STOEL RIVES LLP
ATTORNEYS AT LAW

500 Capitol Mall, Suite 1600
Sacramento, California 95814
main 916 447 0700
fax 916 447 4781
www.stoel.com

MELISSA A. FOSTER
Direct (916) 319-4673
mafoster@stoel.com

April 18, 2012

VIA HAND DELIVERY AND US MAIL

Mr. Eric Solorio, Siting Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: Pio Pico Energy Center Project (11-AFC-01)
Additional Data in Support of PSD Permit Application

Dear Mr. Solorio:

On behalf of Applicant Pio Pico Energy Center, LLC, please find enclosed herein for docketing supplemental information submitted to U.S. Environmental Protection Agency Region 9 related to Applicant's PSD Permit Application for the Pio Pico Energy Center Project.

Should you have any questions regarding this submittal, please contact me directly.

Respectfully submitted,

Melissa A. Foster

MAF:jmw
Enclosure
cc: See Proof of Service List

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION
FOR THE *PIO PICO ENERGY CENTER, LLC*

Docket No. 11-AFC-1
PROOF OF SERVICE
(Revised 3/20/12)

Pio Pico Energy Center, LLC
Applicant's Submittal of Additional Data In Support of PSD Permit Application

APPLICANT

Gary Chandler, President
Pio Pico Energy Center
P.O. Box 95592
South Jordan, UT 84095
grchandler@apexpowergroup.com

David Jenkins, Project Manager
Pio Pico Energy Center, LLC
1293 E. Jessup Way
Mooresville, IN 46158
djenkins@apexpowergroup.com

APPLICANT'S CONSULTANTS

Maggie Fitzgerald
Sierra Research
1801 J Street
Sacramento, CA 95811
MFitzgerald@sierraresearch.com

COUNSEL FOR APPLICANT

John A. McKinsey
Melissa A. Foster
Stoel Rives, LLP
500 Capitol Mall, Suite 1600
Sacramento, CA 95814
jamckinsey@stoel.com
mafoster@stoel.com

INTERESTED AGENCIES

California ISO
e-mail service preferred
e-recipient@caiso.com

PETITIONERS

April Rose Sommer
Attorney for Rob Simpson
P.O. Box 6937
Moraga, CA 94570
e-mail service preferred
aprilsommerlaw@yahoo.com

ENERGY COMMISSION-DECISIONMAKERS

CARLA PETERMAN
Commissioner and Presiding Member
cpeterma@energy.state.ca.us

KAREN DOUGLAS
Commissioner and Associate Member
e-mail service preferred
kldougla@energy.state.ca.us

Raoul Renaud
Hearing Adviser
rrenaud@energy.state.ca.us

Jim Bartridge
Presiding Member's Adviser
jbartrid@energy.state.ca.us

Galen Lemei
Associate Member's Adviser
e-mail service preferred
glemei@energy.state.ca.us

ENERGY COMMISSION STAFF

Eric Solorio
Siting Project Manager
esolorio@energy.state.ca.us

Kevin W. Bell
Staff Counsel
kwbell@energy.state.ca.us

Eileen Allen
Commissioners' Technical Advisor for Facility Siting
e-mail service preferred
eallen@energy.state.ca.us

ENERGY COMMISSION – PUBLIC ADVISER

Jennifer Jennings
Energy Commission Public Adviser
e-mail service preferred
publicadviser@energy.state.ca.us

DECLARATION OF SERVICE

I, Judith M. Warmuth, declare that on April 18, 2012:

☐ I deposited copies of the aforementioned document and, if applicable, a disc containing the aforementioned document in the United States mail at 500 Capitol Mall, Suite 1600, Sacramento, California 95814, with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list herein and consistent with the requirements of California Code of Regulations, Title 20, sections 1209, 1209.5, and 1210.

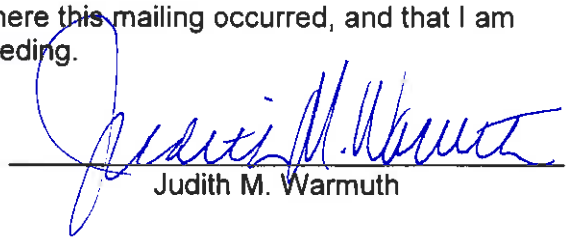
OR

☒ I transmitted the document(s) herein via electronic mail only pursuant to California Energy Commission Standing Order re Proceedings and Confidentiality Applications dated November 30, 2011. All electronic copies were sent to all those identified on the Proof of Service list herein and consistent with the requirements of California Code of Regulations, Title 20, sections 1209, 1209.5, and 1210.

OR

☐ On the date written above, I placed a copy of the attached document(s) in a sealed envelope, with delivery fees paid or provided for, and arranged for it/them to be delivered by messenger that same day to the office of the addressee, as identified on the Proof of Service list herein and consistent with the requirements of California Code of Regulations, Title 20, sections 1209, 1209.5, and 1210.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.



Judith M. Warmuth

April 13, 2012

sierra research

1801 J Street
Sacramento, CA 95811
Tel: (916) 444-6666
Fax: (916) 444-8373

Ann Arbor, MI
Tel: (734) 761-6666
Fax: (734) 761-6755

Mr. Gerardo Rios
Chief, Permits Office
U.S. EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Subject: Pio Pico Energy Center PSD Permit Application
Response to Supplemental Information Request

Dear Mr. Rios:

As requested in your March 21, 2012 email request, we are submitting the additional information set forth below on behalf of Applicant Pio Pico Energy Center LLC.

10-Minute Startup Requirement

Comment: You agreed to provide an explanation of the need for a 10 minute turbine start-up time, and why a longer startup time, e.g., 30 minutes, would not be consistent with the operational needs of the project.

First, it is important to clear up a misunderstanding about the startup time for the current generation of "fast start" combined-cycle units. There are no combined cycle configurations in the size range needed for this project that can start up and reach full rated power in 30 minutes.[1] For a 300 MW combined cycle unit, an output of only 180-200 MW can be achieved within this 30 minute time period. It takes a considerably longer period of time for a combined cycle unit to reach full load under combined cycle operation (and corresponding efficiency).

Under hot start conditions, it can take up to 2 hours for a combined cycle unit to reach full power production. Under cold start conditions, up to 3 ½ hours are required to achieve full load combined cycle output. Because the purpose of the comparison between simple cycle and combined cycle turbine performance is to evaluate whether a combined cycle unit is capable of meeting the performance requirements of the project, the more appropriate question is "why a longer startup time (e.g., 125 minutes) would not be consistent with the operational need of the project."

[1] Both Siemens and GE have developed "flexible efficiency" combined cycle units capable of reaching full gas turbine capacity in 30 minutes from a hot start. However, these units are rated at over 500 MW; and under cold start conditions, the time to full load is considerably longer than 30 minutes. For a peaking facility such as PPEC, fast cold start response is an important feature.

No single power production technology is capable of meeting all of the needs of a power production system. In general, renewable resources produce relatively low greenhouse gas emissions, but are not reliable or available at all times. Baseload technologies provide steady, reliable, and efficient power, but cannot react quickly to changes in load or supply. Enough generation must be distributed in order to balance the generation and load demands of the electric distribution systems. The power production system uses different power production technologies so that the system, as a whole, is capable of meeting the widely varying demands placed on it, without grid instability or possible interruption of service.

EPA has recognized the distinction between baseload, intermediate, and peaking power production, and the fact that certain technologies are not suited for all uses. Specifically, EPA has recognized that combined cycle facilities are well-suited for baseload and intermediate power production, due to their efficiency. However, the relatively high capital costs and relatively slow response times of combined cycle facilities makes them unsuited for use as peaking production units. Power grids need both in their mix of resources.[2] For peaking service, a delay of an hour or more from dispatch to full load is not acceptable.

PPEC was designed to meet SDG&E's stated need for peaking/intermediate capability (see Product 2 of the attached letter from SDG&E). It is important to understand the context of the RFO in order to interpret the requirements. First, at the time that the RFO was published (and, indeed, at this time as well) combined cycle plants were not considered candidates for peaking operation. Second, the anticipated heat rate of 10,500 Btu/kWh in the RFO is consistent with an expectation that simple cycle technology would be proposed. Finally, the requirement that proposals should provide "flexible resources that are capable of providing regulation" and that proposals capable of "quick start operations" would be ranked higher both rule out technology with a long startup cycle. All three bids that were accepted by SDG&E in response to the RFO were either simple cycle combustion turbines or reciprocating engines, all with extremely fast response and startup times. This provides clear evidence that a combined cycle alternative to PPEC would not have been feasible as a practical matter, as it would not have been selected to receive a contract by SDG&E.

PPEC is designed to operate not more than 4,000 hours per year, and to cycle several times a day in response to sudden shifts in demand. A combined cycle unit operating in this fashion would a) spend much of its operating time ramping up or ramping down the steam turbine, thereby not achieving the expected combined cycle efficiency; and b) incur significant maintenance costs as a result.

Because a combined cycle unit would constitute a fundamental redesign of the project, and because use of currently available combined cycle technology would not meet the legitimate objectives of the project, combined cycle technology was eliminated as technically infeasible at Step 2 of the Top-Down BACT analysis.

---

[2] EPA, *Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units*, EPA-HQ-OAR-2011-0660 (March 27, 2012). "The EPA is not including stationary simple cycle turbines in this rule because they generally operate differently than the other units covered by today's rule. The units covered by today's rule are generally used to serve baseload or intermediate demand, while simple cycle turbines are generally used much less often (and thus have lower GHG emissions) and are generally used to meet peak demand rather than base or intermediate load requirements."

Cost Data

Comment: You agreed to provide cost data that compares construction and annual operating costs of your proposed simple cycle plant with a hypothetical combined cycle plant of similar capacity.

Response: Applicant retained E3 Consulting, LLC, to evaluate the costs to build and operate a nominal 300 MW power generation facility using three different generation technology options. The following three options were evaluated:

- GE LMS100PA, three units in simple-cycle configuration;
- GE Frame 7FA.04 Fast Start in 1x1 combined-cycle configuration; and
- Siemens SGT 5000F Flex 10 1x1 combined-cycle configuration.

The basis for the analysis is provided in Table 1. The results of cost analysis are summarized in Table 2. Details of the analysis are provided in the attached letter from E3 Consulting.

