California Independent System Operator
Response to
California Wind Energy Association
Data Request No. 1
In R. 10-05-006
(Long-term Procurement Planning Case)

July 22, 2011

July 22, 2011

VIA ELECTRONIC MAIL

Mr. R. Thomas Beach
Crossborder Energy
2560 Ninth Street
Suite 213A
Berkeley, CA 94710

Re: ISO Response to the California Wind Energy Association Data Request No. 1

Dear Mr. Beach:

Enclosed please find the ISO response to the California Wind Energy Association Data Request No. 1 propounded in the Long Term Procurement Proceeding, CPUC Docket R.10-05-006.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Judith B. Sanders /amp

Judith B. Sanders
Senior Counsel
California Independent System Operator

cc: Service List R.10-05-006

BEFORE
THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Integrate	**)**	
And Refine Procurement Policies and	**)**	**R.10-05-006**
Consider Long-Term Procurement Plans	**)**	

RESPONSE OF
THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION
TO THE FIRST SET OF DATA REQUESTS OF
THE CALIFORNIA WIND ENERGY ASSOCIATION

Below are responses by the California Independent System Operator Corporation (ISO) to the First Set of Data Requests of the California Wind Energy Association (CALWEA).

Request No. 1:

The following questions concern the planning reserve margin (PRM) results shown in Table 7, Figure 11, and Slide 7.

a. Did the CAISO use the current counting rule for determining the resource adequacy (RA) qualifying capacity (QC) of wind & solar resources, and their contribution to the PRM?

ISO RESPONSE TO No. 1a:

The NQC values were provided in the RPS Calculator by technology and CREZ. They can be found on the "a – ProForma" tab of the RPS Calculator, found at: http://www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/LTPP2010/2010+LTPP+Tools+and+Spreadsheets.htm .

b. Did this calculation include the CPUC's adopted adjustment for the aggregate capacity of intermittent resources?

ISO RESPONSE TO No. 1b:

Please refer to the response to Data Request No. 1a. .

c. Please provide the calculations and data used to calculate the RA QCs of the 2020 wind and solar resources used in the CAISO modeling, including the adjustment for the aggregate capacity of these intermittent resources, if that adjustment was used.

*Also include the NREL site numbers and the 10-minute data from 2005 for each site, for the 43 NREL sites used to model new wind projects (see **Slide 60**).*

ISO RESPONSE TO No. 1c:

Please refer to the response to Data Request No. 1a. Exhibit 2 provides the NREL site number for the new wind projects.

Request No. 2:

What does the CAISO mean when it says that the PRM "is significantly reduced" in the All-Gas case? (**Page 44**). Table 7 shows that the PRM in the All-Gas case (39%) is 7% to 12% less than the PRMs in the 33% RPS scenarios (46% to 51%). Is that the significant reduction to which the CAISO refers?

ISO RESPONSE TO No. 2:

Yes, this reduction was significant in that the difference in PRM correlated to needs in the all-gas scenario versus no needs in the priority scenarios.

Request No. 3:

What is the difference in the amount of resources needed for integration (A/S, load following, and regulation) in the All-Gas and High Load-Trajectory cases versus the CPUC's four 33% RPS priority scenarios? In other words, all of these cases show resources substantially in excess of the PRM (see **Table 7, Figure 11, and Slide 7**). How much of the "excess" resources above the PRM are needed for integration in each of these cases? If the CAISO cannot determine the answer to this question based on its results to date, please confirm that.

ISO RESPONSE TO No. 3:

The ISO has not performed an analysis to identify how many resources above a 15-17% planning reserve margin are needed for integration

Request No. 4:

Pages 43-44 and Slide 11 show that the High Load – Trajectory case has an additional A/S and load following up requirement of 4,600 MW. The All-Gas case has an additional load following up requirement of 1,400 MW.

a. In the High Load – Trajectory case, can the CAISO determine how much of the increased integration needs in this case are the result of the higher loads, and how *much are the result of the additional renewables needed to reach a 33% RPS at the higher loads?*

RESPONSE TO REQUEST No. 4a:

The ISO has not performed an analysis to determine how much of the 4600MW need is the result of higher load and how much is the result of integration of renewable resources.

b. Why does the All-Gas scenario, which appears to be a 20% RPS scenario as no new renewable resources are added, require an additional 1,400 MW of capacity for integration, given that the CAISO has found no need for integration today at a 20% RPS?

RESPONSE TO REQUEST No. 4b:

The All-Gas scenario described in the ISO testimony differs from the 20% RPS study in that OTC resources were assumed to be retired whereas the 20% study was a study of 2012 that still had OTC resources. In addition, load in the All Gas scenario reflects planning load levels for 2020 and not 2012.

c. Please provide data on the number of hours of A/S and load following up violations that were experienced in the All-Gas and High Load –Trajectory cases.

RESPONSE TO REQUEST No. 4c:

Need runs identified that the All-Gas scenario required 1,400 MW of additional capacity to meet upward ancillary service and load following-up requirements. The High Load – Trajectory scenario required 4,600 MW of additional capacity.

The need run process consists of two steps. First, a linear programming (LP) simulation (i.e., the same setup as the need run but without unit commitment decision) for the full year of 2020 is conducted to identify the months in which the highest shortages in ancillary service and load following may occur. The LP run, however, cannot accurately determine the magnitude of the shortage. Second, a need run (i.e., with unit commitment decision and monthly maximum regulation and load following requirements for each hour) is conducted only for the months identified in the LP run. The purpose of taking this approach is to avoid unnecessarily long simulation times.

In the need run, generic resources will be committed whenever necessary to cover the shortage in upward ancillary service and load following. The relevant results of the need run are the generation and upward ancillary service and load following provided by the generic resources. The need for generic capacity is calculated based on these results.

The upward ancillary service and load following provided by the generic resources are not necessarily the same in magnitude as the violation of the requirements without the generic resources. Each generic resource has a 50 MW minimum capacity. When it is committed, its generation (from 50 MW up to 100 MW) will displace generation by other existing resources and may change upward ancillary service and load following provision by these existing resources. No need run without generic resource was done so the actual magnitude of upward ancillary service and load following shortage is unknown.

The LP run identified July as the month with the highest volume of upward ancillary service and load following provided by generic resources for the All Gas and High Load-Trajectory cases. The need run was done for July only. The capacity needed to meet the requirements of upward ancillary service and load following was then calculated based on the results of the need run. The data and calculation of capacity need for the All Gas case is set forth in the attached Excel file "CalWEA Data Request 1_Data Sheets.xlsx" under "Contribution by Generic Units", "All-Gas Capacity Need", and "Hi-Load Capacity Need" sheets.

d. Please provide data on the distribution of the magnitude of the A/S and load following up violations that were experienced in the All-Gas and High Load – Trajectory cases.

RESPONSE TO REQUEST No. 4d:

Please refer to the response to Data Request No. 4c.

e. Please provide data that will allow CalWEA to understand the distribution across the months of the year and the hours of the day of the A/S and load following up violations that were experienced in the All-Gas and High Load – Trajectory cases.

RESPONSE TO REQUEST No. 4e:

Please refer to the response to Data Request No. 4c.

Request No. 5:

The following questions concern the All-Gas Scenario:

a. CalWEA would like to understand the exact assumptions for renewable in the All-Gas scenario. Please provide a table similar to Slide 5, showing the renewable portfolios for 2020 associated with the All-Gas scenario.

RESPONSE TO No. 5a:

Slide 5 shows the incremental renewable capacity added to the five cases. In the All-Gas scenario no incremental renewable capacity is added. That is why the All-Gas scenario is not listed on Slide 5.

b. Please list the types of generic gas-fired capacity additions in the All-Gas Scenario (CT or CCGT), the capacities of these additions, the years in which these resources are added, and the CAISO zone or local resource area in which they are sited.

