	43%		184	45%	

Annual recycled water usage: 53,050,588 gallons
(based on 12,000 turbine-hours) 162 acre-feet

Note: water consumed is water that is evaporated in the process and not returned to combined sewer.



SFPUC Electric Reliability Project - Water Balance

Rev G

Point No	From	To	Average Water Use (3 CTG's in Operation) GPM	Maximum Water Use (3 CTG's in Operation) GPM	Notes
1	SF SEWTP Outfall system	Ultra Filter Inlet	318	409	
2	Ultra Filter Reject	Plant Waste Water Sump	32	41	
3	RO Reject	Plant Waste Water Sump	95	119	
4	UV	Recycled water tank	221	278	
5	Reclaimed water tank	2nd Pass RO Inlet	195	194	
6	2nd Pass RO reject	1st Pass RO Inlet	29	29	
7	RO Product	Mixed Bed DI Vessel Inlet	166	165	
8	Mixed Bed DI Vessel (DI Water)	CTG NOx & SPRINT Injection	168	165	
9	DI Water	CTG NOx Injection	141	140	@ 25 ppm NOx
10	DI Water	CTG SPRINT Injection	25	25	
11	DI Water Evaporation	Atmosphere	166	165	
12	Recycled Water Tank	Cooling Tower Makeup	24	80	
13	Recycled water tank	Plant / equipment drains	2	4	
14	Cooling Tower Evaporation	Atmosphere	19	64	
15	Cooling Tower Blowdown	Plant Waste Water Sump	5	16	(@ 5 cycles of conc)
16	Plant / equipment drains	Plant Waste Water Sump	2	4	
17	Domestic	Plant wastewater system	2	4	
18	Plant wastewater system	City Sanitary Sewer	135	184	

Annual recycled water usage:	53,050,588	gallons
(based on 12,000 turbine-hours)	162	acre-feet

G	04-11-05	REVISED WATER FLOWS
F	12-22-03	REVISED FOR NEW WATER SUPPLY
E	2-19-04	WATER BALANCE CHART ADJUSTED
D	2-16-04	REVISED FOR 3 CTG'S
C	1-27-04	REVISED PRELIMINARY ISSUE
B	1-5-04	PRELIMINARY ISSUE FOR REVIEW
A	11-18-03	PRELIMINARY ISSUE FOR REVIEW

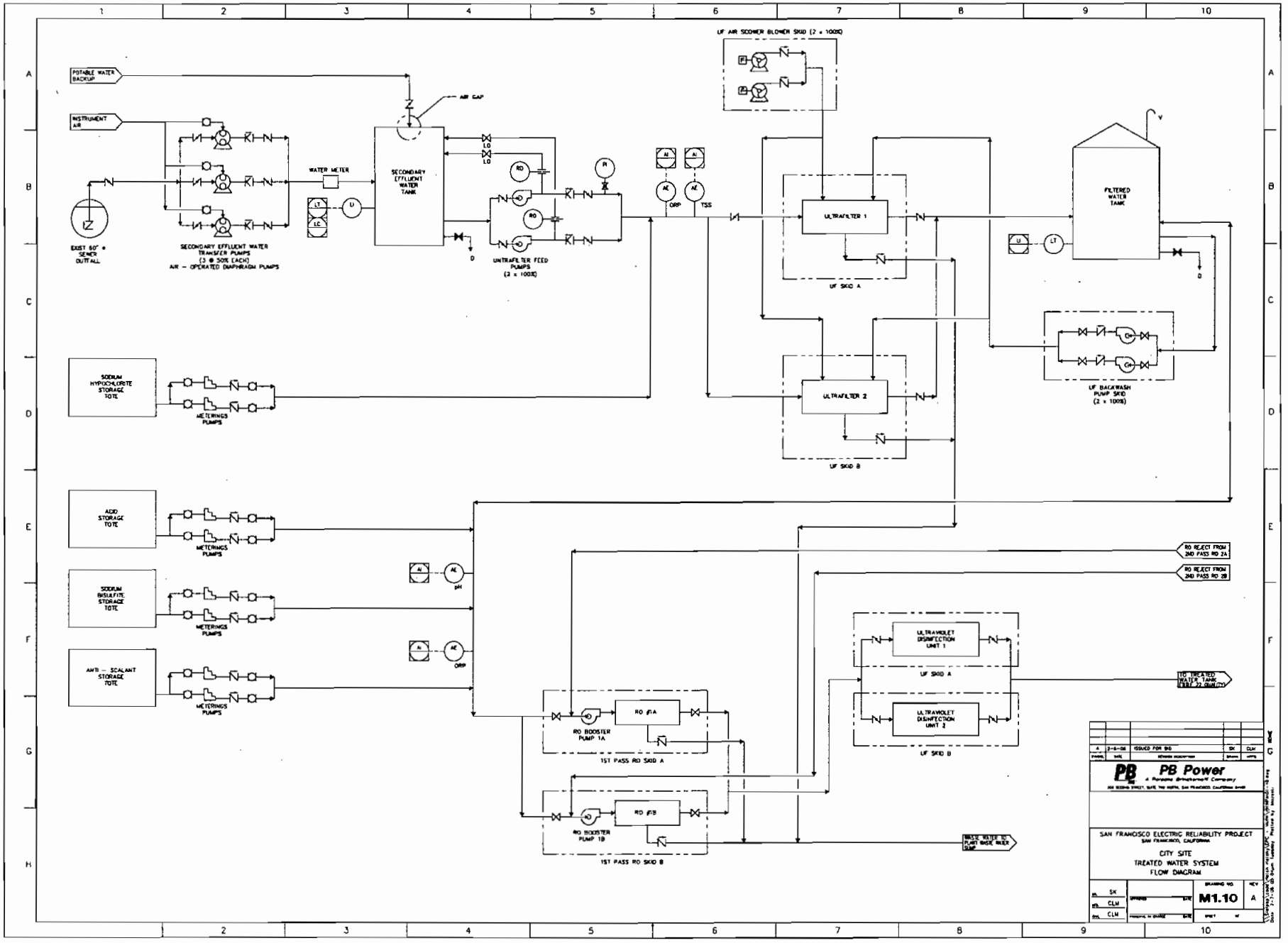
PB Power, Inc.
A Parsons Brinckerhoff Company
One Market Plaza, Suite 700, San Francisco, California 94105

SAN FRANCISCO PUBLIC UTILITIES COMMISSION
San Francisco, California

ELECTRIC RELIABILITY PROJECT
WATER BALANCE DIAGRAM

DRAWING NO. M2.2 REV G

DES. LTW
DR. CM
CK. CM


UF AIR SCOWER BLOWER SKID (2 x 100%)
POTABLE WATER BACKUP
INSTRUMENT AIR
AIR GAP
EXIST 60" ø SEWER OUTFALL
SECONDARY EFFLUENT WATER TRANSFER PUMPS (3 @ 50% EACH) AIR - OPERATED DIAPHRAGM PUMPS
WATER METER
SECONDARY EFFLUENT WATER TANK
UNTRAFILTER FEED PUMPS (2 x 100%)
ORP
TSS
ULTRAFILTER 1
UF SKID A
ULTRAFILTER 2
UF SKID B
FILTERED WATER TANK
UF BACKWASH PUMP SKID (2 x 100%)
SODIUM HYPOCHLORITE STORAGE TOTE
METERINGS PUMPS
ACID STORAGE TOTE
SODIUM BISULFITE STORAGE TOTE
ANTI - SCALANT STORAGE TOTE
pH
RO BOOSTER PUMP 1A
RO #1A
1ST PASS RO SKID A
RO BOOSTER PUMP 1B
RO #1B
1ST PASS RO SKID B
ULTRAVIOLET DISINFECTION UNIT 1
ULTRAVIOLET DISINFECTION UNIT 2
RO REJECT FROM 2ND PASS RO 2A
RO REJECT FROM 2ND PASS RO 2B
TO TREATED WATER TANK (REF. 22 QUALITY)
WASTE WATER TO PLANT WASTE WATER SUMP
A 2-6-08 ISSUED FOR BID SK CLM
PB Power
SAN FRANCISCO ELECTRIC RELIABILITY PROJECT
SAN FRANCISCO, CALIFORNIA
CITY SITE
TREATED WATER SYSTEM
FLOW DIAGRAM
DRAWN SK
CHK'D CLM
APP'D CLM
DRAWING NO. M1.10
REV A

Attachment

#7

Recycled Water Regulatory Requirements

Recycled Water Regulatory Requirements Attachment

The applicable local and State laws, ordinances and regulations are included in the AFC, and they include:

California Constitution, Article X, Section 2
This section requires that the water resources of California be put to beneficial use to the fullest extent possible and prohibits the waste, unreasonable use, or unreasonable method of use of water. The conservation of such waters is to be exercised with a view to the reasonable and beneficial use in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in the state is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use, or unreasonable method of use, or unreasonable method of diversion of water.

California Water Code
Water Code section 461 encourages the reuse of wastewaters. The administering agency is the SWRCB.

Water Code sections 8571, 8608, and Title 22, California Code of Regulations (CCR), chapter 4 sets water standards and treatment criteria for water recycling. This includes bacteriological water quality. Disinfected tertiary treatment is required for waters that have potential for contact with the public.

Water Code section 13550 requires the use of reclaimed water where available, as determined by the SWRCB. The availability of recycled water is based upon a number of criteria, which include provisions that the quality and quantity of the reclaimed water are suitable for the use, the cost is reasonable, the use is not detrimental to public health, and will not impact downstream users or biological resources.

Section 13551 of the Water Code prohibits the use of "...water from any source of quality suitable for potable domestic use for non-potable uses, including ...industrial... uses, if suitable recycled water is available..." given conditions set forth in Section 13550. These conditions take into account the quality and cost of the water, the potential for public health impacts and the effects on downstream water rights, beneficial uses and biological resources.

Section 13552.6 of the Water Code specifically identifies that the use of potable domestic water for cooling towers, if suitable recycled water is available, is an unreasonable use of water. The availability of recycled water is based upon a number of criteria that must be taken into account by the SWRCB. These criteria are that the quality and quantity of the reclaimed water are suitable for the use, the cost is reasonable, and the use is not detrimental to public health, will not impact downstream users or biological resources, and will not degrade water quality.

Section 13552.8 of the Water Code states that any public agency may require the use of recycled water in cooling towers if certain criteria are met, as determined by the SWRCB. These criteria include that recycled water is available and meets the requirements set forth in section 13550; the use does not adversely affect any existing water right; and if there is public exposure to cooling tower mist using recycled water, appropriate mitigation or control is necessary.

Recycling Act of 1991
The California Legislature's Water Recycling Act of 1991 (Water Code § 13575 et seq.) makes several findings and declarations regarding California's water resources and the need to develop reliable water sources. The Act encourages the use of recycled water for certain uses and established standards for the development and implementation of recycled water programs.

Tertiary Wastewater Treatment Permit
Under Title 22 of the California Code of Regulations, the California DHS reviews and approves wastewater treatment systems to meet tertiary treatment standards, allowing recycled use of water for industrial processes such as for steam production and cooling water.