Applicant has evaluated the emissions associated with each of the options for which cost estimates were developed. The same basis used for cost calculations was used for emission calculations. Emissions are summarized in Table 3. This table shows that the GE FS Combined Cycle unit would have higher GHG emissions than the simple cycle configuration proposed for Pio Pico for the specific operating scenario expected for PPEC. This occurs because the lengthy startup cycle results in significantly more hours of startup time, with significantly more fuel consumption, during the 500 starts per year that PPEC is required to offer. The GE FS CC configuration is therefore eliminated as a candidate for BACT for GHG for this project.

Details of the GHG calculations are presented in Tables 4 through 7.

Table 1A Operating Scenario

	Pio Pico	GE FS CC	Siemens FS CC
COLD STARTS			
Number of cold startups per year	500	52	52
Duration of cold startup (total, incl. SC + CC) (hrs/start)	0.2	3.5	2.08
Duration of elevated emissions during cold startup (hrs/start)	0.5	0.75	0.20
Duration of normal emissions during cold startup (hrs/start)	0.0	2.75	1.88
Hours of elevated emissions during cold startups per year (hrs/yr)	250.0	39.0	10.4
Hours of normal emissions during cold startup (hrs/yr)	0.0	143	97.9
HOT/WARM STARTS			
Number of hot/warm startups per year	inc	448	448
Duration of hot/warm startup (total, incl. SC + CC)	inc	2	1
Duration of elevated emissions during hot/warm startup (hrs/start)	inc	0.23	0.2
Duration of normal emissions during hot/warm startup (hrs/start)	inc	1.77	0.75
Hours of elevated emissions during hot/warm startups per year (hrs/yr)	inc	104.5	89.6
Hours of normal emissions during hot/warm startups per year (hrs/yr)	inc	791.5	336
SHUTDOWNS			
Number of shutdowns per year	500	500	500
Duration of shutdown (total, incl SC + CC)	0.2	1	1
Duration of elevated emissions during shutdown (hrs)	0.2	0.5	0.5
Hours of elevated emissions during shutdown per year (hrs/yr)	83.3	250	250
Duration of normal emissions during shutdown (hrs)	0.0	0.5	0.5
Hours of normal emissions during shutdown per year (hrs/yr)	0.0	250	250
ANNUAL OPERATIONS			
Total operating hours per year (hrs/yr)	4167	5578	5034
Hours of elevated startup/shutdown emissions per year (hrs/yr)	333	394	350
Hours of normal startup/shutdown emissions per year (hrs/yr)	0	1184	684
Hours of startup operation per year	83	1078	534
Hours of shutdown operation per year	83	500	500
Hours gas turbine baseload operation per year (hrs/yr)	4000	4000	4000

Table 1B Predicted Heat and Power Rates

GE LMS100PA SC (Pio Pico Energy Center)	Heat Input HHV	Turbine Output MW	Heat Rate, Btu/kWh
Full load, ~ISO conditions (63 F)	903	103.3	8738
Min load, ~ISO conditions	546	51.6	10576

GE Frame 7FA.04 (Fast Start) 1x1 CC (from Oakley Generating Station)	Heat Input HHV	Turbine Output MW	Heat Rate, Btu/kWh
GT only, full load, ISO conditions	2102	213	9869
GT only, min load, ISO conditions	1339	104	12829
CC, full load (net heat rate from AFC)	2102	312	6752
Average, SC to CC full load	2102	263	8310

Notes:

1. Includes evaporative cooling and ACC
2. Cold startup: 45 min to SC full + 2 hr 45 min to CC full (total start time from McLucas/Radback 10/21/10 email to BAAQMD); warm/hot start: 14 min to SC full + 1 hr 46 min SC to CC full (total start time from McLucas/Radback 10/21/10 email to BAAQMD); shutdown: 30 min CC full to SC full + 30 min SC full to off
3. Assume 5000 hours of operation per year for aux boiler, including 500 startups/shutdowns

(per FDOC, aux boiler operates when turbine is down plus during turbine startup/shutdown)

50.6 MMBtu/hr steady state

25.3 MMBtu/hr startup/shutdown

Siemens SGT6 5000F (Flex 10) 1x1 CC (from Carlsbad Energy Center Project)	Heat Input HHV	Turbine Output MW	Heat Rate, Btu/kWh
GT only, full load, ISO conditions	2000	208	9615
GT only, min load, ISO conditions	1227	104	11798
CC, full load	2000	279	7168
Average, SC to CC full load	2000	244	8392

Notes:

1. Includes evaporative cooling and ACC; heat input at ISO conditions without PAG
2. Full load CC turbine output from GHG Table 2, p. 6.1-13, of the RPMPD for Carlsbad Energy Center
3. Cold startup: 12 min to SC full + 113 min to CC full (from Siemens startup curves); warm/hot start: 12 min to SC full + 45 min SC to CC full (from Siemens startup curves, avg of hot and warm ST times); shutdown: 30 min CC full to SC full + 30 min SC full to off
4. Assume Siemens CC utilizes same evaporative cooler as GE CC

Table 2 Turbine Capital and Operating Costs

Primary Technology	Configuration/ Cycle	Net Output		Capital Cost	Fixed O&M Cost	Variable O&M (non major)	Major Maintenance	Total Maintenance	Total Maintenance
		MW	MWH/yr	$/kW	$/kw-yr	$/MWH	$/MWH	$/MWH	$MM/year
LMS100PA-SAC	3x0 SC	310	1,265,400	829	15.3	0.91	2.09	$3.015	$3.82
GE 7FA.05	1x1 CC Fast Start	312	1,599,996	1029	16.1	0.85	2.35	$3.216	$5.15
Siemens SGT6-5000F	1x1 CC Flex 10	279	1,318,938	1153	16.1	0.85	4.56	$5.426	$7.16

Table 3 Emissions

	NOx			SOx			CO			VOC			PM10			GHGs
	Max lb/hr	Max lb/day	Total tpy	Max lb/hr	Max lb/day	Total tpy	Max lb/hr	Max lb/day	Total tpy	Max lb/hr	Max lb/day	Total tpy	Max lb/hr	Max	Total tpy	CO2e metric tpy
LMS100 totals	79.8	898.2	68.4	5.3	141.4	3.9	160.9	1320.6	94.5	19.8	268.0	20.2	17.2	433.8	35.8	608,547
7FA totals	97.6	496.3	49.3	6.0	136.9	5.5	361.3	814.0	54.5	67.4	220.3	19.4	8.8	210.0	23.9	625,385
SGT6-5000F totals	69.2	426.9	42.0	4.2	94.4	3.4	545.0	913.4	63.1	33.1	120.2	11.7	10.2	243.8	25.3	521,540
Difference, LMS 100 vs 7FA	**-17.8**	**401.9**	**19.1**	**-0.7**	**4.5**	**-1.6**	**-200.4**	**506.6**	**40.0**	**-47.6**	**47.6**	**0.8**	**8.4**	**223.8**	**11.9**	**-16,838**
Difference, LMS 100 vs SGT6	**10.6**	**471.3**	**26.4**	**1.1**	**47.1**	**0.5**	**-384.1**	**407.2**	**31.4**	**-13.3**	**147.8**	**8.5**	**7.0**	**190.0**	**10.5**	**87,007**

Table 4 Natural Gas Combustion GHG Emission Rates

Pollutant	CO2 (2)	CH4 (3)	N2O (3)	SF6
Emission Factors, kg/MMBtu	53.020	1.00E-03	1.00E-04	n/a
Global Warming Potential (4)	1	21	310	23,900

Notes:
1. Calculation methods and emission factors from ARB, "Regulation for the Mandatory Reporting of Greenhouse Gas Emissions," amended 12/16/10; effective 1/1/12.
2. 40 CFR 98, Table C-1
3. 40 CFR 98, Table C-2
4. 40 CFR 98, Table A-1.

Table 5 Greenhouse Gas Emissions, PPEC

Unit	Rated Capacity, MW	Operating Hours per year	Maximum Fuel Use, MMBtu/yr	BTU/kWH at ISO conditions	Estimated Gross Annual MWh, 3 CTGs	Maximum Emissions, 3 CTGs metric tons/yr				Estimated Emissions, metric tons/MWh		
						CO2	CH4	N2O	SF6	CO2	CH4	N2O
Turbine, baseload	103.3	4000	3,731,196	9,030	1,239,600	593,484	11.19	1.12	0.00	0.479	9.03E-06	9.03E-07
Turbine, startup	51.6	83	45,475	10,576	12,900	7,233	0.14	0.01	0.00	0.561	1.05E-05	1.06E-06
Turbine, shutdown	51.6	83	45,475	10,576	12,900	7,233	0.14	0.01	0.00	0.561	1.05E-05	1.06E-06
Total	--	--	3,822,146		1,265,400	608,951	11	1	0	0.480	9.06E-06	9.06E-07
CO2eq						608,951	241	355	0			
					TOTAL	609,547						

Notes:
1. Operating hours based on 4000 hours of normal operation +500 startup/shutdown cycles
2. Fuel use based on 100% firing at near-ISO conditions during normal operations; 50% firing (average) during startup and shutdown. Startup = 10 minutes; shutdown = 10 minutes
3. Annual MWh based on 100% during normal operations; 50% (average) during startup and shutdown.