RESPONSE TO No. 5b:

The generic resources added in All-Gas case are all LMS100 CT, which has a maximum capacity of 100 MW. The simulation is for year 2020, so the generic resources are added in 2020. Two units are added in the SGD&E region, six units in the SCE, three units in PG&E-Valley, and three units in PG&E-Bay.

c. What is the percent of renewables in 2020 in the All-Gas scenario?

RESPONSE TO No. 5c:

	WECC (incl. CA)	CA (generated inside CA)
Trajectory	17%	26%
All-Gas	11%	12%

Additional detail below:

Trajectory Case

Region Category	WECC	
Generation (GWh)		
Unit Type	**Total**	
CCGT	188,958	19%
CHP	35,623	4%
Coal	226,509	22%

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DR	27	0%
GT	19,136	2%
Hydro	254,781	25%
Nuclear	74,611	7%
Oil	2	0%
Pumped Storage	7,642	1%
Renewable	167,001	17%
ST	34,113	3%
Grand Total	**1,008,401**	100%
Region Category	CA	
Generation (GWh)		
Unit Type	**Total**	
CCGT	80,511	31%
CHP	35,623	13%
DR	27	0%
GT	4,943	2%
Hydro	34,477	13%
Nuclear	34,786	13%
Oil	2	0%
Pumped Storage	3,513	1%
Renewable	69,536	26%

ST	504	0%
Grand Total	**263,921**	100%

All-Gas Case

Region Category	WECC	
Generation (GWh)		
Unit Type	**Total**	
CCGT	217,031	22%
CHP	35,675	4%
Coal	240,528	24%
DR	116	0%
GT	22,476	2%
Hydro	254,733	25%
Nuclear	74,613	7%
Oil	4	0%
Pumped Storage	7,507	1%
Renewable	112,303	11%
ST	42,412	4%
Grand Total	**1,007,399**	100%
Region Category	CA	

Generation (GWh)		
Unit Type	**Total**	
CCGT	91,102	39%
CHP	35,675	15%
DR	100	0%
GT	5,313	2%
Hydro	34,477	15%
Nuclear	34,786	15%
Oil	4	0%
Pumped Storage	3,378	1%
Renewable	29,291	12%
ST	515	0%
Grand Total	**234,642**	100%

d. Why is the 2020 PRM of 39% in All-Gas scenario much higher than the minimum required planning reserve margin of 15% to 17%? (See page 45). Is the additional 22% reserve margin in the All-Gas case, above the PRM, entirely attributable to the integration needs in this scenario?

RESPONSE TO No. 5d:

No, the reserve margins in the All-Gas scenario reflect reserve margins prior to adding any resources to resolve load following shortfalls. The RA QC capacity is accounting for 17,000MW of import capacity which represents the non-simultaneous import capability of the interties. The expected simultaneous import capability is between 12,000-14,000MW. This accounts for a 3,000-5,000MW difference.

e. Does the 2020 PRM of 39% in the All-Gas case include the 1,400 MW of additional capacity needed for integration (see Page 43 and Slide 11)?

RESPONSE TO No. 5e:

No.

Request No. 6:

Slide 20: in the lowest of these cases, the in-state fuel burn is shown at 1.32 billion MMBtu per year. This is 3.5 Bcf per day of natural gas, assuming a heat content of 1.03 MMBtu/Mcf. The California gas utilities (PG&E, SoCalGas, SDG&E) have forecasted a statewide 2020 natural gas demand for electric generation of 2.6 Bcf per day in the most recent California Gas Report (July 2010 – http://www.pge.com/pipeline/library/regulatory/cgr_index.shtml). 2010 natural gas use for electric generation in California was 2.5 Bcf/d according to the 2010 CGR. CalWEA does not understand this discrepancy, as the 2010 CGR also assumes a 33% RPS by 2020.

a. Does the fuel burn shown in Slide 20 consist entirely of natural gas burned at power plants within California, or does it also include coal burned at power plants outside of California in coal plants whose capacity is dedicated to serving California?

RESPONSE TO No. 6a:

It includes all fuels burned at power plants within California. See response to 6b below.

b. If this data includes fuels other than natural gas consumed within California, please disaggregate all of the fuel burns shown in Slide 20 by fuel type (natural gas / coal / oil) and by whether the plant at which the fuel is burned is physically located inside or outside of California.

RESPONSE TO No. 6b:

Below is the disaggregated fuel burned at power plants within California in the Trajectory scenario.

Fuel Usage (million MMBtu)	Gas	Oil	Other	Uranium	Sum
Trajectory Case	931	2	26	383	1,341

c. If the fuel burns shown in Slide 20 include only natural gas burned at plants inside of California, please explain why the CAISO is projecting a 35% increase in natural gas use for electric generation compared to 2010. Explain how California can meet its GHG goals with such an increase in natural gas burns.

RESPONSE TO No. 6c:

As shown above, natural gas burned inside California in the Trajectory case is 0.931 billion MMBtu. It is equivalent to 2.5 Bcf per day based on the heat content assumption in Question 6. The number is in line with the 2010 California Gas Report 2020 natural gas demand number.

Request No. 7:

Pages 36-39 / Slides 50-52 – CalWEA has the following questions on the revised natural gas price forecast. All prices and rates referenced below are expressed in $ per MMBtu; negative values are in parentheses.

a. What is the source for gas basis adjustments in Slide 52?

RESPONSE TO No. 7a:

The TEPPC PC0 dataset, a 2020 reference case, is the source of the gas basis adjustments on Slide 52. Information on the TEPPC PC0 dataset can be found at: http://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2fcommittees%2fBOD%2fTEPPC%2fShared%20Documents%2fTEPPC%20Production%20Cost%20Model%20Data%2fPublic%20Data%20Format%20Cases%2f2020%20Datasets%2fTEPPC%202020%20Base%20Case%20PC0%20Dataset&FolderCTID=&View={3FECCB9E-172C-41C1-9880-A1CF02C537B7}

b. What is the GDP deflator for the gas price forecast, as the gas forecast is in 2010 dollars, and forward prices are in nominal dollars?

RESPONSE TO No. 7b:

The GDP deflator is taken from the EIA's Annual Energy Outlook and is shown in the table below from 2010 to 2020:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP Deflator (2010 = 1.00)	1.01	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17	1.20

c. What are the sources & details for the gas price forecast by California location, i.e. what are the assumed intrastate transport rates?

RESPONSE TO No. 7c:

The California gas price forecast is derived from the Market Price Referent (MPR) methodology (as specified in the LTPP Scoping Memo Planning Standards). The interstate transportation charges were updated from those used in the 2009 MPR Model to the latest available gas delivery tariffs for the utilities' service areas. The delivery charges for generators in the PG&E service territory is based on PG&E Schedule G-EG: http://www.pge.com/tariffs/tm2/pdf/GAS_SCHEDS_G-EG.pdf. The delivery charge for generators in southern California is based on Socal Gas Schedule GT-F5. In addition to this delivery charges, both northern and southern California generators pay an additional municipal surcharge (0.9% and 1.5% of the commodity price, respectively), and generators in southern California also must pay the Receipt Point Access Tariff.

d. What are the forward market prices in each month of 2020 (in 2010 $/MMBtu), for the Henry Hub?