The California Safe Drinking Water and Toxic Enforcement Act
This Act (California Health & Safety Code Section 25249.5 et seq.) prohibits actions contaminating drinking water with chemicals known to cause cancer or possessing reproductive toxicity. The requirements of the Act are administered by the RWCQB.

Reclaimed Water Use Ordinance Article 22 to Part 11, Chapter X of the San Francisco Public Works Code
Requires installation of dual plumbing and use of recycled water within the recycled water use area. SFWERP is within the designated reclaimed water use area and meets all other ordinance requirements.

Use of recycled water is consistent with City and California Energy Commission's (CEC's) policy addressed in the 2003 Integrated Energy Policy Report (IEPR). IEPR http://www.energy.ca.gov/2003_energypolicy/index.html, Section Five, page 39, which addresses the policy to require use of waste water for power plants. This section states:

"Clean fresh water is an increasingly critical resource in California. California's burgeoning population, expected to grow from 35.5 million in 2003 to 47.5 million in 2020, combined with businesses and industry, will continue to use increasing quantities of fresh water at rates that cannot be sustained. Imbalances in available fresh water supply result in 'average year' shortages projected in every region except parts of the San Francisco Bay area and the North Coast. Energy facilities are among the state's many water users and have the potential to affect fresh water supply and water quality."

"Degraded surface and groundwater can be reused for power plant cooling. When sufficient quantities are available, reclaimed water is a commercially viable cooling medium. Of the 8,409

MW of new cogeneration or combined cycle generated capacity permitted by the Energy Commission and brought on line in California between 1996 and September 2002, more than 1,580 MW or 19 percent is cooled using recycled water."

"State water policy regarding power plants is specified in Resolution 75-58 adopted by the State Water Resources Control Board (the Board). With respect to using fresh water, the Resolution articulates an underlying policy 'to protect beneficial uses of the state's water resources and to keep the consumptive use of freshwater for power plant cooling to that minimally essential for the welfare of the citizens of the state.' The policy reflects the state's concerns over discharges from power plant cooling, as well as the conservation of fresh water for cooling purposes."

"Specifically, the Board states that it 'encourages...power generating utilities and agencies to study the feasibility of using wastewater for power plant cooling' and 'encourages the use of wastewater for power plant cooling where it is appropriate.' The Board also lists specific 'discharge prohibitions' to limit the discharge of blow down and waste waters from cooling facilities so as to 'maintain existing water quality and aquatic environment of the state's water resources'."

"The Board further states as a matter of principle, 'Where the Board has jurisdiction, use of fresh inland waters for power plant cooling will be approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound'."

A reasonable recycled water source is available close to the In-City site. The Airport site will be dual plumbed to allow for the future use of recycled water.

The other options considered included: Potable water, which will be used as a back-up supply, and a source of raw wastewater, which was the original design. The selected option brings this component back into line with the budget submitted to the CDWR in the proforma. Treating wastewater to a level sufficient to be used at the plant was approximately $30 Million capital cost. The cost for the secondary effluent treatment system is less than one third of that.

The city does not believe the licensing process will allow the use of potable water except as a back-up supply.

Attachment

#8

Recycled Water Cost Estimates

Recycled Water Cost Estimates

The original preliminary 2004 estimate before the CH2M design (June 2004 estimate)

	Total Capital Cost
Pump Station	$105,500
Pipeline	$1,416,300
Recycled Water Facility	$7,500,000
Total	$9,021,800

CH2M design (December 2005) Recycled Water with the Marin Street intercept

Pump Station	$1,600,000	
Pipeline	$2,300,000	
Recycled Water Facility	$22,400,000	
Total	$26,300,000	(CH2M estimate)

EPC Documentation Design Connecting to the treated secondary effluent outfall (March 2006)

Intercept Station	$120,000
Pipeline	$1,656,000
Recycled Water Facility	$6,600,000
Recycle engineering	$600,000
Total	$8,976,000

Current Configuration (July 2006) revised secondary effluent supply location. Recycled water system in the current EPC Package.

Equipment	
Pipeline	$2,888,000
Building	$900,000
Engineering	$1,800,000
	$500,000
Total	$ 6,088,000

Attachment

#9

CEC Energy Facility Licensing Process,
Water Supply Information

CALIFORNIA
ENERGY
COMMISSION

ENERGY FACILITY LICENSING PROCESS

Water Supply Information

STAFF PAPER/DRAFT

DECEMBER 2000
P700-00-017

Gray Davis, *Governor*

December 5, 2000 **STAFF DRAFT**

California Energy Commission
Green Team Developer Assistance

WATER SUPPLY INFORMATION

Introduction

This paper was prepared in response to AB 970 in an effort to provide additional assistance to potential thermal power plant developers. This paper focuses on water supply issues, specifically how a developer could obtain water supplies to meet the needs of a new power plant.

A variety of water sources are available for new power plants. These sources include both local and imported surface water supplies, groundwater and reclaimed water. While water consumption by power generation within the state represents only a fraction of one percent of the total amount of water consumed, water demand by a power plant may be competing with other users for deminishing supplies. As California's population and water demand continues to grow, however, there will be increasing pressure for heavy industry, including power plants, to achieve greater water conservation. The Department of Water Resources (DWR) anticpates that the state will be suffering shortfalls in water supplies in excess of several million acre feet of water within the next ten years.

The following discussion briefly reviews the general issues associated with these sources, including regulatory concerns and identifies some alternative approaches for developing a power plant water supply.

Water Supply

The choice of a water supply must take into consideration the quality and the quantity of water the power plant will require. A convention 500 MW thermal combined cycle gas-fired power plant in California may consume from 2,000 to 4,000 acre-feet of water per year. In comparison, one acre-foot is the amount of water that would cover an acre of land to a depth of one foot and would meet the needs of an urban family of 4 for 20 months. The majority of this water, 80 to 90 percent, is used in the closed loop cooling system utilizing wet cooling technology. A simple cycle facility, lacking wet cooling towers will use significantly less water, approximately 60 to 200 acre-feet of water per year. Additionally, water quality issues, driven by the processes involved, also affect water supply decisions. The quality of the cooling water make-up is not as critical as that of steam cycle or plant process water needs which require high quality water. The quality of the source water will also affect the quality of the wastewater generated by the facility.

Approximately 70 percent of the developed water supplies in California are provided by one of the more than 600 water districts within the state. These districts are made up of a number of public and private entities providing water on a retail and/or wholesale basis for agricultural, domestic and industrial uses. Most districts supply

industrial customers such as a power plants, although a number of irrigation districts do not. A list of the private water districts is available on the California Public Utilities website: http://www.cpuc.ca.gov. In addition, the Association of California Water Agencies has a list of a substantial number of public and private water districts within the state: www.acanet.com.

Many districts within the state rely upon a combination of surface water and groundwater or just groundwater for their water supply. For much of the state, surface water supplies depend on two major water projects, the Central Valley Project and the State Water Project that route water from Northern California through the Sacramento-San Joaquin River Delta to Central and Southern California. Other significant water projects include the All-American Canal, the Colorado River Aqueduct, and the Hetch Hetchy Project. Given the variety of water sources utilized by local water districts, it is not unusual for water supply availability to vary significantly from district to district.

Some water districts in the state have sufficient resources to meet anticipated future demand either through existing water rights, water project entitlements, or a declining customer base. Accordingly, the cost of water may also vary greatly from district to district.

Given a project's location, water from the local district may be the only option available. Relying on a water district to supply a project's water requirements provides the project the infrastructure necessary for a secure water supply. It may also reduce the environmental compliance efforts associated with a project pumping or diverting its own water supply. On the other hand, water costs are expected to increase, perhaps significantly over time. In addition, many water districts will curtail water deliveries to heavy industrial facilities, such as power plants, under drought conditions.

An alternative to relying on a water district to supply project water needs is for the project owner to develop the facility's own supply. Many power plants in the state rely on groundwater pumped from their own wells on or near the site. Such an approach provides the facility with control of its water supply and is relatively inexpensive. On the other hand, it requires a more substantial investment in infrastructure, such as backup wells, and additional environmental compliance requirements. Most areas of the state do not regulate groundwater wells beyond well design requirements. Even in areas where the groundwater basin has been adjudicated, new groundwater wells are not prohibited but additional costs may be involved. Information on groundwater conditions throughout much of the state and on adjudicated groundwater basins can be found on the Department of Water Resources website: www.dwr.water.ca.gov.

New diversions of surface water would likely require a new water right by the State Water Resources Control Board. Information on water rights is available on the Board's website: www.swrcb.ca.gov. Given the over-allocation of many water bodies, competition for remaining supplies, and significant environmental concerns water diversions involve, this approach is not recommended.

Another option is water transfers. A water transfer is a change in the allocation of water supplies and may be between neighboring farmers or between water districts on opposite ends of the state. Since changes in allocation are usually for a limited duration, water transfers do not provide a reliable, long-term water supply. Transfers can, however, be used to augment water supplies when necessary. In response to recent droughts, the water transfers intended to alleviate shortfalls has increased and are now a key element of the recent CalFed accord. In addition, state law encourages public agencies to facilitate water transfers. For further information, see the paper on water transfers prepared by the State Water Resources Control Board: www.waterrights.ca.gov/watertransfer/watertransfer.

Alternative Water Supplies

The State Water Resources Control Board's "Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling" (Order No. 75-58) encourages the use of alternative sources of cooling water and/or the use of alternative cooling technology. Alternative sources of cooling water identified in the policy include wastewater, irrigation return flows, and naturally brackish water. The policy also encourages the evaluation of dry or wet/dry cooling technology for those facilities that may require water from the Sacramento-San Joaquin River Delta. These alternatives are discussed further below. A copy of the policy is available on the Board's website: www.swrcb.ca.gov/plnspols/wqplans/pwrplant.doc.

An alternative water source available in urbanized areas is wastewater or effluent from a wastewater treatment facility. A number of facilities within the state use wastewater for use in cooling towers. One facility, a combined cycle plant currently under construction, will use wastewater for both cooling and steam cycle processes. Many wastewater treatment plants, responding to a state mandate to recycle, do provide effluent for beneficial uses, mainly for irrigation. A survey conducted by the State Water Resources Control Board of wastewater treatment facilities and their recycling efforts can be found on their website at www.swrcb.ca.gov. Draft Department of Health Regulations require the use of tertiary treated, disinfected effluent in cooling towers. These regulations are available on the Department of Health Services website: www.dhs.ca.gov. Although most wastewater facilities within the state provide only secondary treatment, the addition of the necessary filtration and chlorination to achieve tertiary treated standards is not a significant cost.

California Water Code Section 13550 et seq. requires the use of effluent for industrial purposes, especially for cooling if it is available under certain conditions. These conditions include the potential affect on other water users, environmental concerns, and costs. The California Water Code is available on the web through the State Water Resources Control Board website: www.swrcb.ca.gov/water_laws/index.

Another approach is to utilize surface or groundwater sources not suitable for most agricultural or urban uses because of natural or anthropogenic contamination. These include brackish or contaminated groundwater supplies. The State Water Resources Control Board's policy on inland sources of cooling water encourages

the use of these and other sources such as irrigation return flows. It is likely, however, in many locations, irrigation returns flows vary greatly with the season and could not be considered a reliable, year-round water supply. While use of brackish or contaminated surface or groundwater for a project may raise a number of environmental concerns, it does present a potentially beneficial use of water that otherwise would further degrade other water supplies.