Table 6 Greenhouse Gas Emissions, (GE Combined Cycle, based on Oakley)

Unit	Rated Capacity, MW	Operating Hours per year	Maximum Fuel Use, MMBtu/yr	BTU/kWH at ISO conditions	Estimated Gross Annual MWh, 3 CTGs	Maximum Emissions, 3 CTGs metric tons/yr				Estimated Emissions, metric tons/MWh		
						CO2	CH4	N2O	SF6	CO2	CH4	N2O
Turbine, CC baseload	312.0	4,000	8,426,496	6,752	1,248,000	446,773	8.43	0.84	0.00	0.358	6.75E-06	6.75E-07
Turbine, SC to CC full load	262.5	1,184	2,583,851	8,310	310,923	136,996	2.58	0.26	0.00			
Turbine, hot start	104.4	104.5	139,970	12,829	10,910	7,421	0.14	0.01	0.00			
Turbine, cold start	104.4	39	52,221	12,829	4,070	2,769	0.05	0.01	0.00			
Turbine, shutdown	104.4	250	334,750	12,829	26,093	17,748	0.33	0.03	0.00			
Aux Boiler	--	5000.0	246,422			13,065	0.25	0.02	0.00			
Total	--	--	11,783,710		1,599,996	624,772	12	1	0	0.390	7.36E-06	7.36E-07
CO2eq						624,772	247	365	0			
					TOTAL	625,385						

Notes:

1. Operating hours based on 4000 hours of normal operation +500 startup/shutdown cycles
2. Fuel use based on 100% firing at ISO conditions during normal operations; 50% firing (average) during startup and shutdown. Cold start = 45 minutes; warm start = 14 minutes; shutdown = 30 minutes.
3. Annual MWh based on 100% during normal operations; 50% (average) during startup and shutdown.
4. Warm/hot start: 120 minutes to ST full load
5. Cold start: 210 minutes to ST full load

Table 7 Greenhouse Gas Emissions, ((Siemens combined cycle, based on Carlsbad)

Unit	Rated Capacity, MW	Operating Hours per year	Maximum Fuel Use, MMBtu/yr	BTU/kWH at ISO conditions	Estimated Gross Annual MWh, 3 CTGs	Maximum Emissions, 3 CTGs metric tons/yr				Estimated Emissions, metric tons/MWh		
						CO2	CH4	N2O	SF6	CO2	CH4	N2O
Turbine, CC baseload	279.0	4,000	8,000,000	7,168	1,116,000	424,160	8.00	0.80	0.00	0.380	7.17E-06	7.17E-07
Turbine, SC to CC full load	243.5	684	1,397,572	8,392	166,538	74,099	1.40	0.14	0.00			
Turbine, hot start	104.0	89.6	109,939	11,798	9,318	5,829	0.11	0.01	0.00			
Turbine, cold start	104.0	10	12,761	11,798	1,082	677	0.01	0.00	0.00			
Turbine, shutdown	104.0	250	306,750	11,798	26,000	16,264	0.31	0.03	0.00			
Total	--	--	9,827,022		1,318,938	521,029	10	1	0	0.395	7.45E-06	7.45E-07
CO2eq						521,029	206	305	0			
					TOTAL	521,540						

Notes:

1. Operating hours based on 4000 hours of normal operation +500 startup/shutdown cycles
2. Fuel use based on 100% firing at ISO conditions during normal operations; 50% firing (average) during startup and shutdown.
3. Annual MWh based on 100% during normal operations; 50% (average) during startup and shutdown.
4. Warm/hot start: 12 minutes to GT full load + 45 minutes to ST full load
5. Cold start: 12 min to GT full load + 113 min to ST full load

Maintenance Tasks

Comment: The letter you emailed on 3/19/2012 regarding GHG BACT does not describe the maintenance tasks and associated frequency that PPEC intends to conduct for the LMS100 turbines. My staff had asked you to provide us with a detailed description of the tasks that PPEC expects to conduct, to allow us to craft maintenance conditions that, combined with a one time heat rate demonstration, might constitute GHG BACT for the project. If you still want us to consider this approach that you proposed, please provide specific details of the tasks and associated frequencies that would be included in the turbine maintenance plans that you referenced in the draft permit condition included in your letter.

Response: As we discussed in our meeting at Region 9 headquarters on March 7, 2012, the language contained in the proposed maintenance condition was based upon the maintenance requirements in the RICE NESHAPS.

Applicant has contacted the manufacturer and received information regarding specific maintenance activities that are intended to keep the turbines operating at maximum efficiency. In addition, we reviewed PSD GHG BACT determinations made by EPA for other recent projects. Based on these sources of information, we have developed the following proposed permit condition language; the specific details of maintenance tasks and associated frequencies that you requested are included below.

The heat rate limits that Applicant proposed in its March 19, 2012 letter were based on estimated turbine performance data provided by GE.[3] These values represent the expected performance of a new turbine, based on the design and manufacturing tolerances to build LMS100 machines. Due to the tolerances of manufacturing, assembly, and construction, the actual performance of a specific new turbine could be 3% higher or lower than the expected value. While suitable for use as a basis for estimating emissions, these data are not guaranteed by GE, and require adjustment for the variability in construction and installation, as well as instrument uncertainty, before being used as a compliance requirement. After further consultation with GE and with the contractor who will be building the facility, Applicant is proposing a heat rate limit consistent with the guarantee provided by GE. Applicant proposes a compliance requirement equal to the highest heat rate in the cases used to evaluate emissions, plus 3% to account for the factors described above. In order to avoid additional uncertainty (and therefore the need for additional compliance margin), the proposed heat limit is based on gross power production.

1. GHG BACT requirements
    a. Operating Requirements
        i. Permittee shall minimize emissions at all times, including during start-up and shutdown activities, by operating and maintaining the facility and associated air pollution control equipment in accordance with good air pollution control practices, safe operating practices, and protection of the facility.

[3] Please note that the values in the March 19, 2012 letter were incorrectly identified as based on net power production. They were actually based on gross power production.

b. Performance Test
    i. Within 90 days after achieving normal operation, but not later than 180 days after the initial startup of equipment, Permittee shall conduct a performance test to demonstrate that the thermal heat rate (btu_{hhv}/kw-hr_{gross}) of each turbine at full load does not exceed 9,196 btu/kw-hr.
        1. Btu_{hhv} is the heat content of the fuel flow into the turbine
        2. Kw-hr_{gross} is the power production measured at the generator terminals
        3. The heat rate performance test shall be conducted according to the requirements of the American Society of Mechanical Engineers Performance Test Code on Overall Plant Performance, ASME PTC 22.

c. Monitoring
    i. Permittee shall measure and record, for each turbine, the following:
        1. Gross energy output (MWh_{gross}) on an hourly basis
        2. Fuel consumption (MMSCF of natural gas) on an hourly basis

d. Maintenance requirements
    i. On or after initial performance testing, permittee shall use the combustion turbine and plant-wide energy efficiency processes, work practices and designs as represented in the permit application.

    ii. Permittee shall prepare a Maintenance Plan for each turbine. The Maintenance Plan shall follow manufacturer's written instructions or operator-developed procedures that provide, to the extent practicable, for the maintenance and operation of the turbine in a manner consistent with good air pollution control practice for minimizing emissions. The Maintenance Plan shall include, but not be limited to, the following requirements:
        1. Permittee shall maintain each turbine, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions.
        2. Annual maintenance shall be performed no less frequently than once every four calendar quarters. Maintenance shall include:
            a. Generator testing
            b. Boroscope inspection of turbine passes
            c. Control system check
        3. Major overhaul shall be conducted as recommended by the manufacturer, at 25,000 operating hours (or other period recommended in writing by the manufacturer).
    iii. Permittee shall maintain each turbine according to the Maintenance Plan.

e. Recordkeeping requirements

i. Permittee shall maintain a log describing maintenance and repair activities, including the following information:
    1. Date of activity
    2. Description of activity
    3. For scheduled maintenance, the elapsed time, hours of turbine operation, or other applicable measure since the activity was last performed.
    4. For scheduled maintenance, the elapsed time, hours of turbine operation, or other applicable measure until the activity should next be performed.

With this submission, we believe EPA has all of the information it needs to establish BACT requirements for all pollutants, including GHGs, for the Pio Pico Energy Center project. To that end, Applicant looks forward to receipt of the draft PSD permit for the Pio Pico Energy Center.

Sincerely,

Steve Hill

Attachments

cc: John McKinsey, Stoel Rives LLP
David Jenkins, Apex Power Group
Steve Moore, SDAPCD

James P. Avery
Senior Vice President - Power Supply

8330 Century Park Court
San Diego, CA 92123-1530
Tel: 858-650-6102
Fax: 858-650-6106
javery@semprautilities.com

April 4, 2012

SENT BY EMAIL AND FEDERAL EXPRESS

Gary Chandler
APEX Power Group, LLC
2542 Singletree Lane
South Jordan, UT 84095

Re: Pio Pico Energy Center
Application for Prevention of Significant Deterioration Permit

Dear Mr. Chandler:

San Diego Gas & Electric Company (SDG&E) understands that Pio Pico Energy Center LLC (Pio Pico) has applied to the U.S. Environmental Protection Agency for a Prevention of Signification Deterioration permit for the Pio Pico Energy Center (the Project). Pio Pico proposed the Project in response to SDG&E's Request for Offer (RFO) dated June 9, 2009, and this letter summarizes key points relating to the RFO.

The California Public Utilities Commission (CPUC) issued Decision 07-12-052 on December 20, 2007. This decision approved SDG&E's long-term resource plan.[1] In the decision, the CPUC required "SDG&E to procure dispatchable ramping resources that can be used to adjust for the morning and evening ramps created by the intermittent types of renewable resources." Decision 07-12-052 at 115, 278.

SDG&E issued the RFO in response to the CPUC's decision. The RFO was for "peaking or intermediate-class resources." RFO at 2.[2] As the RFO explained, "SDG&E requires flexible

---

1 Decision 07-12-052 is voluminous and is therefore not appended to this letter. The decision is available on the CPUC website at <http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/76979.pdf>. The CPUC modified Decision 07-12-052 in Decision 08-11-008, dated November 6, 2008, which is available on the CPUC website at <http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/76979.pdf>.

2 The RFO is appended as Attachment 1.

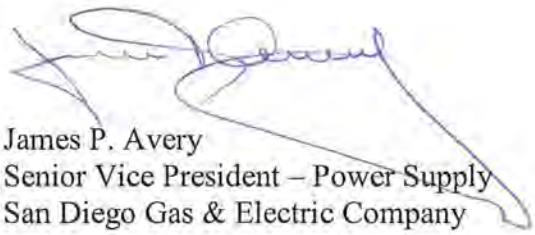
resources that are capable of providing regulation during the morning and evening ramps and/or units that can be started and shut down as needed." RFO at 2.

SDG&E evaluated all bids, including Pio Pico's bid for the Project, on "an expected cost analysis covering both quantitative and qualitative information . . . on the basis of a least cost/best fit (LCBF) analysis." RFO at 8. SDG&E selected the Project based on this least cost/best fit analysis.

SDG&E and Pio Pico then executed a Power Purchase Tolling Agreement (Agreement) on February 2, 2011. SDG&E has applied to the CPUC for authority to enter into the Agreement, and the proceeding on the application is pending.[3]

I hope that this information is helpful.