RESPONSE TO No. 7d:

The Henry Hub gas price by month for 2020 in 2010 dollars is shown in the following table:

	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
Henry Hub price (2010$/MMBtu)	5.934	5.901	5.735	5.333	5.307	5.363	5.432	5.473	5.489	5.561	5.778	6.028

e. The forward market data on basis trades from the period 7/26/10 to 8/14/10 do not extend out to 2020. What forward data were used for 2020 basis trades for:

i. PG&E Citygate,
ii. SoCal border,
iii. Sumas,
iv. Permian,
v. San Juan, and
vi. Rockies.

RESPONSE TO No. 7e:

For all years beyond 2013, it was assumed that the basis differentials would remain constant in real terms.

f. How were Malin prices modeled? The (Malin - SoCal border) basis appears to be $0.25 per MMBtu in Nov-Mar, and ($0.03) in Apr-Oct? Is this a modeling assumption or based on market data? Why are Malin prices higher than PG&E Citygate prices in Nov-Mar, as gas is unlikely to flow from the PG&E Citygate to Malin in these months? Is Topock assumed to be on the margin during these months?

RESPONSE TO No. 7f:

The Malin prices calculated as the average of the PG&E Citygate and Sumas prices. However, these prices were not associated with any generators and were not used in the LTPP analysis.

g. Does the ($0.20) per MMBtu Henry Hub vs. SoCal border basis differential include any monthly variation? The average 7/26/20 to 8/24/10 SoCal border basis differential for 2014 was about ($0.22) per MMBtu; did E3 use a similar market value, adjusted for inflation?

RESPONSE TO No. 7g:

Basis differentials were assumed to vary between two seasons: summer (April – October) and Winter (November – March). Within these periods, the differentials were assumed constant. For years in which NYMEX forward data was available (2011-2013), the differentials in each period were calculated as an average of the NYMEX differentials across the months in the season. For years beyond 2013, the differentials for each season were assumed to remain constant in real terms.

The ($0.20) per MMBtu differential from Henry Hub to Socal Border is an annual average, and this differential varies on a seasonal basis as described above. However, this seasonal difference is very small in the forward data; the summer and winter differentials are ($0.201) and ($0.197) per MMBtu, respectively.

h. Is any impact of the new Ruby pipeline project assumed? Ruby is expected to enter service in 2011 from the Rocky Mountains to Malin. Or is that effect captured through forward market hub prices for the Rockies and the PG&E Citygate?

RESPONSE TO No. 7h:

No explicit assumptions are made about the impact of the Ruby pipeline on regional natural gas prices. However, any impacts of this project on the expectations of regional gas prices are implicitly captured in the use of NYMEX public data.

i. Are intrastate transportation (delivery) charges escalated over time? If they are, what is the escalation rate?

RESPONSE TO No. 7i:

Delivery charges are assumed to escalate at the same rate as inflation over time.

j. Why is SPP modeled as PG&E Citygate – $0.167 per MMBtu? Shouldn't SPP use Malin plus Tuscarora transport, or Rockies + Northwest & Paiute pipeline transport?

RESPONSE TO No. 7j:

The use of the PG&E Citygate hub and the associated delivery charge of $0.167 per MMBtu applied to generators in the SPP basin is based on the natural gas pricing methodology used by TEPPC; the linking of natural gas hubs to regional generators and the associated delivery charges used by TEPPC are shown on pp.176-177 here: http://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/TEPPC%20Annual%20Reports/2009/2009%20TEPPC%20Study%20Results%20Report.pdf. The logic for regional gas prices used by TEPPC was the main source used to develop regional gas prices outside of California for the LTPP analysis.

k. Is TEP modeled as PG&E Citygate plus $0.303 per MMBtu, as shown in Table 5? Or should that table have indicated SoCal border plus $0.303 per MMBtu similar to how SRP is modeled?

RESPONSE TO No. 7k:

This is an error in Table 5, which should have indicated that generators in TEP were modeled using the same gas prices as SRP and APS (Socal Border + $0.303 per MMBtu). The PLEXOS runs were conducted using the same gas prices for TEP, SRP, and APS.

l. Why is the SDG&E transport rate ($0.438) higher than the SCE delivery charge ($0.359), when there is a common "Sempra-wide" electric generation transportation rate in southern California?

RESPONSE TO No. 7l:

This is an error in Table 5, which should show a total delivery charge of $0.438 per MMBtu for all southern California bubbles (SCE, SDGE, IID, LDWP). The PLEXOS runs were conducted using this uniform delivery charge across all of southern California.

m. Table 5 indicates several possible prices for PG&E "Valley" generation: SoCal border + $0.359, or PG&E City-gate plus $0.23 for local transmission (LT) or +$0.06 for backbone transportation (BB). Which of these prices is used and for modeling which generating plants?

RESPONSE TO No. 7m:

Each generator modeled in PLEXOS is individually linked to a specific natural gas price point. Some generators in PG&E's service area were modeled as taking gas from the backbone system, while others were modeled as taking gas from the local system. The mapping of generators to the price points is part of the Plexos data input model available on ISO FTP site.

n. SDG&E is also modeled as Baja + 0.00? Are LNG volumes assumed for this gas? What is the assumed LNG price delivered to Baja?

RESPONSE TO No. 7n:

A subset of generators in the SDGE bubble were modeled as taking gas from Baja.

o. The Arizona prices listed in Table 5 appear to equal the SoCal border price plus a sales tax of 5.6%? Is an Arizona delivery charge (of $0.303 per MMBtu) also included for plants in Arizona?

RESPONSE TO No. 7o:

The $0.303 per MMBTu adder listed in Table 5 represents the average cost of the 5.6% gas tax for Arizona generators. It should not be added in addition to the gas tax.

p. Idaho-Montana is modeled as Rockies plus $0.512 per MMBtu? Is a municipal surcharge included as well?

RESPONSE TO No. 7p:

The gas prices for Idaho-Montana were calculated based on TEPPC's regional natural gas price mapping (as with other WECC regions). Pages 176-177 of the following document indicate the linkage between the Rockies hub and the Idaho region and also provide the delivery charge used in the LTPP analysis (adjusted for inflation): http://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/TEPPC%20Annual%20Reports/2009/2009%20TEPPC%20Study%20Results%20Report.pdf

Request No. 8:

At pages 44-45, the CAISO states as follows:

> ... we cannot conclude from these results whether sufficient flexible capability would exist to meet the simultaneous energy, operating reserve, regulation and load following requirements if the available generation capacity was not in excess of the 15-17% PRM. For example, if the utilities contract for less import qualifying capacity, just meeting their PRM of 117%, the ISO may need to dispatch the capacity that is currently unloaded and providing flexibility services in these cases, and therefore may be short the needed flexible capacity. The four priority scenarios were not analyzed assuming the PRM would just be met but not exceeded.

CalWEA is struggling to understand this point, because it does not appear possible for the utilities to satisfy a 33% RPS and hit the minimum PRM of 17%. Please explain how the utilities could satisfy a 33% RPS yet only have a PRM of 17%. Would this be a case in which the system would have substantial gas-fired capacity that is not under contract to the utilities?

RESPONSE TO No. 8:

This may be possible if non-renewable capacity is not contracted for. This may include gas-fired resources but also may include imports. One thing to point out is that the RA QC capacity is accounting for approximately 17,000MW of import capacity which represents the non-simultaneous import capability of the interties. The expected simultaneous import capability is between 12,000-14,000MW. This accounts for a 3,000-5,000MW difference.

Request No. 9:

The IOUs have run a scenario that considers Day-Ahead (DA) forecast error. The CAISO recently released a proposal to move to a scheduling regime that includes a much greater emphasis on Day-Of (DO) scheduling and markets (see http://www.caiso.com/2bb3/2bb3e594394f0.pdf). Does the CAISO agree that a move from DA to DO scheduling would reduce the significance of DA forecast error?