Alternative Technology

As noted above, a significant portion of a combined cycle power plant's water demand is to meet cooling water makeup requirements. Cooling towers reject heat from a power plant's steam cycle to condense the steam exiting the steam turbine and to maintain the lowest possible condenser vacuum. The heat rejection mechanism in wet cooling towers is primarily the evaporation of water to the atmosphere. Dry cooling towers transfer heat convectively through heat exchangers, while wet/dry hybrid cooling towers use combinations of the two mechanisms to reject heat to the atmosphere. The use of dry or hybrid cooling technology therefore can reduce a project's water demand by up to 90 percent.

The fundamental differences between wet, hybrid, and dry cooling towers are initial capital costs and heat rejection effectiveness. Dry cooling towers are two to three times more expensive than a wet system. Hybrid systems fall in the range between the two, depending upon the ratio of "wet to dry" cooling in the hybrid design. In general, the cost differences are due to the dry condenser, or heat exchanger, and taller and larger structures for dry and hybrid cooling systems.

Not taken into account in these relative cost estimates, are a variety of factors including the cost of water which will likely increase over time and the associated environmental compliance requirements. In addition, dry or wet/dry cooling substantially reduce a facility's wastewater stream and those associated costs. Perhaps more importantly, use of these technologies avoids the potential for curtailment of a project's water supply. However, heat rejection inefficiencies inherent in dry cooling towers can reduce net generator output during high ambient air temperatures. These production losses would need to be taken into consideration.

Although there is a variety of water sources within the state available to meet a project's water needs, the anticipated shortfall of the state's water supplies, even under normal conditions, must be taken into account. It is likely that under drought conditions, water deliveries to heavy industry, including power plants, may be curtailed. Another factor is that a project should be a good neighbor and not perceived as squandering limited high quality water supplies. As noted above, there are opportunities to use alternative water sources or alternative cooling technology to achieve water conservation. Another way to achieve water conservation is for a facility to cycle water through the cooling towers as much as possible. Hundreds of acre-feet of water can be saved by a facility cycling water 15 to 20 times through the cooling towers instead of just five. Such an approach poses additional treatment costs but does reduce water supply costs. This approach also

raises concerns about wastewater quality but these issues can be readily addressed.

For further information on this topic, please contact the California Energy Commission staff at:

Joe O'Hagan
Environmental Protection Office
1516 Ninth Street, MS 16
Sacramento, CA 95814
(916) 653-1651

Attachment

#10

Correspondence John Martin SFIA Director to
Susan Leal SFPUC General Manager
May 5, 2005

San Francisco International Airport

P.O. Box 8097
San Francisco, CA 94128
Tel 650.821.5000
Fax 650.821.5005
www.flysfo.com

May 5, 2005

Ms. Susan Leal
General Manager
Public Utilities Commission
1155 Market Street, 11th Floor
San Francisco, CA 94103

Dear Ms. Leal:

Since early 2000, the Airport has been working cooperatively with the San Francisco Public Utilities Commission ("PUC") in the PUC's efforts to develop new electric power generation resources that will improve electric reliability in the Bay Area, as well as allow the City to close the Hunters Point Power Plant. Toward this end, in May 2004 the Airport and PUC entered into a Memorandum of Understanding ("MOU") authorizing the PUC to site a 48-megawatt gas combustion turbine at the Airport ("Airport Plant") in conjunction with three identical units to be sited elsewhere in the City (collectively, the "Project").

The Airport's message has been clear and consistent throughout these efforts. While we wish to cooperate with PUC for the benefit of the City as a whole, in order to be compliant with Federal Aviation Administration regulations, the Airport Plant must have an "airport purpose," and that includes a direct connection to the Airport's power grid to provide back-up power in the event of a regional outage. This purpose is clearly stated in the MOU,[1] and is highlighted in the memoranda transmitting the MOU for approval of both the Airport and Public Utilities Commissions, respectively.

You are no doubt aware that all four of the gas combustion units to be used in the project were obtained by the City from Williams Energy Company in settlement of a lawsuit arising from the 2000-01 electricity crisis, and that the settlement also resulted in a power purchase agreement between the City and the California Department of Water Resources ("CDWR") that provides, among other things, for CDWR to reimburse the City for reasonable Project development costs.

Beginning as early as September 2004, Ralph Hollenbacher, PUC's Manager of Power Plant Development, began to express apprehension about CDWR's willingness to fully fund the Project, citing CDWR's concerns about the elevated costs of siting the Project at two separate locations. Mr. Hollenbacher suggested that cost savings could be realized by foregoing the direct Airport interconnection. Under Mr. Hollenbacher's plan, the Airport Plant would supply direct power to the PG&E grid only; PG&E would have the ability to direct the power to the Airport system in case of grid outage. This proposal was unacceptable to the Airport, as it would not only extend the Airport's response time, but would also make the Airport dependent upon PG&E's regional priorities in times of electrical emergency. The Airport

[1] "Supply of Emergency Backup Service to the Airport. It is the intent of the parties that the Project shall be used to supply emergency backup electric service to the Airport in the event of an outage of the statewide interconnected electricity grid that affects Airport operations. . . ." MOU Section 10(c).

reiterated its position that direct connection is essential from a practical standpoint, as well as to satisfy the "airport purpose" required by the FAA.

In a January 21, 2005 conference call including both Barbara Hale, Assistant General Manager for Power, and Project Manager Karen Kubick, there was a renewed effort to get the Airport to agree to drop the requirement of a direct Airport interconnection in order to effect cost savings. The Airport continued to require the direct connection and offered to assist PUC in making the strongest possible case to CDWR that such interconnection is essential. Both Ms. Hale and Ms. Kubick agreed to commit PUC's best efforts to get the interconnection included in the CDWR funding.

Nevertheless, we learned in a meeting held at PUC's request on Monday, April 18th, that Mr. Hollenbacher had sent a pro forma to CDWR that excluded the Airport interconnection from the base price for the Project but mentioned it in a footnote as a possible extra. After further discussion in which Ms. Kubick and PUC's legal counsel, Deputy City Attorney Jeanne Solé, again agreed that emergency backup power is required to meet the Airport's practical needs, in addition to the "airport purpose" test, Mr. Hollenbacher was instructed by Ms. Kubick to correct the pro forma by removing the footnote and including the Airport interconnection costs in the base price.

Two days later the Airport was copied on the transmittal to CDWR of the revised pro forma, which characterized the correction as a "change . . . not confirmed until recently. . . [that] . . . increases the capital costs for the airport site by $4 million." This is in direct contradiction to the Airport's steadfast position on this requirement, and the implication that this essential element of the Project is viewed as a costly extra may be damaging to PUC's efforts to secure full funding for the Project.

Ms. Kubick took immediate steps to correct the situation and has assured us of PUC's full commitment to ensure that the Airport has dedicated emergency power that is not dependent upon PG&E. Nevertheless, we fear that the damage may already be done with the CDWR.

Let me assure you that the Airport will continue to cooperate with your staff to effect the Project as originally contemplated. However, I feel compelled to re-emphasize to you that, consistent with the MOU and all subsequent discussions on the matter, the Airport deems the direct interconnection to be an essential element of the Project, and we will be unable to proceed with the Airport Plant without the emergency power capability that has been at the core of our agreement.

Very truly yours,

John L. Martin
Airport Director

cc: Gary Franzella
Jackson Wong
Jessie Blout, Mayor's Office of Economic & Workforce Development

JLF/LF/GF/DS:amm
bc: Baljit Boparai, Ernie Eavis, Gretchen Nicholson Dorothy Schimke

Attachment

#11

Memorandum of Understanding,
executed April 30, 2004 between the
Airport Commission and the
San Francisco Public Utilities Commission

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING (herein "**MOU**") dated hereof for reference purposes only as of April 30, 2004, is entered into by and between the Airport Commission of ("**SFO**"), and the Public Utilities Commission of the City and County of San Francisco (the "**PUC**").

RECITALS

A. The City and County of San Francisco ("**City**"), acting by and through SFO, is the owner of that certain property described on Exhibit A attached hereto (the "**Premises**"). The Premises are a part of the San Francisco International Airport (the "**Airport**").

B. The City obtained from Williams Energy Company ("**Williams**") four natural gas turbines for generating electricity in settlement of actions brought by the City against Williams arising from the electricity crisis of 2000-01.

C. Additional power generation in San Francisco and on the San Francisco Peninsula is needed to close down existing dirty generation while assuring electrical power reliability.

D. Action by the City is necessary to minimize the effects of an unexpected disruption of the supply of electric power to the Airport and to assure safety and reliability in Airport operations.

E. Pursuant to an MOU dated June 21, 2001, SFO and the PUC agreed to cooperate to secure a power plant on Airport property.

F. The PUC wishes to lease the Premises from SFO in order to construct a 48 MW power generation facility using one of the combustion turbines obtained through the Williams' settlement (the "**Project**"). The scope of the Project will include an interconnection to the Airport in order to supply emergency backup service to the Airport.

G. The parties now wish to enter into this MOU to set forth the conditions under which the PUC will lease the Premises from SFO for development of the Project.

H. This MOU is made in recognition of the requirements of the Federal Aviation Administration (FAA) final Policy and Procedures Concerning the Use of Airport Revenue, the Airport/Airline Settlement Agreement, the Airport/Airline Lease & Use Agreement and the September 14, 1982 Stipulated Judgement between TWA et. al. and City regarding the provision and sale of power by the City to the Airport and its airline tenants.

NOW, THEREFORE, IT IS AGREED AS FOLLOWS:

AGREEMENT

1. **Recitals.** The foregoing recitals are true and correct and are incorporated herein by this reference.

2. **Lease of Premises.** Subject to the provisions of this MOU, SFO shall lease to the PUC, and the PUC shall lease from SFO, the Premises.

3. **Effective Date.** The effective date of this MOU (the "**Effective Date**") shall be date that this MOU is executed by both parties, conditioned upon the subsequent approval by the Airport Commission and the Public Utilities Commission, each in their sole discretion.

4. **Term.** The term of this MOU (the "**Term**") shall commence on the date that the PUC notifies the Airport in writing that it needs to commence activities on the Premises in furtherance of the Project (the "**Commencement Date**"). The Term shall continue for a period of thirty (30) years thereafter, subject to any extensions mutually agreed upon by the parties (the "**Expiration Date**"). If, with permission of SFO, the PUC holds possession of the Premises after the Expiration Date, the PUC's use of the Premises shall continue on all of the terms and conditions stated herein, terminable by either party on ninety (90) days' written notice to the other.

5. **Rental Payments.**

(a) Rent Commencement; Fair Market Value. During construction of the Project, but in no event longer than one year following the Commencement Date, there shall be no base rent due for the PUC's use of the Premises. Upon completion of the Project or, if earlier, on the first anniversary of the Commencement Date (the "**Rent Commencement Date**"), and continuing for the remainder of the Term, the PUC shall pay to SFO the fair market value for rent of the Premises (the "**FMV**") as determined by the City's Department of Real Estate ("**DRE**"). For the first year, the parties agree that the FMV shall be One Hundred Fifty Nine Thousand Two Hundred Ten Dollars ($159,210; or $13,268 per month).