Sincerely,



James P. Avery
Senior Vice President – Power Supply
San Diego Gas & Electric Company

---

3 The documents filed in the proceeding are available on the CPUC website at http://docs.cpuc.ca.gov/published/proceedings/A1105023.htm.

ATTACHMENT 1

REQUEST FOR OFFERS
for
DEMAND RESPONSE
and
SUPPLY RESOURCES

June 9, 2009

San Diego Gas & Electric Company
Electric and Gas Procurement Department
8315 Century Park Court,
San Diego, CA 92123-1593

1. Scope of Supply[1]

San Diego Gas & Electric Company (SDG&E) is issuing this Request for Offers (RFO) for demand response and supply resources to support reliability within the SDG&E service territory, supply energy to bundled customers and/or meet other portfolio needs including Resource Adequacy (RA) requirements. All resources that can meet the obligations set forth below are welcome to bid their offers into this RFO (Offer(s)); however, all renewable resources are strongly encouraged to participate in a separate renewables-only solicitation, which SDG&E issues annually[2]. SDG&E anticipates this RFO will produce contracts from respondents (Respondent(s)) as indicated below:

	Local Resources		Resources Outside SDG&E	
	Short-Term	Long-Term	Short Term	Long Term
Product 1: Demand Response	Term: 3 years Delivery Starts: 2012			
Product 2: New Generation		Term: 20 years Delivery Starts: 2010 - 2014		
Product 3: Existing Resources	Term: 1 year / 2 years Delivery Starts: 2010 or 2011			
Product 4: Existing Resources			Term: 2 years Delivery Starts: 2010	
Product 5: Existing Resources		Term: 10 years Delivery Starts: 2012		
Product 6: New or Existing Resources				Term: 10 years Delivery Starts: 2012
Product 7a: Firm LD Energy	Term: 2 years / 4 years Delivery Starts: 2010 or 2012		Term: 2 years / 4 years Delivery Starts: 2010 or 2012	
Product 7b: Resource Adequacy				

[1] Amounts requested in each product category may vary based upon CAISO determinations on RMR, local zone definition, unit retirement, and the quantity selected in other product categories.

[2] To be notified of pending Renewable-only solicitations, please email contact information to RenewableRFO@sempra utilities.com.

General characteristics of each product are described below. SDG&E anticipates that all Offers received will provide SDG&E with a menu of resources from which it can select to fulfill its short- and long-term needs. The capacities listed are not a guarantee of purchase amounts for each product, but rather estimates of potential volumes. The final purchase amounts will depend on factors including evolving resource planning considerations, the number of Offers received for each product type and potential overlap in product characteristics from various Offers. Offered prices for Products 1 through 6 and 7b are valid and binding upon the Respondent until contract execution; there will be no opportunities to refresh Offer prices. There will be one opportunity to refresh Offer prices for Product 7a as indicated in the schedule on Section 3 RFO Schedule. Tolling products 2-6 will include supply of all capacity attributes including Resource Adequacy and Ancillary Services if available.

Product 1 - Demand Response
SDG&E seeks Demand Response products for a three year term. Initial load reduction will commence on May 1st 2012. This product must be a means of reducing an end-use customer's demand and/or energy usage during a demand response event, must be for at least 1.0 MW in the aggregate and be within SDG&E's service territory. The demand and/or energy reduction must be measureable. The Offer must provide, in sufficient detail, the Demand Response product, the process for delivering Demand Response and the manner in which it will meet the minimum guidelines specified in Section 6 Offer Requirements of this solicitation.

Product 2 - New Local[3] Generation Projects, online in 2010 - 2014.
SDG&E seeks a minimum of 100 MW of peaking or intermediate-class resources as new construction or expansion projects within SDG&E's territory. Any resulting contract will be a tolling agreement with a term of 20 years and online dates of May 1- or October 1 in either 2010, 2011, 2012, 2013 or 2014. The generation must be located physically within SDG&E's service territory (as more specifically described in the Addendum) or have its sole generator transmission system interconnection (gen-tie) directly interconnected to the electric network internal to SDG&E's local area as currently defined by the California Independent System Operator ("CAISO") such that the unit supports SDG&E's Local RA requirement. Units located within CAISO's proposed expanded local area for SDG&E (see Addendum) should submit Offers in other products of this solicitation. Products offered in this category shall be capable of operating under all permits at annual capacity factors of a minimum of 30%with an availability of -98%. It is anticipated that heat rates will be no higher than 10,500 btu/kWh. For this product, SDG&E requires flexible resources that are capable of providing regulation during the morning and evening ramps and/or units that can be started and shut down as needed. In addition, SDG&E will include the additional value provided from projects that can provide quick start operations[4] in the ranking of Offers. SDG&E also requires that each Offer contain pricing for, and an option to provide, black start capability.

Product 3 - Existing Local Resources, delivering in 2010 and/or 2011
SDG&E seeks a minimum of 400 MW of existing resources currently operating within SDG&E's territory for deliveries in 2010 and 2011. Any resulting contract will be a tolling agreement with a term of up to 2 years with a start date of January 1, 2010, or a 1 year term with a start date of January 1, 2010 or January 1, 2011. Offers for this product must be existing generation capacity that is currently recognized by the CAISO as counting towards SDG&E's service area Local Capacity Requirement. Respondents must provide Offers for deliveries in both 2010 and 2011 and pricing may differ between the years. However, SDG&E may at its discretion contract with the Respondent for

[3] "Local" for purposes of satisfying Resource Adequacy, is defined by the CAISO and generally described in the Addendum below.
[4] Respondents will specify resource ramp-up rates and other operating characteristics within the offer forms.

either or both years. For this product, SDG&E requires flexible resources that are capable of providing regulation during the morning and evening ramps and/or units that can be started and shut down as needed. In addition, SDG&E will include the additional value provided from projects that can provide quick start operations[5] in the ranking of Offers. SDG&E also requires that each Offer contain pricing for, and an option to provide, black start capability.

Product 4 - Existing Regional Resources, delivering in 2010 and 2011
SDG&E seeks a minimum of 200 MW of existing resources currently operating outside of SDG&E's territory. Any resulting contract will be a tolling agreement with a term of 2 years starting on January 1, 2010. This product must deliver into CAISO's SP-15. For this product, SDG&E requires flexible resources that are capable of providing regulation during the morning and evening ramps and/or units that can started and shut down as needed. In addition, SDG&E will include the additional value provided from projects that can provide quick start operations[5] in the ranking of Offers.

Product 5 - Existing Local Resources, delivering in 2012-2021
SDG&E seeks a minimum of 400 MW of existing resources currently operating within SDG&E's territory. Any resulting contract will be a tolling agreement with a term of 10 years and a start date of January 1, 2012 to qualify. Offers for this product must be existing generation located physically within SDG&E's service territory (as more specifically described in the Addendum) or have its sole generator transmission system interconnection (gen-tie) directly interconnected to the electric network internal to SDG&E's local area as currently defined by the California Independent System Operator ("CAISO") such that the unit supports SDG&E's Local RA requirement. Units located within CAISO's proposed expanded local area for SDG&E (see Addendum) should submit Offers in other products of this solicitation. In consideration of California State Once Through Cooling (OTC) goals and pending Water Board rules, any Offer for supply from a unit utilizing OTC will be offered a contract with SDG&E that consists of a 2 year transaction with the possibility to extend for eight – 1 year options. OTC offers shall not include proposals for upgrades or retrofits of OTC facilities. The decision to exercise the option will be based upon future rules[6] governing OTC or SDG&E's sole discretion given its portfolio need. For this product, SDG&E requires flexible resources that are capable of providing regulation during the morning and evening ramps and/or units that can be started and shut down as needed. In addition, SDG&E will include the additional value provided from projects that can provide quick start operations[5] in the ranking of Offers. SDG&E also requires that each Offer contain pricing for, and an option to provide, black start capability.

Product 6 - All-Source Regional Resources, 2012-2021
SDG&E seeks minimum of 200 MW of new construction, expansion, or existing resources currently operating outside of SDG&E's territory. Any resulting contract will be a tolling agreement with a term of 10 years and deliveries will begin on May 1, 2012. This product must deliver into CAISO's SP-15. For this product, SDG&E requires flexible resources that are capable of providing regulation during the morning and evening ramps and shutting down at night. In addition, SDG&E will include the

---

[5] Respondents will specify resource ramp-up rates and other operating characteristics within the offer forms.

[6] From the California State Water Resources Control Board website: *The State Water Board staff is working on a draft statewide policy to implement section 316 (b) of the Clean Water Act that controls the harmful effects of once-through cooling water intake structures on marine and estuarine life. Since 1972, the Clean Water Act has required, in Section 316 (b), that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts. The projected release date for a draft Substitute Environmental Document is the end of the summer.* For additional information, please visit: http://www.swrcb.ca.gov/water_issues/programs/npdes/cwa316.shtml

additional value provided from projects that can provide quick start operations[6] in the ranking of Offers. In consideration of California State Once Through Cooling (OTC) goals and pending Water Board rules, any Offer for supply from a unit located in California utilizing OTC will be offered a contract with SDG&E that consists of a 2 year transaction with the possibility to extend for eight – 1 year options. OTC offers shall not include proposals for upgrades or retrofits of OTC facilities. The decision to exercise the option will be based upon future rules[6] governing OTC or SDG&E's sole discretion given its portfolio need. If the CAISO expands SDG&E's Local RA area as described in the addendum, SDG&E could, at its sole discretion, evaluate Product 6 Offers that are located within the expanded area as if it were a Product 5 Offer.

Product 7 Firm Liquidated Damages (LD) Energy and/or Resource Adequacy
SDG&E seeks a minimum of 200 MW of Firm LD Energy and/or Resource Adequacy Purchases. Resources may be within or outside of SDG&E service area.

Product 7a: Third Quarter, 6x16, on-peak Firm LD energy products conforming to Schedule C of the Western States Power Pool. Any resulting agreement will be an EEI agreement for short-term, block power purchases. Respondents may provide Offers for the following delivery periods: 1) for deliveries in 2010 and 2011 and/or 2) deliveries in 2012 and 2013. If a Respondent provides Offers for both options, SDG&E may at its discretion contract with the Respondent for either or both options. Resources outside of SDG&E must deliver to SP-15. For Product 7a, SDG&E will shortlist projects within the timeframes indicated in the schedule in Section 3 of this RFO. Refreshed pricing of shortlisted Offers will be allowed only once and by the date indicated in the schedule. Respondents are caution that if refreshed prices exceed the competitive range, the Offer may be rejected.