RESPONSE TO No. 9:

While the day-of market would provide an opportunity scheduling adjustment, the day-of market was not intending to replace the day-ahead market. Therefore, the ISO expects the need for a day-ahead market to still exist. However, there will be mechanisms that adjust and commit resources prior to real-time to account for supply and load changes after the day-ahead forecast. In addition, the ISO proposal is part of the renewable integration market product review stakeholder initiative that is in the beginning stages and is therefore a preliminary proposal subject to change.

Request No. 10:

On Page 46, describing the WECC production cost results, should the words "California" in lines 15-16 be replaced with "WECC"?

RESPONSE TO No. 10:

Yes, page 46 lines 15-18 should read as follows:

> The production costs to meet to ~~California~~ WECC load in the All Gas scenario were $20.79 billion. The production costs to meet ~~California~~ WECC load in the Trajectory High Load scenario were $19.63 billion. This information can be found on Slide 14 of Exhibit 1.

ATTACHMENT A

Case	Generic Unit	Year	Month	Day	Hour	Property	Value
AllGas	SDGE Generic LMS100	2020	7	22	13	Generation	150
AllGas	SDGE Generic LMS100	2020	7	22	13	NonSpin Reserve	173.19
AllGas	SDGE Generic LMS100	2020	7	22	13	Units Generating	3
AllGas	SCE Generic LMS100	2020	7	22	14	Generation	192.934
AllGas	SCE Generic LMS100	2020	7	22	14	NonSpin Reserve	113.56
AllGas	SCE Generic LMS100	2020	7	22	14	Spining Reserve	7.07
AllGas	SCE Generic LMS100	2020	7	22	14	Units Generating	2
AllGas	SDGE Generic LMS100	2020	7	22	14	Generation	500
AllGas	SDGE Generic LMS100	2020	7	22	14	Spining Reserve	500.00
AllGas	SDGE Generic LMS100	2020	7	22	14	Units Generating	10
AllGas	SCE Generic LMS100	2020	7	22	15	Generation	200
AllGas	SCE Generic LMS100	2020	7	22	15	NonSpin Reserve	46.96
AllGas	SCE Generic LMS100	2020	7	22	15	Units Generating	2
AllGas	SDGE Generic LMS100	2020	7	22	15	Generation	500
AllGas	SDGE Generic LMS100	2020	7	22	15	Spining Reserve	500.00
AllGas	SDGE Generic LMS100	2020	7	22	15	Units Generating	10
AllGas	SCE Generic LMS100	2020	7	22	16	Generation	200
AllGas	SCE Generic LMS100	2020	7	22	16	NonSpin Reserve	112.83
AllGas	SCE Generic LMS100	2020	7	22	16	Units Generating	2
AllGas	SDGE Generic LMS100	2020	7	22	16	Generation	500
AllGas	SDGE Generic LMS100	2020	7	22	16	Spining Reserve	500.00
AllGas	SDGE Generic LMS100	2020	7	22	16	Units Generating	10
AllGas	SDGE Generic LMS100	2020	7	22	17	Generation	100
AllGas	SDGE Generic LMS100	2020	7	22	17	NonSpin Reserve	120.00
AllGas	SDGE Generic LMS100	2020	7	22	17	Spining Reserve	12.94
AllGas	SDGE Generic LMS100	2020	7	22	17	Units Generating	2
AllGas	SDGE Generic LMS100	2020	7	27	16	Generation	50
AllGas	SDGE Generic LMS100	2020	7	27	16	NonSpin Reserve	60.00
AllGas	SDGE Generic LMS100	2020	7	27	16	Spining Reserve	31.54
AllGas	SDGE Generic LMS100	2020	7	27	16	Units Generating	1
AllGas	SDGE Generic LMS100	2020	7	28	16	Generation	100
AllGas	SDGE Generic LMS100	2020	7	28	16	Spining Reserve	80.95
AllGas	SDGE Generic LMS100	2020	7	28	16	Units Generating	2
AllGas	SDGE Generic LMS100	2020	7	29	16	Generation	50
AllGas	SDGE Generic LMS100	2020	7	29	16	NonSpin Reserve	22.33
AllGas	SDGE Generic LMS100	2020	7	29	16	Units Generating	1
AllGas	SDGE Generic LMS100	2020	7	30	14	Generation	50
AllGas	SDGE Generic LMS100	2020	7	30	14	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	13	16	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	13	16	LoadFollowingUp	3.24
HiLoad	SDGE Generic LMS100	2020	7	13	16	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	13	17	Generation	205.501
HiLoad	SCE Generic LMS100	2020	7	13	17	Units Generating	3
HiLoad	SCE Generic LMS100	2020	7	14	15	Generation	162.806
HiLoad	SCE Generic LMS100	2020	7	14	15	Units Generating	2
HiLoad	SCE Generic LMS100	2020	7	14	16	Generation	70.9844

HiLoad	SCE Generic LMS100	2020	7	14	16	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	14	17	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	14	17	NonSpin Reserve	0.24
HiLoad	SDGE Generic LMS100	2020	7	14	17	Spining Reserve	5.24
HiLoad	SDGE Generic LMS100	2020	7	14	17	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	15	16	Generation	109.652
HiLoad	SCE Generic LMS100	2020	7	15	16	Units Generating	2
HiLoad	SCE Generic LMS100	2020	7	15	17	Generation	274.976
HiLoad	SCE Generic LMS100	2020	7	15	17	Units Generating	3
HiLoad	SCE Generic LMS100	2020	7	16	14	Generation	50
HiLoad	SCE Generic LMS100	2020	7	16	14	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	16	15	Generation	309.379
HiLoad	SCE Generic LMS100	2020	7	16	15	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	16	16	Generation	319.986
HiLoad	SCE Generic LMS100	2020	7	16	16	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	16	17	Generation	437.32
HiLoad	SCE Generic LMS100	2020	7	16	17	Units Generating	5
HiLoad	SCE Generic LMS100	2020	7	17	13	Generation	189.104
HiLoad	SCE Generic LMS100	2020	7	17	13	Units Generating	2
HiLoad	SCE Generic LMS100	2020	7	17	14	Generation	414.697
HiLoad	SCE Generic LMS100	2020	7	17	14	Units Generating	5
HiLoad	SCE Generic LMS100	2020	7	17	15	Generation	576.351
HiLoad	SCE Generic LMS100	2020	7	17	15	Units Generating	6
HiLoad	SCE Generic LMS100	2020	7	17	16	Generation	116.913
HiLoad	SCE Generic LMS100	2020	7	17	16	Units Generating	2
HiLoad	SDGE Generic LMS100	2020	7	17	16	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	17	16	NonSpin Reserve	300.00
HiLoad	SDGE Generic LMS100	2020	7	17	16	Spining Reserve	250.00
HiLoad	SDGE Generic LMS100	2020	7	17	16	Units Generating	5
HiLoad	SCE Generic LMS100	2020	7	17	17	Generation	520.702
HiLoad	SCE Generic LMS100	2020	7	17	17	Units Generating	6
HiLoad	SDGE Generic LMS100	2020	7	17	17	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	17	17	LoadFollowingUp	50.00
HiLoad	SDGE Generic LMS100	2020	7	17	17	NonSpin Reserve	56.67
HiLoad	SDGE Generic LMS100	2020	7	17	17	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	20	17	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	20	17	NonSpin Reserve	60.00
HiLoad	SDGE Generic LMS100	2020	7	20	17	Spining Reserve	48.61
HiLoad	SDGE Generic LMS100	2020	7	20	17	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	20	18	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	20	18	Spining Reserve	19.20
HiLoad	SDGE Generic LMS100	2020	7	20	18	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	20	19	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	20	19	NonSpin Reserve	300.00
HiLoad	SDGE Generic LMS100	2020	7	20	19	Spining Reserve	215.91
HiLoad	SDGE Generic LMS100	2020	7	20	19	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	20	20	Generation	200