(b) Adjustments. On each anniversary of the Rent Commencement Date ("**Rent Adjustment Date**") through the fifth (5^{th}) lease year, the rent shall be adjusted to reflect any increase in the Consumer Price Index, as defined below, as follows: if the most recent Consumer Price Index published immediately prior to the applicable Rent Adjustment Date (the "**Comparison Index**") shall exceed the most recent Consumer Price Index published immediately prior to the Commencement Date (the "**Base Index**"), then the rent with respect to the upcoming year shall be increased to equal the following amount:

$$\text{Initial FMV} \times \frac{\text{Comparison Index}}{\text{Base Index}}$$

"**Consumer Price Index**" means that index published by the United States Department of Labor, Bureau of Labor Statistics known as "All Urban Consumers - All Items for the San Francisco-

Oakland-San Jose Area (1982-84 = 100)." In the event such index is discontinued, then "Consumer Price Index" shall mean an index chosen by DRE which is, in DRE's reasonable judgment, comparable to the index specified above.

The FMV shall be adjusted on the fifth (5th) anniversary of the Rent Commencement Date, and each fifth (5th) anniversary thereafter (**"FMV Adjustment Date"**), to reflect the actual fair market value of the Premises (excluding the Project). On each Rent Adjustment Date after a FMV Adjustment, the rent shall be adjusted to reflect any increase in the Consumer Price Index in accordance with the methodology described above, except that the Initial FMV shall be equal to the FMV as most immediately adjusted and the Base index shall be equal to the most recent Consumer Price Index published immediately prior to the most recent FMV Adjustment Date. Notwithstanding anything to the contrary herein, in no event will the annual rent for any lease year of the Term be lower than the annual rent with respect to the prior lease year. All payments hereunder shall be made in lawful money of the United States of America at Airport's address for notices, set forth below. Payments for any partial month will be prorated at the rate of one-thirtieth (1/30) of the monthly charge.

(c) Additional Charges. The PUC will pay or cause to be paid all charges for utility services provided to the Premises, including but not limited to electricity, water, sewer, gas and telephone, and will provide any scavenger service necessitated by its use of the Premises. Any utilities or services provided by SFO shall be at SFO's standard rates, as applied to other Airport tenants. If any possessory interest taxes are due as a result of the PUC's use of the Premises, then such taxes shall be the PUC's responsibility. Any and all charges and other amounts payable pursuant to this MOU shall be paid as additional rent, at the same place and in the same manner as FMV is payable. Airport shall have the same remedies for a default in the payment of any such additional charges as for a default in the payment of the FMV.

6. **Rights of Ingress and Egress**. The PUC and its agents shall have the non-exclusive right of ingress and egress to and from the Premises over roads, ramps, aprons, taxiways and other areas within the Airport designated by the Airport Director ("**Director**"). Without limiting the foregoing, Director shall have the right to alter or amend access routes at any time, and to impose reasonable restrictions on such access; provided SFO gives the PUC reasonable notice of any such alteration or amendment or imposition of any such restrictions. All such access shall be subject to Airport Rules and Regulations as amended from time to time, including those pertaining to badge, permitting, and other security requirements, and the requirements of this MOU.

7. **Rights of Way for Benefit of the PUC**. The PUC shall have the use and enjoyment of suitable rights of way over lands within the Airport, at locations and in a manner first to be approved by Director in writing. Such rights of way shall be for the purpose of enabling the PUC to install and maintain conduits, connections, ducts, pipes and wires, and incidental accessories, equipment and devices which are necessary or convenient in connection with the PUC's use of the Premises, including any installations necessary to provide connectivity to the SFO electricity grid and the statewide interconnected electricity grid (collectively, the "**Infrastructure**"), and shall not interfere with SFO's or SFO's tenants' use of Airport property. The parties understand and agree that the Project shall require connection to the existing

statewide interconnected electricity grid and the SFO electricity grid, and SFO and PUC engineers shall meet and confer in order to reach agreement upon the best location of the Infrastructure in order to accomplish this requirement. Subject to section 10(c) of this MOU, all costs relative to the installation, maintenance, repair and replacement of the Infrastructure shall be paid for by the PUC; provided, the PUC shall not be required to pay SFO any additional rent for the use of the land in which the Infrastructure is placed.

8. **Rights of Way for Benefit of SFO**. SFO shall have the right, at all times, without unreasonably or unduly interfering with PUC's use of the Premises to enter upon the Premises and install, construct, maintain, operate and remove water pipes, drainage pipes, electric power supply lines, telephone and communication conduits, sewerage lines for general airport use or SFO's tenants' use, and for any hazardous material remediation in, on, under or about the Premises. Any work performed by SFO under this Section shall not materially or unreasonably interfere with the PUC's use of the Premises.

9. **Changes to Airport**. The PUC acknowledges and agrees that (a) SFO shall have the right at all times to change, alter, expand, and contract the Airport or any portion thereof, and (b) SFO has made no representations, warranties, or covenants to the PUC regarding the design, construction, pedestrian traffic, cargo traffic, airline schedules, or views of or relating to the Airport or the Premises. Without limiting the generality of the foregoing, the PUC acknowledges and agrees that the Airport (i) is currently undergoing, and may from time to time hereafter undergo, renovation, construction, and other Airport modifications that may affect the need for emergency backup service from the Project; and (ii) may from time to time adopt rules and regulations relating to security and other operational concerns that may affect the PUC's business and its use of the Premises. SFO will use reasonable efforts to minimize the effect of Airport changes on the PUC's business.

10. **Use of the Premises**.

(a) Permitted Uses. The PUC may use the Premises for the installation, maintenance, repair, replacement, and operation of the Project, for related power generation activities, and for such other uses as may be approved by SFO. The PUC agrees to use the Premises and the Airport in strict compliance with Airport Rules and Regulations, including, but not limited to, the Airport Tenant Improvement Guide (the "**TI Guide**").

(b) Compliance with Laws. The PUC, at the PUC's expense, shall comply with all laws, regulations and requirements of federal, state, county and municipal authorities, now in force or which may hereafter be in force, relative to the PUC's use of the Premises.

(c) Supply of Emergency Backup Service to the Airport. It is the intent of the parties that the Project shall be used to supply emergency backup electric service to the Airport in the event of an outage of the statewide interconnected electricity grid that affects Airport operations, subject to and consistent with the requirements of the California Independent System Operator (the "**ISO**") and the California Department of Water Resources ("**DWR**"). SFO acknowledges that the City entered into a power purchase agreement with DWR, dated December 30, 2002,

pursuant to which DWR is entitled to purchase the output of the Project and to direct dispatch of the Project for the first ten years of commercial operation. The parties shall cooperate and work with DWR and the ISO to ensure that the Project is interconnected to the Airport, and able to supply emergency backup electric service to the Airport in the event of an outage of the statewide interconnected electricity grid that affects Airport operations. If and to the extent required, the parties agree to seek approval from DWR and the ISO with regard to the provision of such emergency backup electric service before construction of the Project. Furthermore, the parties agree to negotiate in good faith to design and construct the Airport interconnection in a manner that is practical, financially feasible, and provides adequate backup support to the Airport, and to ensure that the costs of such interconnection are appropriately allocated. If necessary, the parties may amend or supplement this MOU to reflect their agreement relative to the interconnection.

(d) Payment for Power. In the event that the Project is required to operate to supply emergency backup service to SFO, the Airport will pay the PUC for the power actually provided in an amount equal to the PUC's actual costs of operating the Project to supply the emergency backup service including any reasonable start-up, variable operation and maintenance and fuel costs, subject to the requirements of the 1982 Stipulated Judgement between TWA et. al. and City regarding the provision and sale of power by the City to the Airport and its airline tenants, if and to the extent applicable.

(e) PUC Supply of Hetchy Power. Nothing in this MOU is intended to interfere with or alter the respective responsibilities of the PUC and SFO as to supply of power by the PUC to Airport and its tenants pursuant to existing agreements.

(f) SFO Entry. SFO and its agents may enter upon the Premises at any reasonable time for the purpose of inspection or inventory, and when otherwise deemed reasonably necessary for the protection of the Airport's interests.

11. **Limitations on Use.** The PUC shall not (i) create a nuisance or commit or permit any waste on the Premises, (ii) permit the dumping or other disposal of landfill, refuse, hazardous material or any other material that could pose a hazard to health or safety or the environment, on the Premises; (iii) create or permit any liens, including mechanics', materialmen's and tax liens, to be placed on the Premises as a result of the PUC's activities without promptly discharging the same, and (iv) do anything in, on, under or about the Premises that could cause damage or interference to any of SFO's facilities. The PUC shall use reasonable precautions to prevent unauthorized persons from gaining access to restricted flight and public aircraft operational areas and all other nonpublic areas around the Premises.

12. **Antennae and Telecommunications Dishes.** No antennae, telecommunications dish, wireless telecommunications system, or other similar facilities may be installed on the Premises without the prior written approval of Director, which approval shall not be unreasonably withheld, conditioned or delayed. No such antennae shall interfere with SFO's emergency and non-emergency communications facilities or transmission facilities.

13. **Representative of the PUC.** The PUC shall assure SFO of emergency access to the Premises by providing a list of current emergency telephone numbers at which the PUC representative may be reached on a 24-hour basis. Emergency procedures shall be developed to insure proper communications between the PUC, SFO and the ISO in the event of an outage of the statewide interconnected electricity grid that would require the Project to provide power to SFO.

14. **Installation of Facilities.** All improvements on the Premises shall be constructed and installed in accordance with the TI Guide, and upon satisfaction of the following conditions:

(a) Approval of Plans and Specifications. The Project shall be constructed in accordance with plans and specifications (including drawings) approved in advance by SFO, which approval shall not be unreasonably withheld, delayed or conditioned. Certain improvements may require the approval of SFO's Design Review Committee.

(b) Permits and Approvals. Before beginning any work in the Premises, the PUC shall obtain any and all permits, licenses and approvals of all regulatory agencies and other third parties that are required to commence, complete and maintain the permitted work.

(c) Exercise of Due Care. The PUC shall use, and shall cause its agents to use, due care at all times to avoid any damage or harm to Airport facilities and the Premises.

(d) As-Built Drawings/Reports. Promptly upon completion of the Project, the PUC shall furnish SFO with two (2) complete copies of final as-built drawings for the facilities, including Infrastructure, which drawings shall include sufficient detail so as to allow SFO to precisely locate the facilities. In the event that the PUC or its agents prepares any environmental, seismic, geophysical or other written report relating to the Premises and/or any work performed thereon, the PUC shall furnish to SFO a complete copy of such report, including any schedules, exhibits and maps, promptly upon completion of the same.

