Responses of The California Independent System Operator Corporation to the Discovery Request from Aspen Environmental Group (April 18, 2007)

A.06-08-010

Aspen Request ISO-1: Please describe whether CAISO considers construction and operation of new geothermal or solar generation in the Imperial Valley to be a reasonably foreseeable, indirect consequence of approving SDG&E's Sunrise project.

Response ISO-1: Yes. The CAISO believes that construction of the Sunrise project would increase the economic value of renewable resources located in the Imperial Valley, and therefore increase the likelihood that renewable resources would locate in the Imperial Valley. The increase in economic value would arise from the ability to deliver more MW of Imperial Valley resources to the IOUs for Resource Adequacy counting. The CAISO believes that only 600MW of incremental geothermal generation in the Salton Sea area would be deliverable and count for Resource Adequacy if the Sunrise, or other major transmission project is not constructed.

Aspen Request ISO-2: Please describe the difference in generation by power plant between the Base Case and the Sunrise case. Identify which generators would provide the incremental power and which generators would be displaced. Please focus on the expected changes in annual generation at plants in San Diego County, Imperial County, and Mexico for each year modeled by the CAISO for its 3/1/07 testimony.

Response ISO-2: Please see the spreadsheet SunriseMWhChange.xls. The spreadsheet lists each unit that has an output change between the base and Sunrise case. The file also includes load area and region identification. The spreadsheet shows plants that have output increases on the "Increases" tab. Plants that have output reductions are shown on the "Reductions" tab. Please note that the spreadsheet changes the GridView load area designation for five plants. These plants are radially connected to the ISO controlled Imperial Valley 230 kV bus. Although they are listed in the San Diego area in the Gridview database they are physically located in Mexico, so their area designation has been changed to Mexico for the purpose of these data responses.

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22996 INTBST      18    1     LaRosCC
22997 INTBCT      16    1     LaRosSC
22981 IV GEN1     21    1     Thrmlct1
22982 IV GEN2     18    1     Thrmlct2
22983 IV GEN3     18    1     Thrmlct3
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Aspen Request ISO-3: If quantification of the emission benefits is possible, please estimate the quantity of the overall annual emission reduction caused by Sunrise compared to the Base Case (e.g., an analysis of nitrogen oxides or NOx in tons per year, similar to that in the CAISO February 2005 Economic Evaluation of the Palo Verde-Devers Line No. 2). Please provide the quantity of emission increases or decreases at power plants in Imperial County and Mexico.

Response ISO-3. The CAISO has prepared a rough estimate of the change in annual emissions in 2015 due to the Sunrise project. The analysis required a number of assumptions that are listed below. The CAISO notes that while the GridView software provides the capability to calculate emissions, this capability has not been used for the runs to date. To obtain that information would require the CAISO to input additional information and re-run all of the past analyses. Because of time and manpower constraints, the CAISO has utilized a simplified spreadsheet estimation process.

Assumptions

- Heat rates are the incremental heat rates weighted by the MW in each block.
- Heat rates are rounded to the nearest 0.1 MMBTU/MWh
- CO2 emission rate for gas-fired units is from the CPUC's adopted methodology for energy efficiency measures. It is based on a carbon intensity of 117 lb CO2 per MMBTU.
- NOX emission rates are from the CPUC's adopted methodology for energy efficiency measures. The formula for deriving NOx from heat rates is: Rate = 0.0541 + (HR – 6240)*0.00002842. Rate is in lbs/MWh, HR is the heat rate of the generator in BTU/kWh. For more information on the NOX derivation see http://www.ethree.com/CPUC/E3_Avoided_Costs_Final.pdf
- CO2 emission rate for coal plants use 211.9 lbs/MMBTU. The is the US average for sub-bituminous coal, from Table FE4 of the 1994 US EIA paper, Carbon dioxide emission factors for coal. http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html
- NOX rate for coal plants is assumed to be 0.15lb/MMBtu, which is the emission limit for reconstructed units after July 9, 1997. 0.15lb/MMBTU is also the equivalent NOx emission rate used in the Title 1 National Ambient Air Quality Standards for ozone. See http://www.netl.doe.gov/technologies/coalpower/ewr/nox/regs.html
- Fuel oil units are assumed to burn residual fuel with a carbon content of 174 lbs CO2 per MMBTU. See http://www.uspowerpartners.org/Topics/SECTION1Topic-NaturalGas.htm
- NOX rate for fuel oil units is assumed to be half way between the natural gas and coal emission rates for the same heat rate.

Table 1: Change in MWh output in 2015 (Sunrise compared to base case)

Sum of Case1	GenType					
Load Area	1	2	3	4	5	Grand Total
ALBERTA	(34,562)	74,899		(1,637)	-	38,700
ARIZONA	(1,574,649)	(86,875)	7,853	-	-	(1,653,672)
B HILL	-	(1,988)	-		-	(1,988)
B.C.HYDR	503,064				145	503,208
BONZ		(2)				(2)
COL E	(71,747)	28,275	-		316	(43,156)
COL W	(240)	67,586			-	67,346
IDAHO	3,743	3,240			-	6,983
IMPERIAL	(44,758)		-	(38,333)	8,759,402	8,676,311
IPP		-				-
JB		(2,019)				(2,019)
KGB					-	-
LADWP	(17,309)				(13,061)	(30,370)
LRS	-	-			-	-
MEXICO-C	(1,880,358)		1,688		218	(1,878,453)
MONTANA	385	(3,644)		164	-	(3,095)
NEVADA	(831,171)	(71)	-			(831,242)
NEW MEXI	79,506	20,980		(1,274)	-	99,212
NW_EAST	2,432,208		-	7,546	(7,446,150)	(5,006,396)
NW_WEST	1,582,678	11,357	-	108	-	1,594,143
PG&E_BAY	546,416	300	-	-	-	546,716
PG&E_VLY	565,055	171	15,582	9,072	(2,837,487)	(2,247,608)
SANDIEGO	(1,131,872)		-		1,525,156	393,284
SIERRA	23,718	(5,625)		719	8,206	27,017
SOCALIF	(190,694)	2,587	-	(11,063)	(6,859)	(206,029)
SW WYO					-	-
UT N	32,262	5,084			-	37,346
UT S	1,858	1,731			-	3,589
WAPA L.C	(320,217)	-			-	(320,217)
WYO		1,843				1,843
YLW TL					-	-
Grand Total	(326,687)	117,829	25,122	(34,698)	(10,115)	(228,548)