HiLoad	SDGE Generic LMS100	2020	7	20	20	NonSpin Reserve	240.00
HiLoad	SDGE Generic LMS100	2020	7	20	20	Spining Reserve	69.22
HiLoad	SDGE Generic LMS100	2020	7	20	20	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	21	13	Generation	89.3119
HiLoad	SCE Generic LMS100	2020	7	21	13	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	21	14	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	21	14	NonSpin Reserve	268.89
HiLoad	SDGE Generic LMS100	2020	7	21	14	Spining Reserve	155.24
HiLoad	SDGE Generic LMS100	2020	7	21	14	Units Generating	5
HiLoad	SCE Generic LMS100	2020	7	21	15	Generation	370.605
HiLoad	SCE Generic LMS100	2020	7	21	15	Units Generating	4
HiLoad	SDGE Generic LMS100	2020	7	21	15	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	21	15	NonSpin Reserve	300.00
HiLoad	SDGE Generic LMS100	2020	7	21	15	Spining Reserve	250.00
HiLoad	SDGE Generic LMS100	2020	7	21	15	Units Generating	5
HiLoad	PG&E_VLY Generic LMS100	2020	7	21	16	Generation	150
HiLoad	PG&E_VLY Generic LMS100	2020	7	21	16	NonSpin Reserve	180.00
HiLoad	PG&E_VLY Generic LMS100	2020	7	21	16	Spining Reserve	138.37
HiLoad	PG&E_VLY Generic LMS100	2020	7	21	16	Units Generating	3
HiLoad	SCE Generic LMS100	2020	7	21	16	Generation	1000
HiLoad	SCE Generic LMS100	2020	7	21	16	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	21	16	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	21	16	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	21	16	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	21	17	Generation	283.713
HiLoad	SCE Generic LMS100	2020	7	21	17	Units Generating	3
HiLoad	SDGE Generic LMS100	2020	7	21	17	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	21	17	NonSpin Reserve	300.00
HiLoad	SDGE Generic LMS100	2020	7	21	17	Spining Reserve	250.00
HiLoad	SDGE Generic LMS100	2020	7	21	17	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	21	18	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	21	18	LoadFollowingUp	44.37
HiLoad	SDGE Generic LMS100	2020	7	21	18	NonSpin Reserve	60.00
HiLoad	SDGE Generic LMS100	2020	7	21	18	Units Generating	1
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	13	Generation	50
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	13	Spining Reserve	13.04
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	13	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	22	13	Generation	835.578
HiLoad	SCE Generic LMS100	2020	7	22	13	LoadFollowingUp	164.42
HiLoad	SCE Generic LMS100	2020	7	22	13	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	13	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	13	RegulationUp	216.00
HiLoad	SDGE Generic LMS100	2020	7	22	13	Spining Reserve	284.00
HiLoad	SDGE Generic LMS100	2020	7	22	13	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	14	Generation	950
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	14	NonSpin Reserve	179.02
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	14	Spining Reserve	820.75

HiLoad	PG&E_VLY Generic LMS100	2020	7	22	14	Units Generating	19
HiLoad	SCE Generic LMS100	2020	7	22	14	Generation	1000
HiLoad	SCE Generic LMS100	2020	7	22	14	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	14	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	14	LoadFollowingUp	11.25
HiLoad	SDGE Generic LMS100	2020	7	22	14	RegulationUp	216.00
HiLoad	SDGE Generic LMS100	2020	7	22	14	Spining Reserve	272.75
HiLoad	SDGE Generic LMS100	2020	7	22	14	Units Generating	10
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	15	Generation	150
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	15	NonSpin Reserve	219.70
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	15	Spining Reserve	65.64
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	15	Units Generating	3
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	15	Generation	1000
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	15	NonSpin Reserve	233.74
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	15	RegulationUp	338.95
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	15	Spining Reserve	427.31
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	15	Units Generating	20
HiLoad	SCE Generic LMS100	2020	7	22	15	Generation	1000
HiLoad	SCE Generic LMS100	2020	7	22	15	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	15	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	15	LoadFollowingUp	224.23
HiLoad	SDGE Generic LMS100	2020	7	22	15	Spining Reserve	275.77
HiLoad	SDGE Generic LMS100	2020	7	22	15	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	16	Generation	1000
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	16	NonSpin Reserve	3.53
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	16	Spining Reserve	993.07
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	16	Units Generating	20
HiLoad	SCE Generic LMS100	2020	7	22	16	Generation	1000
HiLoad	SCE Generic LMS100	2020	7	22	16	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	16	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	16	LoadFollowingUp	21.56
HiLoad	SDGE Generic LMS100	2020	7	22	16	NonSpin Reserve	478.44
HiLoad	SDGE Generic LMS100	2020	7	22	16	Units Generating	10
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	17	Generation	50
HiLoad	PG&E_BAY Generic LMS100	2020	7	22	17	Units Generating	1
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	17	Generation	1000
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	17	NonSpin Reserve	305.75
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	17	RegulationUp	216.00
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	17	Spining Reserve	446.36
HiLoad	PG&E_VLY Generic LMS100	2020	7	22	17	Units Generating	20
HiLoad	SCE Generic LMS100	2020	7	22	17	Generation	916.698
HiLoad	SCE Generic LMS100	2020	7	22	17	LoadFollowingUp	83.30
HiLoad	SCE Generic LMS100	2020	7	22	17	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	17	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	17	LoadFollowingUp	104.35
HiLoad	SDGE Generic LMS100	2020	7	22	17	Spining Reserve	395.65
HiLoad	SDGE Generic LMS100	2020	7	22	17	Units Generating	10

HiLoad	SCE Generic LMS100	2020	7	22	18	Generation	100
HiLoad	SCE Generic LMS100	2020	7	22	18	NonSpin Reserve	34.66
HiLoad	SCE Generic LMS100	2020	7	22	18	Units Generating	1
HiLoad	SDGE Generic LMS100	2020	7	22	18	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	22	18	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	22	18	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	22	19	Generation	400
HiLoad	SDGE Generic LMS100	2020	7	22	19	NonSpin Reserve	120.00
HiLoad	SDGE Generic LMS100	2020	7	22	19	Spining Reserve	373.27
HiLoad	SDGE Generic LMS100	2020	7	22	19	Units Generating	8
HiLoad	SDGE Generic LMS100	2020	7	22	20	Generation	300
HiLoad	SDGE Generic LMS100	2020	7	22	20	NonSpin Reserve	240.00
HiLoad	SDGE Generic LMS100	2020	7	22	20	Spining Reserve	270.74
HiLoad	SDGE Generic LMS100	2020	7	22	20	Units Generating	6
HiLoad	SCE Generic LMS100	2020	7	23	15	Generation	50.3001
HiLoad	SCE Generic LMS100	2020	7	23	15	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	24	13	Generation	632.682
HiLoad	SCE Generic LMS100	2020	7	24	13	Units Generating	7
HiLoad	SCE Generic LMS100	2020	7	24	14	Generation	823.398
HiLoad	SCE Generic LMS100	2020	7	24	14	Units Generating	9
HiLoad	SCE Generic LMS100	2020	7	24	15	Generation	975.692
HiLoad	SCE Generic LMS100	2020	7	24	15	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	24	15	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	24	15	LoadFollowingUp	50.00
HiLoad	SDGE Generic LMS100	2020	7	24	15	NonSpin Reserve	48.02
HiLoad	SDGE Generic LMS100	2020	7	24	15	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	24	16	Generation	993.785
HiLoad	SCE Generic LMS100	2020	7	24	16	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	24	17	Generation	935.362
HiLoad	SCE Generic LMS100	2020	7	24	17	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	24	17	Generation	100
HiLoad	SDGE Generic LMS100	2020	7	24	17	LoadFollowingUp	100.00
HiLoad	SDGE Generic LMS100	2020	7	24	17	NonSpin Reserve	120.00
HiLoad	SDGE Generic LMS100	2020	7	24	17	Units Generating	2
HiLoad	SCE Generic LMS100	2020	7	24	18	Generation	511.718
HiLoad	SCE Generic LMS100	2020	7	24	18	Units Generating	6
HiLoad	SCE Generic LMS100	2020	7	27	13	Generation	396.891
HiLoad	SCE Generic LMS100	2020	7	27	13	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	27	14	Generation	200
HiLoad	SCE Generic LMS100	2020	7	27	14	NonSpin Reserve	0.19
HiLoad	SCE Generic LMS100	2020	7	27	14	Units Generating	2
HiLoad	SDGE Generic LMS100	2020	7	27	14	Generation	250
HiLoad	SDGE Generic LMS100	2020	7	27	14	NonSpin Reserve	300.00
HiLoad	SDGE Generic LMS100	2020	7	27	14	Spining Reserve	250.00
HiLoad	SDGE Generic LMS100	2020	7	27	14	Units Generating	5
HiLoad	SCE Generic LMS100	2020	7	27	15	Generation	881.264
HiLoad	SCE Generic LMS100	2020	7	27	15	Units Generating	9