Product 7b: Respondents shall Offer System Resource Adequacy (and local if within the SDG&E Local Area). Any resulting agreement will be a WSPP agreement for Resource Adequacy. Respondents may provide Offers for the following delivery periods: 1) for deliveries in 2010 and 2011 [Q3 or full year] and/or 2) deliveries in 2012 and 2013 [Q3 or full year]. If a Respondent provides Offers for both options, SDG&E may at its discretion contract with the Respondent for either or both options.

Respondents may provide Offers for a single product and term or a combination of Offers, providing SDG&E with flexibility to match Offers and fill its required energy and capacity needs. For products seeking new or expanded generation resources, the Respondent shall be responsible for development, permitting, financing, and construction of any required facilities. The generating facility and transmission interconnection must be designed and constructed in conformance with CAISO's Tariff, applicable CPUC and/or FERC rules, orders, and/or regulations, and SDG&E's specifications.

2. RFO Website and Communication

The website for this solicitation is http://www.sdge.com/2009SupplyResourcesRFO/ . All forms and documents necessary to submit Offers are available for download at the RFO Website. Respondents will also submit Offers electronically via this website. (See RFO Section 4.0 RFO Response for additional information.) Please check the website periodically as SDG&E will post all solicitation announcements, including scheduling changes or RFO amendments at this website.

All questions or other communications regarding this RFO should be submitted via e-mail to the RFO's mailbox: rfo@semprautilities.com. All questions and answers will be posted anonymously at the RFO Website. SDG&E will not accept questions or comments in any other form, except during the bidders' conference.

3. RFO Schedule

SDG&E will host a pre-bid conference on the date and time indicated below. Participation in the pre-bid conference is NOT mandatory in order to submit an Offer. Any party interested in attending this pre-bid conference should download the Pre-Bid Conference Registration Form from the RFO Website and email the form to rfo@semprautilities.com. Details on the exact location of the pre-bid conference will be posted on the RFO Website as soon as it is available.

SDG&E reserves the right to revise this schedule at SDG&E's sole discretion and will post such changes on the RFO Website. Respondents are responsible for accessing the RFO website for updated schedules and possible amendments to the RFO or the solicitation process. Short-listed Respondents will be notified of interview date, time, and meeting room location. All interviews will be conducted at SDG&E's Century Park complex.

#	MILESTONE	DATE
1	**RFO Issued**	**June 9, 2009**
2	DEADLINE TO REGISTER for PRE-BID CONFERENCE Those intending to bid must register to receive a username/password in order to upload electronic Offers.	June 25, 2009
3	Pre-Bid Conference at 10:00am in San Diego, CA	July 8, 2009
4	DEADLINE TO SUBMIT QUESTIONS Question submittal cut-off date.	July 27, 2009
5	DEADLINE TO REGISTER Those intending to bid must register to receive a username/password in order to upload electronic Offers.	August 5, 2009
6	**CLOSING DATE: Offers uploaded and received by noon** (San Diego local prevailing time)	**August 10, 2009**
7	Hard-copies of Offers must be received at SDG&E's offices	August 12, 2009
8	Product 3 and Product 7a: Shortlisting, negotiation and contract execution	Within 3 months after closing date
9	Products 1, 2, 4, 5, 6, 7b: Shortlisted Bidders notified / Negotiation commences	3 months after closing date
10	~~Products 1, 2, 4, 5, 6, 7b:~~ Deadline to refresh Product 7a offered pricing.	No later than 2 months after shortlist notification
11	Products 1, 2, 4, 5, 6, 7b: Contracts Executed	Approx. 3 – 9 months after shortlisting
12	Products 1, 2, 4, 5, 6, 7b: Contracts filed with CPUC	Approx. 1 - 2 months after contract execution
13	Products 1, 2, 4, 5, 6, 7b: CPUC approves contracts	Typically 6 - 9 months after contract filing (but could be longer)

4. RFO Response

Any party interested in submitting an Offer must fill-out and email to rfo@semprautilities.com the RFO Registration Form (available from the RFO Website). SDG&E will process the form and provide the interested party instructions necessary to upload Offers, a username/password combination and access to the offer upload link (see below).

SDG&E **requires** that all Offers submitted pursuant to this RFO contain at a minimum, the items listed below. All forms and documents referenced below are available on the RFO Website.

a) the information requested in the Submittal Forms using the forms provided. The forms should be submitted in editable electronic form for efficient processing by SDG&E.
b) Respondents must redline comments on the pro forma agreement applicable to the Offer. In order to evaluate Offers against each other in each Product class, SDG&E urges that Respondents develop their Offers using existing Terms and Conditions of the pro forma agreements. Substantial, material mark-ups may result in an Offer being deemed non-conforming.
c) Credit. Respondent's Offer **must include** a completed credit application (available on the RFO website).
d) Respondents to products seeking new or expanded generating resources, must submit a detailed Gantt chart (or equivalent alternative) which outlines all major project milestones (including but not limited to permitting, engineering, site preparation, equipment contract and delivery and construction). The project timeline will also include milestones associated with major cost commitments (>$500,000). The workplan should also include a description of any uncertainties, where any changes would still result in not meeting the required on line date.

All Offers must be uploaded to SDG&E via the RFO Website by the date and time indicated in the schedule above. One original hardcopy Offer, identical to the electronic submittal and signed by an authorized officer of the Respondent, shall also be sent to the address shown below and must be received by SDG&E by the date indicated in the schedule. Contents of the electronic Offer submittal and the original hardcopy signed Offer shall be identical. Any conflicts between the information set forth in an electronic Offer and the signed Offer shall be resolved in favor of the signed Offer. All Offer materials and information submitted shall be subject to the confidentiality provisions of this RFO.

San Diego Gas & Electric Company
Electric and Gas Procurement Department
Attn: Supply Resource RFO
8315 Century Park Court, CP 21D
San Diego, CA 92123-1548

5. Project Timeline

Respondents must demonstrate that they have or are in process of getting all necessary permits (including air and building permits), site control, engineering designs and transmission interconnection studies. Sufficient documentation must be provided to evidence that the project can come online by the proposed date.

6. Offer Requirements

1. The Respondent shall be responsible for all costs for land, development, permitting (including emissions offsets, if applicable), engineering, procurement, and construction and for associated taxes, insurance, financing and bonding. The Respondent shall be operationally responsible for all development work and construction, including acquisition of land, permitting (including emissions offsets), engineering, procurement, and construction up to the highest industry standards and in accordance with time critical milestones and schedules.

2. The Respondent shall be responsible for all electric system and gas pipeline upgrades and / or extensions if required under and in accordance with applicable gas and electric tariffs. See http://www.sdge.com/tariff .

3. The Respondent must have all necessary water rights consistent with the generating resource needs. Resources located on leased properties may be accepted upon review of the lease terms, but must have a minimum lease term that covers the term of the PPA offered.

4. Respondent must identify all necessary emissions offsets and the associated costs which will be incorporated into their Offer. All Offers must comply with all existing air quality laws and be compliant with the CPUC Emissions Performance Standards (as adopted in R.06-04-009) on GHG.

5. For all products where the resulting contract will be tolling agreements, Respondents must provide generating facilities designed and permitted for operation for a minimum availability of 2,700 hours per year annual operations for peaking and intermediate duty.

6. SDG&E will, if requested, be responsible for the purchase and transportation cost of natural gas or other fuels to the plant site during commissioning, testing and contract term, for tolling agreements. In such instance, electric output during commissioning and testing shall be delivered at no charge to SDG&E, and SDG&E shall be entitled to receive all revenues for such energy.

7. For new development, permitting information provided by the Respondent shall include status of existing and required additional new permits, including any additional required approvals, along with a permitting and approval schedule. Such schedule must demonstrate an achievable online date of no later than that deadline dates stated in the Product descriptions.

8. For Product 1 Demand Response, the minimum criteria are indicated below.

    a. Offers must meet Resource Adequacy requirements for Demand Response as set forth by the CPUC in D.05-10-042.
    b. Offers should be for three (3) year Demand Response product Offer to provide load reduction beginning May 1, in 2012.
    c. Ability to fully respond to an event notification within 10 minutes.
    d. Load must be curtailable between 12:00 PM and 6:00 PM.

e. Offers must conform with all CAISO requirements for Demand Response Resources[7], including but not limited to Metering and Telemetry requirements, as may be updated from time to time.
f. Offers must comply with the policy guidance of the Energy Action Plan I and II and be in alignment with California's Demand Response Vision for the Future.[8]
g. Offers must be for load not yet committed to other programs.
h. Offered loads must be curtailable under a Direct Load Control (DLC) program.
i. Offered loads must have an average monthly maximum greater than 100kW for at least three (3) of the most current twelve (12) months.
j. Offers must be targeted toward nonresidential customers with a minimum demand of 100kW. Offers targeted at residential and/or small business customers with demands <100kW will not be considered.

Generation resources located on the customer side of the meter, such as back –up generation, will not qualify as a Demand Response product in this Offer.[9]

Alternative Offers may be submitted. At SDG&E discretion, alternative Offers may be evaluated and considered. If alternative Offers are submitted, please clearly state (identify) the alternative Offers.

Please note that any resultant contract will include provisions for:

a. A Non-Performance penalty for capacity load reduction shall be applied. For example, a non-performance calculation may be similar as SDG&E's Capacity Bidding Program CBP. Refer to SDG&E' Schedule CBP - Capacity Bidding Program, Special Condition 6 in http://www.sdge.com/regulatory/elec_misc.shtml
b. A Non-Performance penalty for load reduction during an event shall be applied. Energy load reduction shortfall during an event shall be considered non-performance and an adjustment will be required in order to compensate for any failure of the contractor to deliver committed load reductions. For example, a non-performance calculation may be similar as SDG&E's Capacity Bidding Program CBP Schedule.

At the request of SDG&E, the selected Respondent will be required to provide the following documents during contract negotiations:

a. Audited financial statements, including balance sheet, statement of cash flows, and income, for 2007 and 2008; OR
b. Complete income tax returns for 2007 and 2008.