1 = Gas-fired, 2 = Coal-fired, 3 = Fuel Oil, 4 = Other (nuclear, wood, biomass), 5 = renewable (hydro, wind, solar)

Table 2: Change in CO2 emissions for Sunrise case in 2015 (tons of CO2)

Sum of CO2	GenType					
Load Area	1	2	3	4	5	Grand Total
ALBERTA	(37,198,685)	164,873,826		-	-	127,675,140
ARIZONA	(1,427,843,845)	(193,293,250)	17,472,329	-	-	(1,603,664,766)
B HILL	-	(4,668,975)	-		-	(4,668,975)
B.C.HYDR	460,709,603				-	460,709,603
BONZ		(5,371)				(5,371)
COL E	(65,529,896)	62,658,584	-		-	(2,871,312)
COL W	(221,499)	154,029,173			-	153,807,674
IDAHO	3,722,231	7,208,854			-	10,931,084
IMPERIAL	(41,850,041)		-	-	-	(41,850,041)
IPP		-				-
JB		(4,491,865)				(4,491,865)
KGB					-	-
LADWP	(8,958,836)				-	(8,958,836)
LRS	-	-			-	-
MEXICO-C	(1,703,600,991)		3,754,612		-	(1,699,846,379)
MONTANA	347,040	(8,128,483)		-	-	(7,781,442)
NEVADA	(750,084,086)	(158,595)	-			(750,242,681)
NEW MEXI	109,231,713	46,758,239		-	-	155,989,952
NW_EAST	2,185,283,495		-	-	-	2,185,283,495
NW_WEST	1,378,419,853	25,269,547	-	-	-	1,403,689,400
PG&E_BAY	493,725,487	699,423	-	-	-	494,424,910
PG&E_VLY	518,679,426	398,298	40,174,539	-	-	559,252,263
SANDIEGO	(1,036,262,608)		-		-	(1,036,262,608)
SIERRA	21,367,605	(12,516,223)		-	-	8,851,382
SOCALIF	(169,658,117)	5,756,560	-	-	-	(163,901,557)
SW WYO					-	-
UT N	29,422,479	12,928,693			-	42,351,172
UT S	819,270	4,402,691			-	5,221,961
WAPA L.C	(291,085,423)	-			-	(291,085,423)
WYO		4,146,024				4,146,024
YLW TL					-	-
Grand Total	(330,565,826)	265,867,151	61,401,480	-	-	(3,297,194)

1 = Gas-fired, 2 = Coal-fired, 3 = Fuel Oil, 4 = Other (nuclear, wood, biomass), 5 = renewable (hydro, wind, solar)

Table 3 Change in NOX emission for Sunrise case in 2015 (lbs of NOx)

Sum of NOX	GenType					
Load Area	1	2	3	4	5	Grand Total
ALBERTA	(4,681)	116,711		-	-	112,030
ARIZONA	(152,771)	(136,829)	12,368	-	-	(277,231)
B HILL	-	(3,305)	-		-	(3,305)
B.C.HYDR	49,911				-	49,911
BONZ		(4)				(4)
COL E	(7,075)	44,355	-		-	37,279
COL W	(24)	109,034			-	109,010
IDAHO	443	5,103			-	5,546
IMPERIAL	(4,650)		-	-	-	(4,650)
IPP		-				-
JB		(3,180)				(3,180)
KGB					-	-
LADWP	(43)				-	(43)
LRS	-	-			-	-
MEXICO-C	(182,078)		2,658		-	(179,420)
MONTANA	37	(5,754)		-	-	(5,717)
NEVADA	(79,766)	(112)	-			(79,878)
NEW MEXI	16,735	33,099		-	-	49,834
NW_EAST	231,071		-	-	-	231,071
NW_WEST	139,776	17,888	-	-	-	157,664
PG&E_BAY	52,588	495	-	-	-	53,083
PG&E_VLY	56,353	282	28,439	-	-	85,073
SANDIEGO	(112,222)		-		-	(112,222)
SIERRA	2,267	(8,860)		-	-	(6,593)
SOCALIF	(17,710)	4,075	-	-	-	(13,635)
SW WYO					-	-
UT N	3,171	9,152			-	12,323
UT S	(30)	3,117			-	3,087
WAPA L.C	(31,243)	-			-	(31,243)
WYO		2,935				2,935
YLW TL					-	-
Grand Total	(39,940)	188,202	43,465	-	-	191,727

1 = Gas-fired, 2 = Coal-fired, 3 = Fuel Oil, 4 = Other (nuclear, wood, biomass), 5 = renewable (hydro, wind, solar)