HiLoad	SDGE Generic LMS100	2020	7	27	15	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	27	15	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	27	15	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	27	16	Generation	766.398
HiLoad	SCE Generic LMS100	2020	7	27	16	Units Generating	8
HiLoad	SDGE Generic LMS100	2020	7	27	16	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	27	16	NonSpin Reserve	126.13
HiLoad	SDGE Generic LMS100	2020	7	27	16	Spining Reserve	373.87
HiLoad	SDGE Generic LMS100	2020	7	27	16	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	27	17	Generation	474.111
HiLoad	SCE Generic LMS100	2020	7	27	17	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	27	17	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	27	17	NonSpin Reserve	18.25
HiLoad	SDGE Generic LMS100	2020	7	27	17	RegulationUp	81.00
HiLoad	SDGE Generic LMS100	2020	7	27	17	Spining Reserve	400.75
HiLoad	SDGE Generic LMS100	2020	7	27	17	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	27	18	Generation	50
HiLoad	SDGE Generic LMS100	2020	7	27	18	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	28	14	Generation	310.849
HiLoad	SCE Generic LMS100	2020	7	28	14	Units Generating	4
HiLoad	SDGE Generic LMS100	2020	7	28	14	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	14	RegulationUp	83.05
HiLoad	SDGE Generic LMS100	2020	7	28	14	Spining Reserve	416.95
HiLoad	SDGE Generic LMS100	2020	7	28	14	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	28	15	Generation	50
HiLoad	PG&E_VLY Generic LMS100	2020	7	28	15	NonSpin Reserve	35.16
HiLoad	PG&E_VLY Generic LMS100	2020	7	28	15	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	28	15	Generation	838.873
HiLoad	SCE Generic LMS100	2020	7	28	15	Spining Reserve	161.13
HiLoad	SCE Generic LMS100	2020	7	28	15	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	28	15	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	15	LoadFollowingUp	36.79
HiLoad	SDGE Generic LMS100	2020	7	28	15	Spining Reserve	463.21
HiLoad	SDGE Generic LMS100	2020	7	28	15	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	28	16	Generation	500
HiLoad	SCE Generic LMS100	2020	7	28	16	NonSpin Reserve	280.89
HiLoad	SCE Generic LMS100	2020	7	28	16	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	28	16	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	16	LoadFollowingUp	11.67
HiLoad	SDGE Generic LMS100	2020	7	28	16	Spining Reserve	488.33
HiLoad	SDGE Generic LMS100	2020	7	28	16	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	28	17	Generation	500
HiLoad	SCE Generic LMS100	2020	7	28	17	NonSpin Reserve	149.93
HiLoad	SCE Generic LMS100	2020	7	28	17	Spining Reserve	346.25
HiLoad	SCE Generic LMS100	2020	7	28	17	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	28	17	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	17	Spining Reserve	500.00

HiLoad	SDGE Generic LMS100	2020	7	28	17	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	28	18	Generation	100
HiLoad	SCE Generic LMS100	2020	7	28	18	Spining Reserve	93.21
HiLoad	SCE Generic LMS100	2020	7	28	18	Units Generating	2
HiLoad	SDGE Generic LMS100	2020	7	28	18	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	18	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	28	18	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	28	19	Generation	350
HiLoad	SCE Generic LMS100	2020	7	28	19	NonSpin Reserve	180.00
HiLoad	SCE Generic LMS100	2020	7	28	19	Spining Reserve	346.58
HiLoad	SCE Generic LMS100	2020	7	28	19	Units Generating	7
HiLoad	SDGE Generic LMS100	2020	7	28	19	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	19	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	28	19	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	28	20	Generation	250
HiLoad	SCE Generic LMS100	2020	7	28	20	NonSpin Reserve	300.00
HiLoad	SCE Generic LMS100	2020	7	28	20	Spining Reserve	132.84
HiLoad	SCE Generic LMS100	2020	7	28	20	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	28	20	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	28	20	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	28	20	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	29	14	Generation	400
HiLoad	SCE Generic LMS100	2020	7	29	14	NonSpin Reserve	10.99
HiLoad	SCE Generic LMS100	2020	7	29	14	Units Generating	4
HiLoad	SDGE Generic LMS100	2020	7	29	14	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	29	14	NonSpin Reserve	137.98
HiLoad	SDGE Generic LMS100	2020	7	29	14	Spining Reserve	362.02
HiLoad	SDGE Generic LMS100	2020	7	29	14	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	15	Generation	450
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	15	NonSpin Reserve	540.00
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	15	Spining Reserve	334.46
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	15	Units Generating	9
HiLoad	SCE Generic LMS100	2020	7	29	15	Generation	983.13
HiLoad	SCE Generic LMS100	2020	7	29	15	LoadFollowingUp	16.87
HiLoad	SCE Generic LMS100	2020	7	29	15	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	29	15	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	29	15	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	29	15	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	16	Generation	500
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	16	NonSpin Reserve	514.65
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	16	Spining Reserve	382.61
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	16	Units Generating	10
HiLoad	SCE Generic LMS100	2020	7	29	16	Generation	1000
HiLoad	SCE Generic LMS100	2020	7	29	16	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	29	16	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	29	16	Spining Reserve	500.00
HiLoad	SDGE Generic LMS100	2020	7	29	16	Units Generating	10