7. Binding Offer Evaluation

SDG&E anticipates evaluating Offers for different Products on different timelines. In general, supply offers for 2010-2011 delivery dates will be evaluated first. Supply Offers for 2012 – on delivery dates will be evaluated second. Offers that are determined to meet the threshold requirements will be evaluated on the basis of an expected cost analysis covering both quantitative and qualitative information. In general, Offers that meet RFO requirements will be evaluated on the basis of a least cost/best fit (LCBF) analysis. The quantitative analysis will look at the total expected cost to SDG&E's bundled customers when the Offer is added to SDG&E's resource portfolio. The quantitative components of this analysis include the items listed below.

[7] http://www.caiso.com/1893/1893e350393b0.html
[8] California Demand Response: A Vision for the Future. D. 03-06-032, Appendix A.
[9] D.06-11-049 (mimeo at pp.57-58) discusses the Commission's policy regarding back-up generation options.

SDG&E reserve the right to evaluate non-conforming Offers and may request additional data from Respondents to bring non-conforming Offers into conformance.

1. Binding Offer prices for both capacity and energy (Offers deemed by SDG&E to contain unreasonably low or high prices will be rejected).

2. Transmission system upgrade costs necessary for the new generation resource to satisfy grid reliability and deliverability requirements for new capacity.

3. Congestion costs - Potential for SDG&E incurred congestion costs will be assessed, as well as SDG&E's ability to hedge these costs.

4. Impacts on existing SDG&E financial structure, such as debt equivalence and/or the effect of FIN 46, may be considered in the evaluation process.

5. Changes to SDG&E bundled customer's total GHG Emissions will also be valued. SDG&E will determine the forecasted change in total GHG emissions from adding the Offer to SDG&E's portfolio. Portfolio GHG increases or reductions will be valued based on previous CPUC direction.

In accordance with CPUC D.07-12-052 preference will be given to procurement that will encourage the retirement of aging plants, particularly inefficient facilities with once-through cooling, by providing, at minimum, qualitative preference to Offers involving repowering of these units or Offers for new facilities at locations in or near the load pockets in which these units are located." (p.113) and further "IOUs are to consider repowered or replacement options presented in a RFO..... before they choose options developed on Greenfield sites, or make a showing that justifies their decision not to do so (p.229).

Qualitative factors used to differentiate Offers include the following:

1. Brownfield vs. greenfield – the proposed location will be assessed to determine if the project is located at a brownfield or greenfield site.

2. Environmental stewardship – SDG&E will assess the project team's history and any special benefits of the specific Offer.

3. Financing plan – the Offer will be assessed as to the plan and likelihood of the project securing the necessary financing.

4. Technology, major equipment manufacturers and operational flexibility. The evaluation will include an assessment of the proposed technology's commercial operating history, and the manufacturer's U.S. presence and experience.

5. The proposed facility will be evaluated from the perspective of maximizing the operational flexibility of generating assets available to SDG&E. This incorporates unit capabilities that include size, start-up time, load response, minimum up and down times.

6. Development risk – consideration will be given to regulatory and other risks as appropriate that could diminish the viability of the project.

7. Corporate capabilities and proven experience

8. Ability to meet schedule

9. Project team (environmental, engineering, equipment procurement, construction) – Project team will be assessed on whether the project team has demonstrated experience with the specific technology and implementation plan they are proposing.

10. Credit Risk

Portfolios of Offers that are short listed based on qualitative and quantitative criteria will be analyzed using production cost modeling. Offers for local capacity will be analyzed and ranked first until the combined capacity of the short listed Offers meets local need requirements. The remaining Offers will then be evaluated and ranked to meet the remaining system need.

SDG&E requests that Respondents who believe their Offers have any important qualitative benefits elaborate on them in their Offer.

SDG&E will utilize the information provided on the Offer Response Forms to evaluate all Offers. Respondents are responsible for the accuracy of all figures and calculations. Errors discovered during negotiations may impact Respondents' standing on the short-list.

8. Binding Offer Duration

All Offers into this RFO (with the exception of Product 7 as noted elsewhere in this document) are binding as of the submittal date and must remain binding, open and valid through SDG&E's Offer evaluation, price negotiations, contract execution between SDG&E and the selected Respondent(s), and any required CPUC and FERC approval. No Offer adjustments which increase costs shall be permitted after submission of Binding Offer.

9. Confidentiality

Except with the prior written consent of SDG&E, Respondents may not disclose (other than by attendance alone at any meeting to which more than one Respondent is invited by SDG&E) to any other Respondent or potential Respondent their participation in this RFO, and Respondents may not disclose, collaborate on, or discuss with any other Respondent, bidding strategies or the substance of Offers, including without limitation the price or any other terms or conditions of any indicative or final Offer.

SDG&E will use the higher of the same standard of care it uses with respect to its own proprietary or confidential information or a reasonable standard of care to prevent disclosure or unauthorized use of Respondent's confidential and proprietary information that is labeled as "proprietary and confidential" on the Offer page on which the proprietary information appears (confidential information). Respondent shall also summarize the elements of the Offer(s) it deems confidential. The summary must clearly identify whether or not price, project name, location, size, term of delivery, technology type (either collectively or individually) or any other term are to be considered confidential information Confidential information may be made available on a "need to know" basis to SDG&E's directors, officers, employees, an independent third-party evaluator required by the CPUC, agents and advisors (representatives) for the purpose of evaluating Respondent's Offer, but such representatives shall be required to observe the same care with respect to disclosure as SDG&E.

Notwithstanding the foregoing, SDG&E may disclose any of the confidential information to comply with any law, rule, or regulation or any order, decree, subpoena or ruling or other similar process of any court, securities exchange, control area operator, governmental agency or governmental or regulatory authority at any time even in the absence of a protective order, confidentiality agreement or non-disclosure agreement, as the case may be, without notification to the Respondent and without liability or any responsibility of SDG&E to the Respondent.

It is expressly contemplated that materials submitted by a Respondent in connection with this RFO will be provided to the CPUC, its staff, and possibly to the CEC, its staff, SDG&E's Independent Evaluator (IE) and Procurement Review Group (PRG). SDG&E will seek confidential treatment in accordance with CPUC Decision 06-06-066 and any subsequent decision by the CPUC related to confidentiality, with respect to any Respondent confidential information submitted by SDG&E to the CPUC for the purposes of obtaining regulatory approval. SDG&E will also seek confidentiality protection from the CEC for Respondent's confidential information and will seek confidentiality and/or non-disclosure agreements with the PRG. SDG&E cannot, however, ensure that the CPUC or CEC will afford confidential treatment to a Respondent's confidential information or that confidentiality agreements or orders will be obtained from and/or honored by the PRG, CEC, or CPUC.

SDG&E, its representatives, Sempra Energy, and any of their subsidiaries disclaim any and all liability to a Respondent for damages of any kind resulting from disclosure of any of Respondent's information.

10. Other Requirements

CALIFORNIA CLIMATE ACTION REGISTRY

In D.06-02-032, the CPUC directed SDG&E to include a provision in any power purchase agreement for non-renewable energy that requires the supplier to register and report its GHG emissions with the California Climate Action Registry (CCAR). More information about the CCAR is available at California Climate Action Registry.

Pursuant to D.06-02-032, SDG&E will be required to include a provision in any tolling agreement that will require the supplier to register and report its GHG emissions with the CCAR. Specific registration requirements and reporting protocols with the CCAR will be established, and a method for assigning emissions values to supplies that are unregistered with the CCAR will also be developed.

For more information, see: http://www.cpuc.ca.gov/proceedings/R0604009.htm

FIN 46 Requirements

Securities and Exchange Commission rules for reporting power purchase agreements may require SDG&E to collect and possibly consolidate financial information for the facility whose output is being purchased under long-term contractual arrangements. General guidelines include:

a) determination of allocation of risk and benefits
b) proportion of total project output being purchased by SDG&E
c) proportion of expected project life being committed to SDG&E
d) pricing provisions of contract; that is, whether the contract contains fixed long-term prices or pricing that varies over the term of the agreement based on market conditions or other factors

For any Agreements that meet the applicability criteria, SDG&E is obligated to obtain information from successful Respondents to determine whether or not consolidation is required. If SDG&E determines that consolidation is required, SDG&E shall require the following during every calendar quarter for the term of an Agreement:

a) Complete financial statements and notes to financial statements, and financial schedules underlying the financial statements, all within 15 days of the end of each quarter.
b) Access to records and personnel, so that SDG&E's independent auditor can conduct financial audits (in accordance with generally accepted auditing standards) and internal control audits (in accordance with Section 404 of the Sarbanes-Oxley Act of 2002).

Procurement Review Group and Independent Evaluator

In D.02-08-071 (p. 24), the CPUC established the Procurement Review Group (PRG), whose members, subject to an appropriate non-disclosure agreement, would have the right to consult with and review the details of each utility's procurement plan, overall procurement strategy, contracts, and related matters. Since that time, the PRG process has been endorsed and continued in a variety of subsequent decisions, as it performs a valuable consultative role in the IOUs' procurement activities, including relating to the issuance and evaluation of RFOs and their results.[10] Thus, from RFO language development to Offer evaluation to contract negotiation, SDG&E will brief the PRG on a periodic basis during the entire process.

Respondents are hereby notified that revealing Offer information to the PRG is required during PRG briefings in accordance with Section 11.0 Confidentiality. Respondents must clearly identify, as part of the Offer, what type of information it considers to be confidential.
In D.04-12-048, the Commission ordered, in certain instances, the use of Independent Evaluators (IE) in competitive solicitations. SDG&E will make use of an IE in this solicitation. All Offer material produced in this solicitation will be available, under confidentiality provisions, to the IE. SDG&E in its sole discretion may make available to its PRG each response to this RFO and may review the results of its evaluation and ranking of the proposals with the IE and PRG.

11. Credit Terms and Conditions

SDG&E has the unilateral right to evaluate and determine the ability of the Respondent to perform relative to this project. The shortlisted Respondents will be required to complete, execute, and submit a credit application. This form is available to Respondents on the RFO website. The application requests financial and other relevant information needed to demonstrate and confirm creditworthiness.

Upon execution of a mutually acceptable definitive agreement, the Respondent will be required to post collateral based on the credit requirements established by SDG&E. For new development, Respondents will be required to post development collateral until commercial operation has been met. Collateral will be required during delivery periods for new and existing projects.

The table below presents the collateral amounts (cash or letter of credit) required for each product type should a contract be executed and depending on quantity. All Offers must include the cost of collateral in the amount required below in their Offer price.