(e) Underground Utilities. Prior to the beginning of any construction, the PUC shall locate all existing underground utilities in order to avoid damage to said utilities. The PUC shall promptly backfill any trench made by it so as to restore the surface of the ground thereover. In the event that any pipelines located on the Premises need to be changed, altered, removed or reconstructed in connection with other improvements at the Airport, the PUC shall, at its own expense, make such change, alteration, removal or reconstruction; provided, (i) any such relocation shall occur only after consultation with the PUC and all other alternatives have been considered and deemed unreasonable by SFO, and (ii) if the need for such relocation results from a project or improvement that is initiated by a tenant for the primary benefit of such tenant, then the PUC shall not be responsible for the costs.

(f) Drainage. Drains or other facilities provided by the PUC for the purpose of disposing of storm or other waters shall in no case be connected to sanitary sewers. In the event that the PUC's facilities (either storm or sanitary) are below an elevation that will permit gravity flow into facilities provided by SFO, then the PUC shall provide and maintain such pumping facilities as may be necessary to deliver storm water or sanitary sewage to the proper drainage

system facilities or sanitary sewers provided by SFO for the disposal of same. The PUC must provide adequate separations to prevent flow into the sanitary sewer system of petroleum products or chemicals or any foreign matter. The PUC shall take all reasonable precautions to prevent material going into the drainage system which would create interference with the flow therein, or which would cause undue hazards or unlawful contamination of the waters of the San Francisco Bay into which the drainage flow may be deposited.

15. **Maintenance.** The PUC shall be solely responsible for repairing and maintaining the Project and all improvements placed in or on the Premises pursuant hereto in good, clean, secure and safe condition, and SFO shall have no duty whatsoever for any maintenance or repair of the Premises. The PUC shall keep the Premises, or cause the Premises to be kept in strict compliance with the provisions of the TI Guide.

16. **Surrender.** Upon the expiration or termination of this MOU, the PUC shall surrender the Premises in the same condition as received, free from hazards and clear of all debris. At such time, the PUC shall remove all of its property and improvements from the Premises with the exception of such improvements that SFO agrees that the PUC may leave on the Premises.

17. **Insurance.** The PUC shall require any agent, contractor or subcontractor it hires in connection with its use of the Premises, to secure such insurance as is recommended by the City Risk Manager. All insurance policies shall include the Airport Commission, and its agents and employees, as additional insureds.

18. **"As Is" Condition.** The PUC accepts the Premises in its "AS-IS" condition, without representation, warranty or covenant of any kind by SFO, including without limitation, the suitability of the Premises for the PUC's proposed use. The PUC waives any and all rights to seek reimbursement or indemnity from SFO for any loss or cost relating to the condition of the Premises.

19. **Damages.** It is the understanding of the parties that SFO shall not expend any funds due to or in connection with the PUC's use of the Premises, except as otherwise set forth herein to the contrary. Therefore, the PUC agrees to be responsible for all costs associated with all claims, damages, liabilities or losses which arise out of the PUC's use of the Premises, including but not limited to the release or handling of hazardous materials on or about the Premises by PUC, its agents or contractors but excluding pre-existing hazardous materials which are the responsibility of SFO or SFO's tenants. The foregoing obligation of the PUC shall survive the termination of this MOU. As used herein, "hazardous materials" shall mean any substance, water or material which has been determined by any state, federal, or local government authority to be capable of posing a risk of injury to health, safety or property.

20. **No Assignment.** The PUC shall not assign, sublet, encumber, or otherwise transfer, whether voluntary or involuntary or by operation of law, the Premises or any part thereof, or any interest herein, without SFO's prior written consent.

21. Notices. All notices, demand, consents or approvals which are or may be required to be given by either party to the other under this MOU shall be in writing and shall be deemed to have been fully given when delivered in person to such representatives of SFO and the PUC as shall from time to time be designated by the parties for the receipt of notices, or when deposited in the United States mail, postage prepaid, and addressed, if to the PUC to:

San Francisco Public Utilities Commission
1155 Market Street, 5th fl.
San Francisco CA, 94103
Attn: General Manager
Fax No. (415) 554-3161
Tel No. (415) 554-3160

and if to SFO to:

San Francisco International Airport
Administrative Offices
Building 100, International Terminal
North Shoulder Building, 5th Floor
P.O. Box 8097
San Francisco, CA 94128
Attn: Airport Director
Fax No. (650) 821-5005
Tel. No. (650) 821-5000

or such other address with respect to either party as that party may from time to time designate by notice to the other given pursuant to the provisions of this Paragraph.

22. Cooperation. Subject to the terms and conditions of this MOU, SFO and the PUC agree to use reasonable efforts to do, or cause to be done, all things reasonably necessary or advisable to carry out the purposes of this MOU and the PUC's use of the Premises contemplated hereby as expeditiously as practicable, including, without limitation, performance of further acts and the execution and delivery of any additional documents in form and content reasonably satisfactory to both parties. Notwithstanding anything to the contrary in this MOU, neither SFO nor the PUC are in any way limiting their discretion or the discretion of any department, board or commission with jurisdiction over the Project from exercising any discretion available to such department, board or commission with respect to the Project, including but not limited to the discretion to (i) make such modifications deemed necessary to mitigate significant environmental impacts, (ii) select other feasible alternatives to avoid such impacts; (iii) balance the benefits against unavoidable significant impacts prior to taking final action if such significant impacts cannot otherwise be avoided, or (iv) determine not to proceed with the proposed Project. In addition to any conditions described in this MOU, the obligations of SFO and the PUC are expressly subject to the receipt of all legally required approvals following environmental review.

23. **Sponsor's Assurance Agreement**. This MOU shall be subordinate and subject to the terms of any "Sponsor's Assurance Agreement" or any like agreement heretofore or hereinafter entered into by SFO and any agency of the United States of America.

24. **Federal Nondiscrimination Regulations**. The PUC understands and acknowledges that SFO has given to the United States of America, acting by and through the Federal Aviation Administration, certain assurances with respect to nondiscrimination, which have been required by Title VI of the Civil Rights Act of 1964, as effectuated by Title 49 of the Code of Federal Regulations, Subtitle A - Office of the Secretary of Transportation, Part 21, as amended, as a condition precedent to the government making grants in aid to SFO for certain Airport programs and activities, and that City is required under said Regulations to include in every agreement or concession pursuant to which any person or persons other than City, operates or has the right to operate any facility on the Airport providing services to the public, the following covenant, to which the PUC agrees as follows: "the PUC in its operation at and use of San Francisco International Airport, covenants that (1) no person on the grounds of race, color, or national origin shall be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities; (2) that in the construction of any improvements on, over, or under such land and the furnishing of services thereon, no person on the grounds of race, color, or national origin shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, and (3) that the grantee, licensee, permittee, etc., shall use the Premises in compliance with all other requirements imposed by or pursuant to Title 49, Code of Federal Regulations, Subtitle A, Office of the Secretary of Transportation, Part 21, Nondiscrimination in Federally-Assisted Programs of the Department of Transportation Effectuations of Title VI of the Civil Rights Act of 1964, and as said regulations may be amended."

25. **Federal Affirmative Action Regulations**. The PUC assures that it will undertake an affirmative action program as required by 14 CFR Part 152, Subpart E, to insure that no person shall on the grounds of race, creed, color, national origin, or sex be excluded from participating in any employment activities covered in 14 CFR Part 152, Subpart E. The PUC assures that no person shall be excluded on these grounds from participating in or receiving the services or benefits of any program or activity covered by this subpart. The PUC assures that it will require that its covered sub-organizations provide assurances to the PUC that they similarly will undertake affirmative action programs and that they will require assurances from their sub-organizations, as required by 14 CFR Part 152, Subpart E, to the same effect.

26. **Miscellaneous**. (a) This MOU may be amended or modified only by a writing signed by SFO and the PUC. (b) No waiver by any party of any of the provisions of this MOU shall be effective unless in writing and signed by an authorized representative, and only to the extent expressly provided in such written waiver. (c) This MOU (including the exhibit) contains the entire understanding between the parties as of the date of this MOU, and all prior written or oral negotiations, discussions, understandings and agreements are merged herein. (d) Notwithstanding anything to the contrary set forth herein, no officer, director, or employee of the PUC has the authority to bind the PUC hereto unless and until the PUC Commission approves this MOU, and no officer, director or employee of SFO has the authority to bind SFO hereto unless and until the Airport Commission approves this MOU. (e) All transactions described herein are subject to and

must be conducted in accordance with the applicable requirements of the City's Charter and codes and applicable state and/or federal laws.

IN WITNESS WHEREOF, the parties have caused this agreement to be executed as of the date first written above.

AGREED TO AS WRITTEN ABOVE:

CITY AND COUNTY OF SAN FRANCISCO, a municipal corporation operating by and through its AIRPORT COMMISSION

By: _____
JOHN L. MARTIN
Airport Director

Date: 4/30/04

Airport Commission Resolution No. _____

Approved: _____

Attest:

AGREED TO AS WRITTEN ABOVE:

CITY AND COUNTY OF SAN FRANCISCO, a municipal corporation operating by and through its PUBLIC UTILITIES COMMISSION

By: _____
General Manager

Date: 4/30/04

PUC Resolution No.

Approved: _____

GF:bv
X:\AVI\PROJECTS\Power Plant\4-29MOU.DOC

EXHIBIT A

DESCRIPTION OF PREMISES

Attachment

#12

PG&E Supplemental Facilities Study
November 9, 2004

Supplemental Facilities Study

Generation Interconnection

City and County of San Francisco

San Francisco Airport Electric Reliability Plant

Islanded with SFO

DRAFT

Pacific Gas and Electric Company

November 9, 2004

Table of Contents

Appendices

1. Executive Summary

The City and County of San Francisco (CCSF) proposes to interconnect a new gas turbine generating facility to Pacific Gas & Electric's (PG&E's) transmission grid near the San Francisco International Airport. The generation project is called the San Francisco Airport Electric Reliability Plant (SFAERP). The proposed project will consist of one (1) LM6000 unit rated 50.5 MW. The net output of the proposed project will be 48.7 MW. The on-line date of the proposed project is June 2006. The proposed project will be connected to PG&E's transmission grid via a new PG&E-owned switching station tapped off the Martin – San Francisco Airport 115 kV Line near the existing United Co-gen facility. A Facilities Study for the proposed project was prepared and issued on July 29, 2004.

In addition to the Facilities Study, the CCSF requested a separate study be conducted to determine the system requirements necessary to allow the SFAERP to power the San Francisco Airport in an islanding arrangement, when the transmission grid experiences a local grid collapse. CAISO and PG&E have agreed to study this request by the use of a Supplemental Facilities Study (SFS). The SFS provides:

1. Cost estimates and work scope by PG&E for the facilities necessary to operate the SFAERP while it is islanded with SFO through their interconnections with PG&E's transmission grid.

2. An operating plan to establish the island after a grid collapse, operate the island, and establish resynchronization of the island with the grid when the grid disturbance has been resolved.

The Substation Evaluation identified no overstressed equipment associated with the islanding condition. To enable the island to re-synchronize with the PG&E's grid at the SF Airport Substation (also known as Station BA), some substation equipment would need to be installed. The cost of these network upgrades is approximately $51,000 before ITCC[1]. These costs are in addition to those developed in the Facilities Study (FS) for the interconnection of SFAERP.

CCSF will be responsible for controlling its SFAERP generation within permissible levels for re-synchronization with the PG&E's grid. Therefore, CCSF will be responsible for installing the necessary synchronizing system and fiber optics between the SF Airport Substation and the SFAERP generation site.