HiLoad	PG&E_VLY Generic LMS100	2020	7	29	17	Generation	450
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	17	NonSpin Reserve	540.00
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	17	Spining Reserve	396.77
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	17	Units Generating	9
HiLoad	SCE Generic LMS100	2020	7	29	17	Generation	759.53
HiLoad	SCE Generic LMS100	2020	7	29	17	Spining Reserve	240.47
HiLoad	SCE Generic LMS100	2020	7	29	17	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	29	17	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	29	17	LoadFollowingUp	365.09
HiLoad	SDGE Generic LMS100	2020	7	29	17	Spining Reserve	134.91
HiLoad	SDGE Generic LMS100	2020	7	29	17	Units Generating	10
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	18	Generation	50
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	18	NonSpin Reserve	60.00
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	18	Spining Reserve	22.84
HiLoad	PG&E_VLY Generic LMS100	2020	7	29	18	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	29	18	Generation	500
HiLoad	SCE Generic LMS100	2020	7	29	18	Spining Reserve	500.00
HiLoad	SCE Generic LMS100	2020	7	29	18	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	29	18	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	29	18	LoadFollowingUp	185.39
HiLoad	SDGE Generic LMS100	2020	7	29	18	Spining Reserve	314.61
HiLoad	SDGE Generic LMS100	2020	7	29	18	Units Generating	10
HiLoad	SDGE Generic LMS100	2020	7	29	19	Generation	300
HiLoad	SDGE Generic LMS100	2020	7	29	19	NonSpin Reserve	240.00
HiLoad	SDGE Generic LMS100	2020	7	29	19	Spining Reserve	280.62
HiLoad	SDGE Generic LMS100	2020	7	29	19	Units Generating	6
HiLoad	SDGE Generic LMS100	2020	7	29	20	Generation	150
HiLoad	SDGE Generic LMS100	2020	7	29	20	NonSpin Reserve	180.00
HiLoad	SDGE Generic LMS100	2020	7	29	20	Spining Reserve	84.27
HiLoad	SDGE Generic LMS100	2020	7	29	20	Units Generating	3
HiLoad	SCE Generic LMS100	2020	7	30	11	Generation	186.382
HiLoad	SCE Generic LMS100	2020	7	30	11	Units Generating	2
HiLoad	SCE Generic LMS100	2020	7	30	13	Generation	67.5155
HiLoad	SCE Generic LMS100	2020	7	30	13	Units Generating	1
HiLoad	SCE Generic LMS100	2020	7	30	14	Generation	350.657
HiLoad	SCE Generic LMS100	2020	7	30	14	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	30	15	Generation	416.098
HiLoad	SCE Generic LMS100	2020	7	30	15	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	30	15	Generation	350
HiLoad	SDGE Generic LMS100	2020	7	30	15	NonSpin Reserve	180.00
HiLoad	SDGE Generic LMS100	2020	7	30	15	RegulationUp	162.00
HiLoad	SDGE Generic LMS100	2020	7	30	15	Spining Reserve	188.00
HiLoad	SDGE Generic LMS100	2020	7	30	15	Units Generating	7
HiLoad	SCE Generic LMS100	2020	7	30	16	Generation	307.101
HiLoad	SCE Generic LMS100	2020	7	30	16	Units Generating	4
HiLoad	SDGE Generic LMS100	2020	7	30	16	Generation	200
HiLoad	SDGE Generic LMS100	2020	7	30	16	NonSpin Reserve	240.00

HiLoad	SDGE Generic LMS100	2020	7	30	16	Spining Reserve	200.00
HiLoad	SDGE Generic LMS100	2020	7	30	16	Units Generating	4
HiLoad	SCE Generic LMS100	2020	7	30	17	Generation	443.314
HiLoad	SCE Generic LMS100	2020	7	30	17	Units Generating	5
HiLoad	SDGE Generic LMS100	2020	7	30	17	Generation	500
HiLoad	SDGE Generic LMS100	2020	7	30	17	Spining Reserve	495.77
HiLoad	SDGE Generic LMS100	2020	7	30	17	Units Generating	10

Case HiLoad
Month 7

Day	Hour	Generic Unit	Units Committed	Generation	RegulationUp	Spining Reserve	LoadFollowingUp	NonSpin Reserve	OnLineAS - NSpn	OnlineNspn	OfflineNspn	Unit Need	Capacity Need
13	16	SDGE Generic LMS100	1	50	0	0	3.2	0	3.2	0	0	1	100
	16 Total		**1**	**50**	**0**	**0**	**3.2**	**0**	**3.2**	**0**	**0**	**1**	**100**
	17	SCE Generic LMS100	3	206	0	0	0	0	0	0	0	3	300
	17 Total		**3**	**206**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**300**
14	15	SCE Generic LMS100	2	163	0	0	0	0	0	0	0	2	200
	15 Total		**2**	**163**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**200**
	16	SCE Generic LMS100	1	71	0	0	0	0	0	0	0	1	100
	16 Total		**1**	**71**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**100**
	17	SDGE Generic LMS100	1	50	0	5.2	0	0.2	5.2	0.2	0	1	100
	17 Total		**1**	**50**	**0**	**5.2**	**0**	**0.2**	**5.2**	**0.2**	**0**	**1**	**100**
17	13	SCE Generic LMS100	2	189	0	0	0	0	0	0	0	2	200
	13 Total		**2**	**189**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**200**
	14	SCE Generic LMS100	5	415	0	0	0	0	0	0	0	5	500
	14 Total		**5**	**415**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**500**
	15	SCE Generic LMS100	6	576	0	0	0	0	0	0	0	6	600
	15 Total		**6**	**576**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**600**
	16	SCE Generic LMS100	2	117	0	0	0	0	0	0	0	2	200
		SDGE Generic LMS100	5	250	0	250.0	0	300.0	250.0	0	300.0	10	1,000
	16 Total		**7**	**367**	**0**	**250.0**	**0**	**300.0**	**250.0**	**0**	**300.0**	**12.0**	**1,200**
	17	SCE Generic LMS100	6	521	0	0	0	0	0	0	0	6	600
		SDGE Generic LMS100	1	50	0	0	50.0	56.7	50.0	0	56.7	2	200
	17 Total		**7**	**571**	**0**	**0**	**50.0**	**56.7**	**50.0**	**0**	**56.7**	**8**	**800**
20	17	SDGE Generic LMS100	1	50	0	48.6	0	60.0	48.6	1.4	58.6	2	200
	17 Total		**1**	**50**	**0**	**48.6**	**0**	**60.0**	**48.6**	**1.4**	**58.6**	**2**	**200**
	18	SDGE Generic LMS100	1	50	0	19.2	0	0	19.2	0	0	1	100
	18 Total		**1**	**50**	**0**	**19.2**	**0**	**0**	**19.2**	**0**	**0**	**1**	**100**
	19	SDGE Generic LMS100	5	250	0	215.9	0	300.0	215.9	34.1	265.9	10	1,000
	19 Total		**5**	**250**	**0**	**215.9**	**0**	**300.0**	**215.9**	**34.1**	**265.9**	**10**	**1,000**
	20	SDGE Generic LMS100	4	200	0	69.2	0	240.0	69.2	130.8	109.2	6	600
	20 Total		**4**	**200**	**0**	**69.2**	**0**	**240.0**	**69.2**	**130.8**	**109.2**	**6**	**600**
21	13	SCE Generic LMS100	1	89	0	0	0	0	0	0	0	1	100
	13 Total		**1**	**89**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**100**