[10] See, e.g., D.02-10-062, D.03-12-062, and D.04-12-048.

Product	Collateral per 50 MW ($mm)
Product 1*	1.7
Product 2	25.6
Product 3	5.5
Product 4	5.5
Product 5	25.6
Product 6	25.6
Product 7a (delivery years)	
2010-2013*	16.2
2010-2011*	7.3
2012-2013*	8.9
Product 7b (delivery years)	
2010-2013*	1.0
2010-2011*	0.4
2012-2013*	0.5
	** Collateral per 10MW*

Credit support amounts shall not be deemed a limitation of liability. Model credit support documents will be provided to shortlisted Respondents as applicable.

Under no circumstance will SDG&E post collateral for any resultant contract.

12. Proposal Costs

SDG&E will not reimburse Respondents for any of their expenses for developing responses hereto under any circumstances, regardless of whether the RFO process proceeds to a successful conclusion or is abandoned by SDG&E in its sole discretion.

13. Contingencies

1. CPUC Review and Approval. Any agreement entered into by SDG&E and a selected Respondent for Products 1, 2, 5 and 6 will be subject to and contingent upon (at a minimum) (1) the issuance by the CPUC of a final decision acceptable to SDG&E, approving such agreements and that does not materially alter the commercial aspects of the agreements; (2) a finding by the CPUC that the payments under the agreements are reasonable; and (3) a finding that SDG&E is authorized to recover the full amount of its costs including any payments made to Respondent under any of such agreements from SDG&E's customers in rates through existing or future cost recovery mechanisms that may be developed or instituted by the CPUC.
2. FERC Approval. In addition to the approvals required elsewhere in this RFO and the applicable agreement between the parties, SDG&E, in its sole discretion, may obtain and/or require Respondent to obtain: (1) a FERC order, as may be required, accepting and/or

authorizing any agreement(s) entered into hereunder, including without limitation, on terms that do not materially alter the commercial aspects of the agreement(s); and/or (2) a finding by the FERC that the rates, terms, and conditions are just and reasonable.

14. RESERVATION OF RIGHTS

SDG&E makes no guarantee that a contract award shall result from this RFO. SDG&E reserves the right at any time, at its sole discretion, to abandon this RFO process, to change the basis for evaluation of Offers, to terminate further participation in this process by any party, to accept any Offer or to enter into any definitive agreement, to evaluate the qualifications of any Respondent or the terms and conditions of any Offer, or to reject any or all Offer, all without notice and without assigning any reasons and without liability of Sempra Energy, SDG&E, or any of their subsidiaries, affiliates, or representatives to any Respondent. SDG&E shall have no obligation to consider any Offer.

15. Supplemental Information

SDG&E reserves the right to request additional information from individual Respondents or to request all Respondents to submit supplemental materials in fulfillment of the content requirements of this RFO or to meet additional information needs of SDG&E. SDG&E also reserves the unilateral right to waive any technical or format requirements contained in the RFO.

16. WAIVER OF CLAIMS AND LIMITATION OF REMEDIES

SDG&E will not reimburse Respondents for their expenses under any circumstances, regardless of whether the RFO process proceeds to a successful conclusion or is abandoned by SDG&E at its sole discretion without any resultant contract executed for any of the products.

SDG&E reserves the right to disregard a non-conforming Offer or waive requirements for any product and shortlist a non-conforming Offer.

By submitting an Offer, Respondent knowingly, voluntarily, and completely waives any rights under statute, regulation, state or federal constitution, or common law to assert any claim, complaint, or other challenge in any regulatory, judicial, or other forum, including without limitation, the CPUC, (except as expressly provided below), the FERC, the Superior Court of the State of California ("State Court") or any U.S. District Court ("Federal Court") concerning or related in any way to the RFO or any documents in the RFO including all exhibits, attachments, and appendices thereto ("Waived Claims"). Respondent further expressly acknowledges and consents that if it asserts any Waived Claim at the CPUC, FERC, State Court, or Federal Court, or otherwise in any forum, to the extent that Respondent's Offer has not already been disqualified, SDG&E is entitled to automatically disqualify such Offer from further consideration in the RFO or otherwise, and further, SDG&E may elect to terminate the RFO.

By submitting an Offer, Respondent further agrees that the sole forum in which Respondent may assert any challenge with respect to the conduct or results of the RFO is at the CPUC. Respondent further agrees that: (1) the sole means of challenging the conduct or results of the RFO is a complaint filed under Article 3, Complaints and Commission Investigations, of Title 20, Public Utilities and Energy, of the California Code of Regulations, (2) that the sole basis for any such protest shall be that SDG&E allegedly failed in a material respect to conduct the

solicitation in accordance with the RFO; and (3) that the exclusive remedy available to Respondent in the case of such a protest shall be an order of the CPUC that SDG&E again conduct any portion of the solicitation that the CPUC determines was not previously conducted in accordance with the RFO or any RFO documents (including exhibits, attachments, and appendices). Respondent expressly waives any and all other remedies, including, without limitation, compensatory and/or exemplary damages, restitution, injunctive relief, interest, costs and/or attorneys' fees. Unless SDG&E elects to do otherwise in its sole discretion, during the pendency of such a protest the RFO and any related regulatory proceedings related to the RFO will continue as if the protest had not been filed, unless the CPUC issues an order suspending the RFO or SDG&E has elected to terminate the RFO.

Respondent further acknowledges and agrees that if Respondent asserts any Waived Claim, SDG&E shall be entitled to seek immediate dismissal of Respondent's claim, complaint, or other challenge, with prejudice, by filing a motion to dismiss (or similar procedural device) supported by the language in this Section and that Respondent will not challenge or oppose such a request for dismissal. Respondent further acknowledges and agrees that if it asserts any Waived Claim, and if SDG&E successfully has that claim dismissed or transferred to the CPUC, Respondent shall pay SDG&E's full costs and expenses incurred in seeking such dismissal or transfer, including reasonable attorneys' fees. By submitting an Offer, Respondent acknowledges and agrees that it has submitted that Offer after consultation with its own independent legal counsel.

Respondent agrees to indemnify and hold SDG&E harmless from any and all claims by any other Respondent asserted in response to the assertion of any Waived Claim by Respondent or as a result of a Respondent's protest to a filing at the CPUC resulting from the RFO.

Except as expressly provided in the RFO documents, nothing herein, including Respondent's waiver of any Waived Claims as set forth above, shall in any way limit or otherwise affect the rights and remedies of SDG&E.

17. Attachments

The following are available for download at the RFO Website:

1. The RFO

2. Technical Bid Forms (the form applicable to the product being offered is required)
   - Product 1
   - Product 2
   - Product 3
   - Product 4
   - Product 5
   - Product 6
   - Product 7a
   - Product 7b

3. Proforma Agreements – Respondents must include as part of the Offer redline comments to the applicable proforma agreement.
   - Tolling Agreement (required for Products 2, 3, 4, 5, 6)
   - EEI Firm LD Agreement (required for Product 7a)
   - WSPP RA Agreement (required for Product 7b)

4. Credit Application (required for all Products)

5. DBE Subcontracting Commitment And Reporting Requirements Form (required for Product 1)

6. Participation Summary (required for all Products except Product 1)

Respondents are encouraged to provide supplemental information to expand upon any unique capabilities to meet SDG&E's needs.

Addendum

Introduction to SDG&E: Background

San Diego Gas & Electric Company (SDG&E) provides electric service to approximately 1.3 million customers in San Diego County and the southern portion of Orange County. SDG&E also provides natural gas service to approximately 775,000 gas customers. The electric customer base comprises 89% residential and 11% commercial and industrial customers.

SDG&E's electric transmission network is comprised of 130 substations with approximately 884 miles of 69-kV, 265 miles of 138-kV, 349 miles of 230-kV, and 215 miles of 500-kV transmission lines. Major ("on system") generating resources are the Cabrillo plant (connected into SDG&E's grid at 138 kV and 230 kV), the South Bay plant (connected at 69 kV and 138 kV), the Palomar Energy Center (connected at 230 kV), the Otay Mesa plant (expected online in fall of 2009), a number of combustion turbine facilities located around the service area (connected at 69 kV), various Qualifying Facilities and renewable generation. Imported resources are received via the Miguel Substation as the delivery point for power flow on the Southwest Power Link, which is SDG&E's 500-kV transmission line that runs from Arizona to San Diego along the U.S./Mexico border, and via the SONGS 230-kV switchyard.

Figure 1 shows a simplified diagram of existing SDG&E service area and the electric transmission topology in San Diego County and the southern portion of Orange County. [11] Planned or approved transmission facilities for the future (if any) are not shown on this map. Upon completion of the Sunrise Powerlink (expected in 2012), the California ISO has proposed that it may expand their defined local area for SDG&E's transmission system. If the local area is expanded, there will be additional facilities and areas that will be considered local to the SDG&E transmission area.