A draft operating procedure has been prepared for the Islanding Operation Plan. This draft is intended to serve as a basis for future discussion between the SFAERP, CAISO, and PG&E's operations engineers. Should CCSF's management decide to pursue and implement the Islanding Operation Plan, a final operating procedure will be prepared.

[1] Income Tax Component of Contribution

2. Project Information and Interconnection Plan

2.1 General Interconnection and Island Information

The proposed San Francisco Airport Electric Plant will consist of one (1) LM6000 gas turbine. The LM6000 gas turbine is rated at 50.5 MW, 85% (lag) – 95% (lead) power factor. The plant will have one (1) 13.8/115 kV step-up transformer. Figure 2-1 shows the location of the SFAERP in relation to the United Co-gen Facility, the United Co-gen Tap, and the transmission lines in the area.

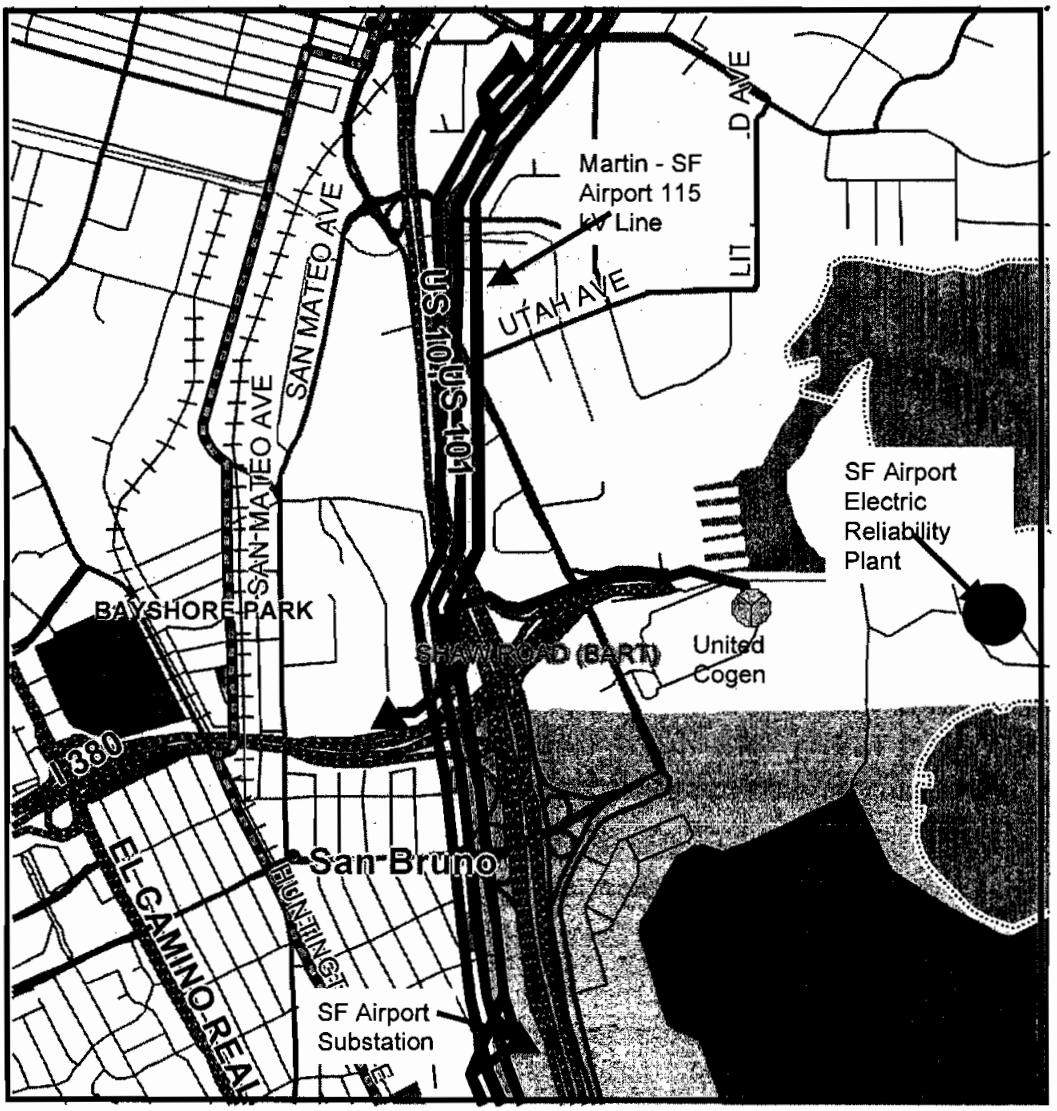


Figure 2-1: Map of the San Francisco Airport Electric Reliability Plant

The SFAERP will be connected to PG&E's transmission grid via a new PG&E switching station tapped off the Martin – San Francisco Airport 115 kV line near the existing United Co-gen facility. The United Co-gen facility will be reconnected to this new switching station. To improve the overall reliability of the system, the recommended configuration of the new switching station is a three-breaker ring-bus scheme as shown in Figure 2-2.

Given that the capacity of the SFAERP unit closely matches the airport load of approximately 50 MW, the CCSF envisions the SFAERP unit capable of islanding the SF Airport load to provide emergency back-up power in an event such as a local grid collapse. The CCSF proposed islanded operation scheme utilizes existing PG&E transmission facilities between the United Co-gen 115 kV Tap and the SF Airport Substation.

The CCSF emphasizes the need to establish emergency back-up power to the airport in a safe and orderly manner consistent with both the emergency management practices and operational constraints of PG&E and the airport. The CCSF indicates the SFAERP combustion turbine has a cold start-up time of approximately 10-20 minutes. Operated as a peaker unit, the CCSF further estimates the chance of having the unit on-line at the time of a grid collapse would be incidental and that United Co-gen would likely be on-line based on current operating practice.

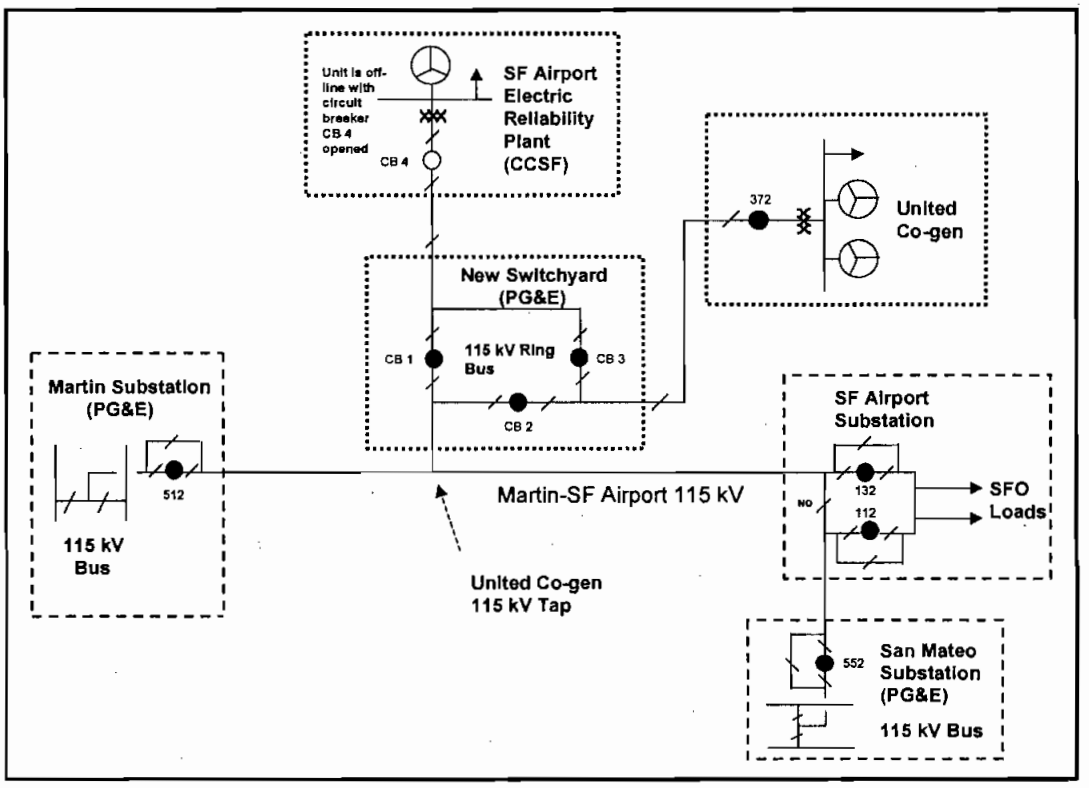


Figure 2-2: Conceptual One-Line Diagram of the San Francisco Airport Electric Reliability Plant

2.2 Post Outage / Pre-island Configuration

When the local area experiences a grid collapse, circuit breakers at San Mateo, SF Airport, Martin, and the New Switchyard will open automatically. The post outage/pre-island configuration is shown in Figure 2-3.

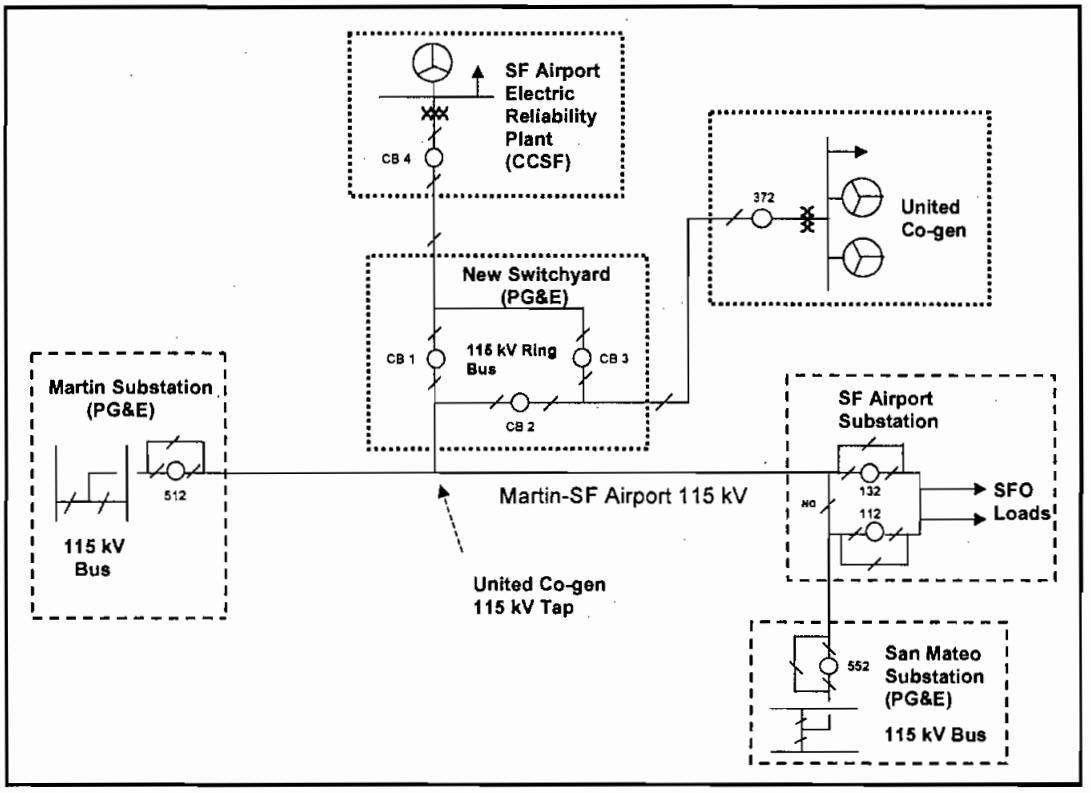


Figure 2-3: One-Line Diagram of the SFAERP Post-outage/Pre-island

2.3 Island Configuration

Closing New Switchyard Circuit Breaker (CB) 1, SF Airport CB 132, and SFAERP CB 4 will establish the island connection proposed by the CCSF. The island configuration is shown in Figure 2-4 with the intended power flow direction from the SFAERP to the SF Airport Substation.

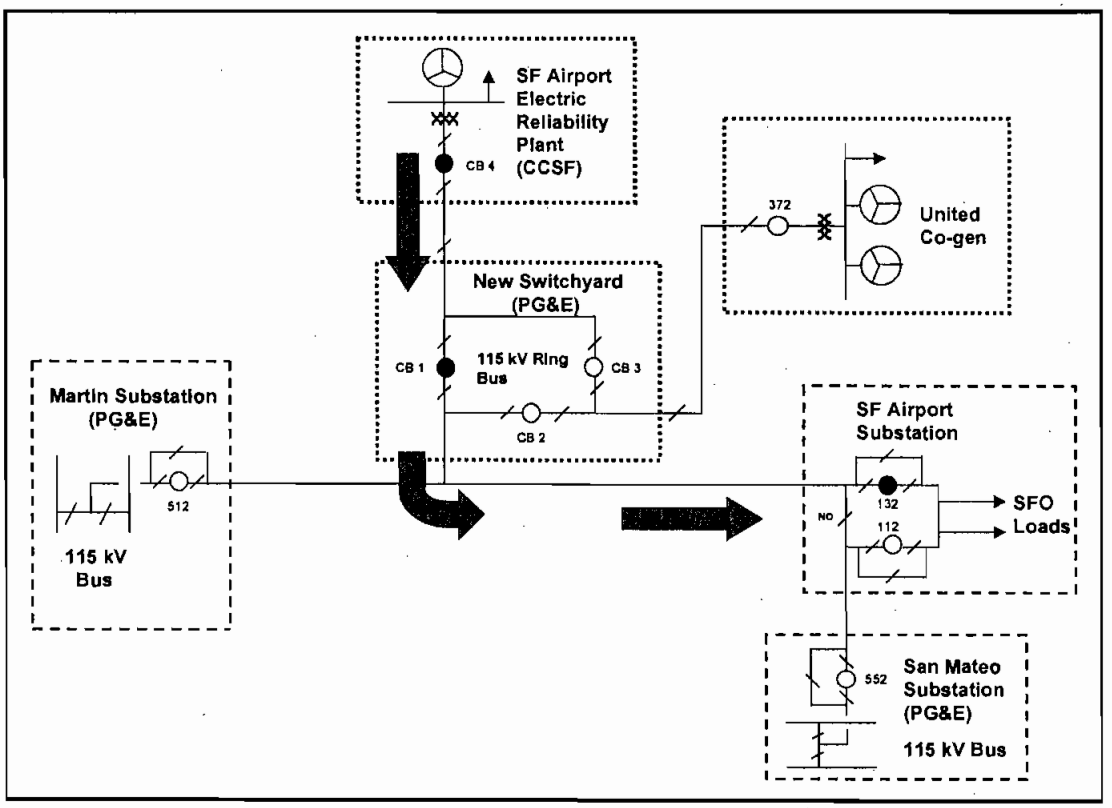


Figure 2-4: One-Line Diagram of the SFAERP Islanded with SFO

3. Cost Summary & Schedule

The additional cost to enable the Islanding Operation Plan is considered as Network Upgrade costs. The following table provides a summary of the PG&E's cost estimates. Appendix D includes the substation work scope.

Substation Work at the SF Airport Substation	
Additional engineering and design (including protection and automation)	***$15,000***
Additional station construction and labor and material	***$28,000***
Telecommunication Work at the SF Airport Substation	
Additional telecommunication engineering and labor	***$8,000***
Total Cost before ITCC Tax	***$51,000***
Total Cost After ITCC Tax @ 22%	***$62,220***

No additional transmission line work or land engineering support beyond that shown in the FS would be required based on the operation procedure in Section 5.

3.1 Tentative Construction Schedule

The estimated 18-month's construction schedule described in the SFAERP Generation Interconnection Facilities Study report is adequate to cover the added work scope needed to support the Islanding Operation Plan.

4. Study Assumptions

PG&E conducted the SFS under the following assumptions:

1) The maximum total output from the San Francisco Airport Electric Reliability Plant is 50.5 MW from one (1) LM6000 gas turbines. The expected total plant load is 1.8 MW. The maximum net output to the grid is 48.7 MW.

2) The expected on-line date is June 2006.

3) There will be one (1) step-up transformer. The transformer is a three phase transformer, 13.8/115 kV impedance grounded wye, rated 40/45/60 MVA @ 55 degree C temperature rise. The impedance is 10 % on the 40 MVA base.

4) CCSF will engineer, procure, construct, own, and maintain its project facility and the 115 kV generator tie lines.

5) In the event of a local grid collapse that de-energizes the Martin-SF Airport 115 kV Line; specific circuit breakers will open automatically or manually by Control Center operators via Supervisory Control and Data Acquisition System (SCADA). On-line generators at United Co-gen and/or SFAERP will trip off-line.

6) During the islanded condition, United Co-gen will not generate.

7) CCSF will be responsible for controlling its SFAERP generation within permissible level for re-synchronization with the PG&E's grid.

8) For generation control, CCSF will be responsible for installing necessary synchronizing system and fiber optics between the SF Airport Substation and the SFAERP generation site.

9) The point of re-synchronization will be located at the SF Airport Substation through the closing of PG&E's circuit breaker (CB) 112.

10) CB 112 will be closed automatically through the supervision of the local sync. check relay. Therefore, frequency meters would not be installed at the SF Airport Substation.

11) Existing single-phase voltage and frequency signals at the SF Airport Substation are adequate for the CCSF to implement re-synchronization with the PG&E's grid.

5. Islanding Operation Procedure

PG&E's Electric System Operations and the Control Center have established a draft operation procedure. This draft procedure is intended to be used as a basis for future discussion between the SFAERP, CAISO, and PG&E's operations engineers. Should CCSF's management decide to pursue and implement the Islanding Operation Plan, a final procedure would be prepared and used to:

- Provide criteria for PG&E and CAISO System Operators to evaluate whether an island should be established following a disturbance.
- Determine the specific operating configuration required for operating the island.
- Establish the communication protocol that authorizes CCSF to operate the island.
- Re-synchronize the island with the PG&E's transmission grid.

The following contents are a summary of the draft operating procedure in Appendix B.

5.1 Creating the SF Airport Island

5.1.1 Determining when an island can be created

The determination on whether an island should be established between SFAERP and SF Airport through the PG&E transmission system will be determined on a case-by-case basis. During any system disturbance, system operators (at both PG&E and CAISO) must assess the situation in terms of safety and the ability to restore the system to normal. The length of time required to make this assessment cannot be guaranteed ahead of time, and consideration will not be given to establishing an island until after this assessment is made.

5.1.2 General Criteria for Creating an Island

Islanding of SFAERP and SF Airport is intended for major system disturbances in which the transmission to both SF Airport Substation (station BA) and station MA becomes unavailable for an extended period of time. Islanding is not intended as an option when the transmission to only station BA is unavailable or in situations where it is expected that the PG&E transmission will be restored to normal in a short period of time.

Creating an island shall not interfere with the normal procedures for responding to system disturbances.

5.1.3 Procedure for Creating the SF Airport Island

- SF Airport to contact PG&E and request to island with SFAERP.
- Islanding procedures will proceed only when they do not interfere with normal disturbance response procedures.
- PG&E will get permission from CAISO to allow islanding of SF Airport with SFAERP through PG&E facilities.
- PG&E to confirm that lines are de-energized and clearance limits are established.
- PG&E to give permission to SFAERP to bring their generation on line and energize up to open CB's 1 and 3.
- SFAERP to notify PG&E when they are ready to pick up load.
- PG&E to close CB 1, energizing Martin-SF Airport 115kV line to open clearance points at Martin CB 512 and SF Airport CB 132.
- PG&E to close SF Airport CB 132, picking up load.

5.2 Paralleling the SF Airport Island with PG&E

5.2.1 Timing of Parallel

The Martin-SF Airport line will be returned to service following normal system restoration procedures. PG&E will notify SFAERP when the line is to be returned to service. If SFAERP is not ready to parallel at this time, SFAERP will have to disconnect from the PG&E transmission system so that the Martin line can be returned to service.

5.2.2 Location of Parallel

The islanded system will be paralleled with PG&E at Airport Substation (also known as Station BA), via CB 112.

5.2.3 Method of Parallel

The islanded system will be paralleled automatically via an auto-synchronizing relay installed by SFAERP. This relay will monitor the two systems on either side of the Airport Substation CB 112, and remotely control the SFAERP generation to bring the island into synchronism with PG&E. When the two systems are in synch, the relay will initiate closing of CB 112, paralleling the two systems. CB 112 closure will be supervised by a separate PG&E's synch check relay.

5.2.4 Procedure for Parallel

- PG&E to contact SFAERP informing them of intent to return Martin line to service.
- SFAERP to acknowledge their intent to parallel.
- PG&E to energize San Mateo – SF Airport 115kV line to open SFIA CB 112.
- PG&E to give permission to parallel.
- SFAERP to initiate parallel.

If for any reason a parallel cannot be made, SFAERP will have to disconnect from the PG&E transmission system so that the PG&E transmission can be returned to service.

6. Short Circuit Analysis

Table 5-1 lists the available short circuit duty during islanding condition at the SFAERP, new SF Airport Switching Station, SF Airport Substation, and Martin end. This data was used to determine if any equipment would be overstressed by the islanding configuration.

Fault Location	kV	3LG (A)	1LG (A)
SFAERP	115	866	1,185
PG&E's SF Airport Switching Station	115	861	1,180
SF Airport (BA)	115	850	1,170
SF Airport (BA)	12	4,910	7,070
Martin CB 512 (Line end)	115	820	1,075

Table 5-1: Short circuit study results

The fault duty results assume an islanding configuration with the SFAERP unit on-line, United Co-gen off-line, Martin CB 512 and San Mateo CB 552 open. Appendix C outlines the preliminary protection requirement.

7. Substation Evaluation

Using the short circuit analysis results in Section 6, the substation evaluation identified no equipment that would require upgrades to mitigate problems caused by overstress or overload as a result of implementing the proposed Islanding Operation Plan.