Local Capacity Requirements are set by the California Independent System Operator ("CAISO") each year for the following year. Areas of Local Resource Adequacy correspond to the areas of Local Capacity Requirements as described in the 2010 Local Capacity Area Technical Study ("Technical Study" or "LCR Study"). This study is performed to identify specific areas within the CAISO Controlled Grid that have local reliability needs and to determine the minimum generation capacity (MW) that would be required to satisfy these local reliability requirements, while enforcing generation deliverability status and Maximum Import Capability for all common mode contingencies as defined by CAISO.[12]

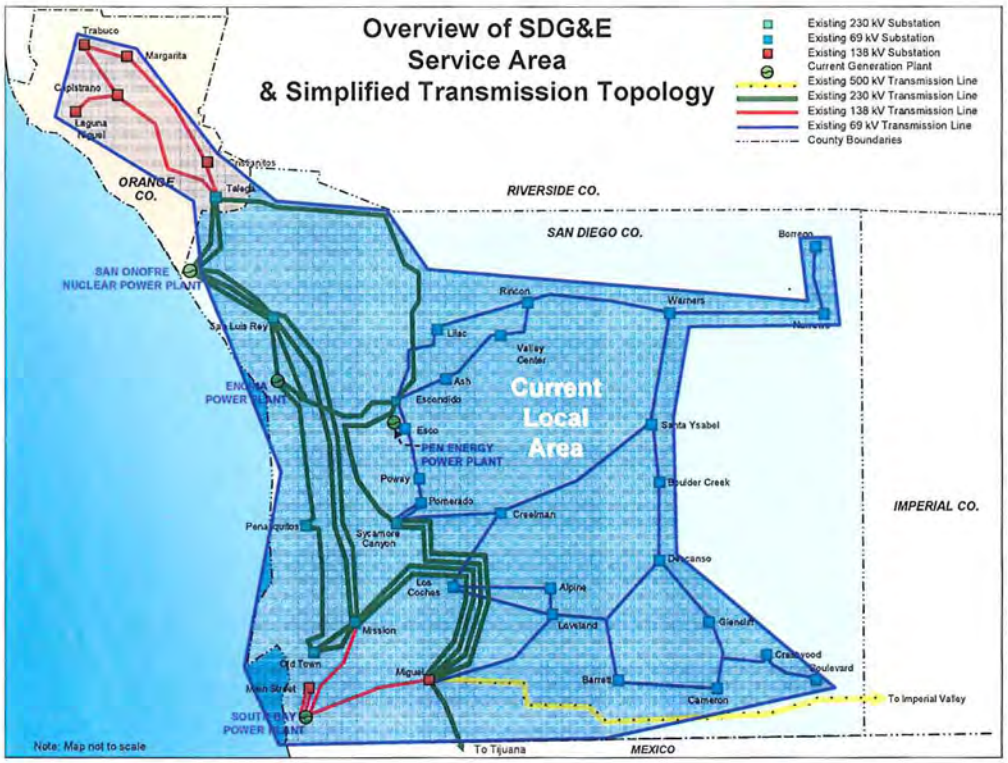
The future area of Local Resource Adequacy has been projected by SDG&E based upon the 2011-13 Local Capacity Technical Analysis Report and Study Results published by CAISO on December 29. 2008 (http://www.caiso.com/20ad/20ad77d04d70.pdf).

---

[11] SDG&E cautions that interconnection with the 500-kV Southwest Power Link or the Imperial Valley 500/230-kV Substation are not acceptable delivery points for proposals under this RFO because the reliability resource requirement is based on a contingency condition with the SWPL out of service. Similarly, direct interconnection to the San Onofre switchyard or the 230-kV lines from San Onofre to either Talega Substation or San Luis Rey Substation are not acceptable for the purpose of this RFO because these network facilities are fully utilized for the reliability condition of concern.

[12] 2010 Local Capacity Technical Analysis, Final Report and Study Results . California Independent System Operator, May 1, 2009.

Figure 1. Current SDG&E Local Area



3333 S. Bannock St., Suite 500
Englewood, CO 80110
p 303 762 7060
f 303 788 9725
www.e3co.com

April 13, 2012

Gary Chandler
Apex Power Group, LLC
2542 Singletree Lane
South Jordan, UT 84095

Subject: Pio Pico Project – Comparative Construction and O&M Cost Analysis

Dear Mr. Chandler:

E3 Consulting, LLC (E3) was requested by Apex Power Group, LLC (Apex) to prepare an independent evaluation of the costs to build and operate a nominal 300 MW power generation facility using three different generation technology options. The three options include:

- GE LMS100PA, three units in simple-cycle (SC) configuration;
- GE Frame 7FA.04 Fast Start in 1x1 combined-cycle (CC) configuration, and;
- Siemens SCC 5000F Flex 10 1x1 combined-cycle configuration.

E3 is a technical advisory firm that specializes in providing independent engineering reviews to support the development, financing or acquisition of electric power generation and electric transmission facilities. E3 provides services to regulatory agencies, government agencies, lenders, investors and developers of energy facilities. Prior to this assignment, E3 has had no involvement of the Pio Pico project being proposed by Apex.

In conducting the analysis, E3 has relied upon its experience reviewing nearly 600 power generation facilities in the U.S. and worldwide. This experience includes conducting other independent reviews of projects using or proposing to use the three technologies listed above. E3 has also reviewed publicly available information regarding costs to develop, construct and operate power generation facilities using the same or similar technologies to those listed above.

Analysis Overview

For the purposes of this analysis E3 was provided with certain assumptions by Apex regarding the design and expected operations of the Pio Pico generating facility. These principal assumptions include:

- The project will be located in San Diego County, CA and will sell its net electrical capacity and energy to San Diego Gas & Electric Company (SDG&E);
- The project will use natural gas only for fuel;
- All three options will include conventional Oxidizing and SCR catalyst systems for CO and NOx control. The LMS100 option will also include water injection for emis-

sions control. The Siemens Flex 10 system also uses steam injection for power augmentation.

- The project will operate at base load for 4000 hours per year with an estimated 500 dispatched starts by SDG&E;
- Construction will be performed under a typical turn-key Engineering, Procurement and Construction (EPC) type agreement.
- Operations and Maintenance (O&M) will be provided by a third-party contractor under a market based O&M Agreement. Major maintenance of the prime mover equipment will be by the original equipment manufacturers under the terms of a typical Long-Term Service Agreement (LTSA).

Based on our review of other similar projects and review of published information regarding construction and O&M costs of similar facilities, E3 estimates the following capital and O&M costs for the three technology options.

Table 1
Construction and O&M Costs for
Three Generation Options

Primary Technology	Cycle	Net Output	Capital Cost	Fixed O&M	Var O&M (non major)	Major Maint
LMS100PA-SAC	3x0 SC	310 MW	$829/kW	$15.3/kW-yr	$0.91/MWh	$2.09/MWh
GE 7FA.05	1x1 CC Fast Start	312 MW	$1,029/kW	$16.1/kW-yr	$0.85/MWh	$2.35/MWh
Siemens SGT6-5000F	1x1 CC Flex 10	279 MW	$1,153/kW	$16.1/kW-yr	$0.85/MWh	$4.56/MWh

The following specific assumptions were made when estimating the numbers presented in the table above:

- Estimated capital costs are in 2012 dollars and are for the basic power block and balance of plant equipment. Costs include interest during construction, but do not include long-term amortization costs.
- Costs are US average do not include site specific costs such as power and gas interconnections, permitting, emissions offsets, land acquisition or adjustments for southern California construction labor costs conditions.
- The base capacity ratings and construction costs have been adjusted for dry or hybrid cooling. Cooling requirements for the CC options are significantly greater than the LMS100 option due to the need for a steam turbine condenser. Capital costs for air cooled condensers on the CC options will increase the CC capital costs by approxi-

mately $30 million compared to a conventional wet evaporative cooling system. The additional costs for dry cooling are included in the table above.

- Fixed O&M costs include O&M contractor costs such as labor, administration, fixed consumables and home office expenses.
- Owner costs such property and liability insurance, property taxes and asset management are not included.
- Variable O&M expenses include consumables, chemicals, routine preventative maintenance and inspections.
- Major maintenance includes major overhauls and parts replacements conducted at scheduled intervals by the OEM in accordance with a LTSA.
- Major maintenance expenses are based on recent OEM quotes for full LTSA services through a typical 50,000 hour major combustion turbine overhaul cycle. Estimated LTSA costs are based on typical Factored Fired Hour (FFH) pricing for scheduled services. The FFH pricing for the CC options are adjusted to the expected ratio of FFH to Factored Fired Starts (FFS) in accordance with GE and Siemens guidelines. The LMS100 combustion turbine technology does consider the number of starts when calculating FFH.

Comments and Observations

1. The combined-cycle facilities are estimated to cost approximately 30 percent more to build than the simple-cycle option. This is due to the greater balance of plant requirements for the steam cycle, significantly larger cooling system (for the steam turbine condenser), higher construction man-hours (boiler erection and steam cycle piping) and greater land requirements. The GE Fast-Start CC option requires an auxiliary boiler to maintain the steam cycle in warm standby condition to allow for 400-minute rapid response. The Siemens Flex-10 CC and LMS100 simple-cycle options do not require an auxiliary boiler to operate during standby periods.
2. The fixed O&M costs for the CC options are slightly higher due to larger staffing requirements to operate auxiliary steam systems and maintain boiler water chemistry on a 24/7 basis.
3. Simple-cycle plants can typically be constructed in 12-16 months. Combined-cycle facilities typically require at least 24 months to build and commission.
4. Simple-cycle configurations do have higher heat rates and emissions per MWh than typical CC configurations, but use less fuel during startup, shutdown and non-operating standby periods.
5. The fast-start CC configurations included in this analysis achieve faster full-power operations (typically 1.5 to 2.0 hours to full load) by using control strategies to shorten the initial gas purge cycle, maintaining turbine lube oil and boiler water at high temperature and using simplified (non-reheat) and lower pressure steam cycles to reduce the thickness of boiler tubing and steam turbine shells (and therefore reduce the

warm up time). These design compromises for fast start capability result in net heat rates for fast-start CC cycles that can be up to 10 percent higher than conventional modern CC cycles that use multi-pressure reheat steam cycles.

6. The GE LMS100 technology was specifically designed for the rapid response peaking market. Over 30 units are in operation and the technology has a proven track record of being capable of full power output within 10 minutes of start initiation.
7. There currently are no GE Fast-Start or Siemens Flex 10 CC cycles with more than one year of operation to demonstrate the capability or efficiency of the cycles. At this time E3 does not consider the GE or Siemens fast start CC plant designs to be commercially proven technology.
8. The CC options will suffer potentially significant major maintenance cost penalties compared to the LMS100 due to the low ratio of FFH to FFS. Based on the assumed 4000 annual operating hours and 500 annual starts the FFH/FFS ratio will be 8. Typically CC projects are intended to run as intermediate to base load units with FFH/FFS ratios of 25 or higher. Due to the frequent starts and low number of operating hours between starts, maintenance on the combustion turbines, heat recovery steam generators and steam turbines is greatly accelerated as a result of rapid thermal cycling. Estimated major maintenance costs are based on actual GE and Siemens OEM long-term service agreements for conventional CC plants which include pricing adjustments based on the ratio of fired hours to starts.
9. Based on our prior reviews of numerous simple-cycle and combined-cycle combustion turbine plants, we are of the opinion that for peaking and intermittent operations, simple-cycle plants are generally better suited because of lower capital and maintenance costs, lower cooling water requirements and low auxiliary power and fuel requirements during standby periods.

Please do not hesitate to contact me if there are any questions related to our analysis or assumptions.

Best Regards,
E3 Consulting

Paul B. Plath, P.E.
President