Appendix D provides the substation work scope need to implement the plan. A cost estimate for this work scope is provided in Section 3. Items for the work scope are as follows:

- Install two frequency transducers and two voltage transducers; wire the outputs to an existing I/O board for signals across CB 112.
- Install one dedicated synch check relay and timer for the islanding scheme.
- Install an analog output I/O board and connect this board to existing RTU. This board will provide analog signals of voltage and frequency to the CCSF. These feedback signals are necessary for the CCSF to adjust their generator terminal voltage and frequency for re-synchronization with the PG&E's grid after islanding.

8. Transmission Line Evaluation

Based on the draft Operation Procedure in Appendix B, there is no transmission line work involved with the proposed Islanding Operation Plan. No transmission line cost is included in the cost estimate.

9. Land Evaluation

PG&E's Corporate Real Estate Department determines that implementation of the proposed Islanding Operation Plan does not require any additional land engineering support. No land engineering cost is included in the cost estimate.

10. Environmental Evaluation/ Permitting

10.1 CPUC General Order 131-D

Pacific Gas and Electric Company (PG&E) is subject to the jurisdiction of the California Public Utilities Commission (CPUC); and must comply with CPUC General Order 131-D (Order) on the construction, modification, alteration, or addition of all electric transmission facilities (i.e., lines, substations, switchyards, etc.). This includes facilities to be constructed by others and deeded to PG&E. In most cases where PG&E's electric facilities are under 200 kV and are part of a larger project (i.e., electric generation plant), the Order exempts PG&E from obtaining an approval from the CPUC provided its planned facilities have been included in the larger project's California Environmental Quality Act (CEQA) review, the review has included circulation with the State Clearinghouse, and the project's lead agency (i.e., California Energy Commission) finds no significant unavoidable environmental impacts. PG&E or the project developer may proceed with construction once PG&E has filed notice with the CPUC and the public on the project's exempt status, and the public has had a chance to protest PG&E's claim of exemption. If PG&E facilities are not included in the larger project's CEQA review, or if the project does not qualify for the exemption, PG&E may need to seek

approval from the CPUC (i.e., Certificate of Public Convenience and Necessity or Permit to Construct) taking as much as 18 months or more since the CPUC would need to conduct its own environmental evaluation (i.e., Negative Declaration or Environmental Impact Report).

PG&E recommends that the project proponent include PG&E facility work in its project description and application to the lead agency performing CEQA review on the project. The lead agency must consider the environmental impacts of the interconnection electric facility, whether built by the developer with the intent to transfer ownership to PG&E or to be built and owned by PG&E directly, and make a finding of no significant unavoidable environmental impacts from construction of those facilities. Once the project has completed the review process and the environmental document (i.e., Negative Declaration or Environmental Impact Report) finds no significant unavoidable environmental impacts from PG&E's work, PG&E would file an Advice Letter with the CPUC and publish public notice of the proposed construction of the facilities. The noticing process takes about 90 days if no protests are filed, but should be done as early as possible so that a protest does not delay construction. PG&E has no control over the time it takes the CPUC to respond when issues arise. If the protest is granted, PG&E may then need to apply for a formal permit to construct the project (i.e., Certificate of Public Convenience and Necessity or Permit to Construct). Facilities built under this procedure must also be designed to include consideration of electric and magnetic field (EMF) mitigation measures pursuant to PG&E "EMF Design Guidelines of New Electrical Facilities: Transmission, Substation and Distribution".

Please see Section III, in General Order 131-D. This document can be found in the CPUC's web page at:

http://www.cpuc.ca.gov/PUBLISHED/GENERAL_ORDER/589.htm

10.2 CPUC Section 851

Because PG&E is subject to the jurisdiction of the CPUC, it must also comply with Public Utilities Code Section 851. Among other things, this code provision requires PG&E to obtain CPUC approval of leases and licenses to use PG&E property, including rights-of-way granted to third parties for interconnection facilities. Obtaining CPUC approval for a Section 851 application can take several months, and requires compliance with the California Environmental Quality Act (CEQA). PG&E recommends that Section 851 issues be identified as early as possible so that the necessary application can be prepared and processed.

11. Liability

As part of CCSF's plan to create and operate an electrical island at or near the SFO Airport in the event of a disturbance on PG&E's system, CCSF intends to use certain PG&E transmission lines and other equipment. You should be aware that PG&E does not generally allow the creation of intentional islands on its system due to the complexities of operating such an island, and the potential for equipment

damage or harm to PG&E employees or the public. Since CCSF plans to operate the island, CCSF must assume responsibility and all liability in the event of any damage to CCSF or PG&E equipment, or any harm to PG&E employees, CCSF employees, SFO employees or the public, that is caused by or results from the establishment and operation of the electrical island, and the return and synchronization of the islanded equipment to the grid subsequent to the disturbance.

By agreeing to conduct the CCSF SFO Airport Islanding Study Plan, PG&E does not warrant or imply that the electrical island envisioned by CCSF is in conformance with FERC or CPUC regulations or Prudent Utility Practice. Further, by agreeing to conduct the Study, PG&E does not warrant or imply that it will ultimately allow the creation of the island.

12. Study Updates

This Supplemental Facilities Study is performed according to the assumptions shown in the Section titled "Study Assumptions". In the event that these assumptions are changed, an updating study may be required to re-evaluate the SFAERP's impact on the PG&E's transmission grid. The CCSF would be responsible for paying for any such updating study. Examples of changes that might prompt such a study are:

- Change in interconnection date.
- Change in interconnection Queue position.
- Change in project's MW size.
- Change in interconnection plan.
- Change in island configuration.
- Change in the point of paralleling the island with the PG&E's grid.

13. Stand-by Power

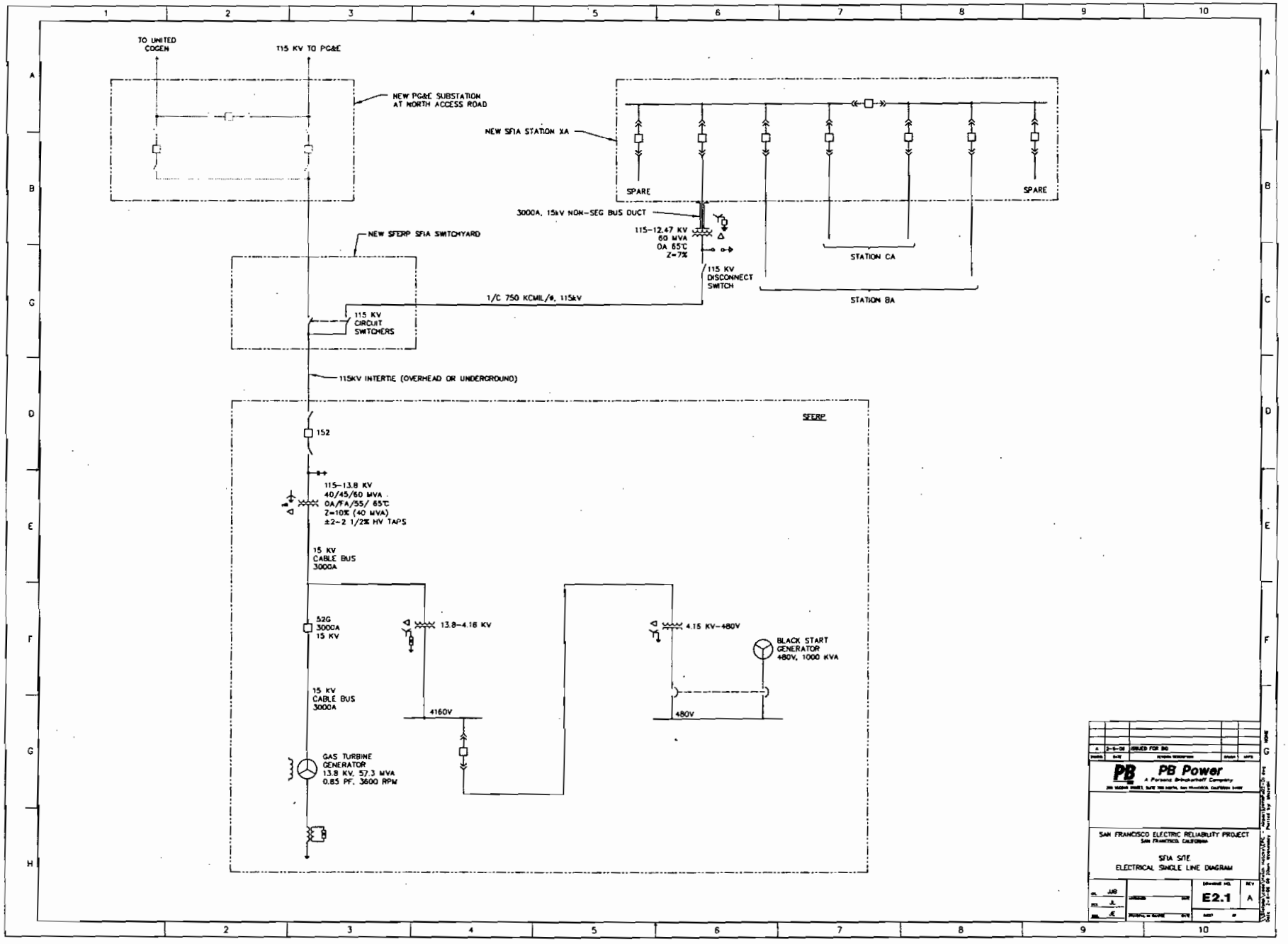
This study does not address any requirements for stand-by power that the project may require. The Applicant should contact their Generation Interconnection Services Representative regarding this service.

Note: The Applicant is urged to contact their Generation Interconnection Services Representative promptly regarding stand-by service in order to ensure its availability for the project's start-up date.

Attachment

#13

SFIA Site Electrical Single Line Diagram


TO UNITED COGEN
115 KV TO PG&E
NEW PG&E SUBSTATION AT NORTH ACCESS ROAD
NEW SFIA STATION XA
SPARE
SPARE
3000A, 15kV NON-SEG BUS DUCT
115-12.47 KV
60 MVA
OA 65°C
Z=7%
115 KV DISCONNECT SWITCH
STATION CA
STATION BA
NEW SFERP SFIA SWITCHYARD
1/C 750 KCMIL/ø, 115kV
115 KV CIRCUIT SWITCHERS
115KV INTERTIE (OVERHEAD OR UNDERGROUND)
SFERP
152
115-13.8 KV
40/45/60 MVA
OA/FA/55/ 65°C
Z=10% (40 MVA)
±2-2 1/2% HV TAPS
15 KV CABLE BUS 3000A
52G 3000A 15 KV
13.8-4.16 KV
4.15 KV-480V
BLACK START GENERATOR 480V, 1000 KVA
15 KV CABLE BUS 3000A
4160V
480V
GAS TURBINE GENERATOR 13.8 KV, 57.3 MVA 0.85 PF, 3600 RPM
ISSUED FOR BID
PB Power
A Parsons Brinckerhoff Company
SAN FRANCISCO ELECTRIC RELIABILITY PROJECT
SAN FRANCISCO, CALIFORNIA
SFIA SITE
ELECTRICAL SINGLE LINE DIAGRAM
DRAWING NO.
E2.1
REV
A