	14	SDGE Generic LMS100	5	250	0	155.2	0	268.9	155.2	94.8	174.1	8	800
	14 Total		**5**	**250**	**0**	**155.2**	**0**	**268.9**	**155.2**	**94.8**	**174.1**	**8**	**800**
	15	SCE Generic LMS100	4	371	0	0	0	0	0	0	0	4	400
		SDGE Generic LMS100	5	250	0	250.0	0	300.0	250.0	0	300.0	10	1,000
	15 Total		**9**	**621**	**0**	**250.0**	**0**	**300.0**	**250.0**	**0**	**300.0**	**14**	**1,400**
	16	PG&E_VLY Generic LMS	3	150	0	138.4	0	180.0	138.4	11.6	168.4	6	600
		SCE Generic LMS100	10	1,000	0	0	0	0	0	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	16 Total		**23**	**1,650**	**0**	**638.4**	**0**	**180.0**	**638.4**	**11.6**	**168.4**	**26**	**2,600**
	17	SCE Generic LMS100	3	284	0	0	0	0	0	0	0	3	300
		SDGE Generic LMS100	5	250	0	250.0	0	300.0	250.0	0	300.0	10	1,000
	17 Total		**8**	**534**	**0**	**250.0**	**0**	**300.0**	**250.0**	**0**	**300.0**	**13**	**1,300**
	18	SDGE Generic LMS100	1	50	0	0	44.4	60.0	44.4	5.6	54.4	2	200
	18 Total		**1**	**50**	**0**	**0**	**44.4**	**60.0**	**44.4**	**5.6**	**54.4**	**2**	**200**
22	13	PG&E_VLY Generic LMS	1	50	0	13.0	0	0	13.0	0	0	1	100
		SCE Generic LMS100	10	836	0	0	164.4	0	164.4	0	0	10	1,000
		SDGE Generic LMS100	10	500	216.0	284.0	0	0	500.0	0	0	10	1,000
	13 Total		**21**	**1,386**	**216.0**	**297.0**	**164.4**	**0**	**677.5**	**0**	**0**	**21**	**2,100**
	14	PG&E_VLY Generic LMS	19	950	0	820.7	0	179.0	820.7	129.3	49.8	20	2,000
		SCE Generic LMS100	10	1,000	0	0	0	0	0	0	0	10	1,000
		SDGE Generic LMS100	10	500	216.0	272.8	11.2	0	500.0	0	0	10	1,000
	14 Total		**39**	**2,450**	**216.0**	**1,093.5**	**11.2**	**179.0**	**1,320.7**	**129.3**	**49.8**	**40**	**4,000**
	15	PG&E_BAY Generic LMS	3	150	0	65.6	0	219.7	65.6	84.4	135.3	6	600
		PG&E_VLY Generic LMS	20	1,000	339.0	427.3	0	233.7	766.3	233.7	0	20	2,000
		SCE Generic LMS100	10	1,000	0	0	0	0	0	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	275.8	224.2	0	500.0	0	0	10	1,000
	15 Total		**43**	**2,650**	**339.0**	**768.7**	**224.2**	**453.4**	**1,331.9**	**318.1**	**135.3**	**46**	**4,600**
	16	PG&E_VLY Generic LMS	20	1,000	0	993.1	0	3.5	993.1	3.5	0	20	2,000
		SCE Generic LMS100	10	1,000	0	0	0	0	0	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	0	21.6	478.4	21.6	478.4	0	10	1,000
	16 Total		**40**	**2,500**	**0**	**993.1**	**21.6**	**482.0**	**1,014.6**	**482.0**	**0**	**40**	**4,000**
	17	PG&E_BAY Generic LMS	1	50	0	0	0	0	0	0	0	1	100
		PG&E_VLY Generic LMS	20	1,000	216.0	446.4	0	305.7	662.4	305.7	0	20	2,000
		SCE Generic LMS100	10	917	0	0	83.3	0	83.3	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	395.7	104.3	0	500.0	0	0	10	1,000
	17 Total		**41**	**2,467**	**216.0**	**842.0**	**187.6**	**305.7**	**1,245.7**	**305.7**	**0**	**41**	**4,100**
	18	SCE Generic LMS100	1	100	0	0	0	34.7	0	0	34.7	2	200

	SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	18 Total	**11**	**600**	**0**	**500.0**	**0**	**34.7**	**500.0**	**0**	**34.7**	**12**	**1,200**
	19 SDGE Generic LMS100	8	400	0	373.3	0	120.0	373.3	26.7	93.3	10	1,000
	19 Total	**8**	**400**	**0**	**373.3**	**0**	**120.0**	**373.3**	**26.7**	**93.3**	**10**	**1,000**
	20 SDGE Generic LMS100	6	300	0	270.7	0	240.0	270.7	29.3	210.7	10	1,000
	20 Total	**6**	**300**	**0**	**270.7**	**0**	**240.0**	**270.7**	**29.3**	**210.7**	**10**	**1,000**
24	13 SCE Generic LMS100	7	633	0	0	0	0	0	0	0	7	700
	13 Total	**7**	**633**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**700**
	14 SCE Generic LMS100	9	823	0	0	0	0	0	0	0	9	900
	14 Total	**9**	**823**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**900**
	15 SCE Generic LMS100	10	976	0	0	0	0	0	0	0	10	1,000
	SDGE Generic LMS100	1	50	0	0	50.0	48.0	50.0	0	48.0	2	200
	15 Total	**11**	**1,026**	**0**	**0**	**50.0**	**48.0**	**50.0**	**0**	**48.0**	**12**	**1,200**
	16 SCE Generic LMS100	10	994	0	0	0	0	0	0	0	10	1,000
	16 Total	**10**	**994**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**1,000**
	17 SCE Generic LMS100	10	935	0	0	0	0	0	0	0	10	1,000
	SDGE Generic LMS100	2	100	0	0	100.0	120.0	100.0	0	120.0	4	400
	17 Total	**12**	**1,035**	**0**	**0**	**100.0**	**120.0**	**100.0**	**0**	**120.0**	**14**	**1,400**
	18 SCE Generic LMS100	6	512	0	0	0	0	0	0	0	6	600
	18 Total	**6**	**512**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**600**
27	13 SCE Generic LMS100	4	397	0	0	0	0	0	0	0	4	400
	13 Total	**4**	**397**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**400**
	14 SCE Generic LMS100	2	200	0	0	0	0.2	0	0	0.2	3	300
	SDGE Generic LMS100	5	250	0	250.0	0	300.0	250.0	0	300.0	10	1,000
	14 Total	**7**	**450**	**0**	**250.0**	**0**	**300.2**	**250.0**	**0**	**300.2**	**13**	**1,300**
	15 SCE Generic LMS100	9	881	0	0	0	0	0	0	0	9	900
	SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	15 Total	**19**	**1,381**	**0**	**500.0**	**0**	**0**	**500.0**	**0**	**0**	**19**	**1,900**
	16 SCE Generic LMS100	8	766	0	0	0	0	0	0	0	8	800
	SDGE Generic LMS100	10	500	0	373.9	0	126.1	373.9	126.1	0	10	1,000
	16 Total	**18**	**1,266**	**0**	**373.9**	**0**	**126.1**	**373.9**	**126.1**	**0**	**18**	**1,800**
	17 SCE Generic LMS100	5	474	0	0	0	0	0	0	0	5	500
	SDGE Generic LMS100	10	500	81.0	400.8	0	18.2	481.8	18.2	0	10	1,000
	17 Total	**15**	**974**	**81.0**	**400.8**	**0**	**18.2**	**481.8**	**18.2**	**0**	**15**	**1,500**
	18 SDGE Generic LMS100	1	50	0	0	0	0	0	0	0	1	100
	18 Total	**1**	**50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**100**
28	14 SCE Generic LMS100	4	311	0	0	0	0	0	0	0	4	400

		SDGE Generic LMS100	10	500	83.0	417.0	0	0	500.0	0	0	10	1,000
	14 Total		**14**	**811**	**83.0**	**417.0**	**0**	**0**	**500.0**	**0**	**0**	**14**	**1,400**
	15	PG&E_VLY Generic LMS	1	50	0	0	0	35.2	0	35.2	0	1	100
		SCE Generic LMS100	10	839	0	161.1	0	0	161.1	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	463.2	36.8	0	500.0	0.0	0.0	11	1,100
	15 Total		**21**	**1,389**	**0**	**624.3**	**36.8**	**35.2**	**661.1**	**35.2**	**0.0**	**22**	**2,200**
	16	SCE Generic LMS100	5	500	0	0	0	280.9	0	0	280.9	10	1,000
		SDGE Generic LMS100	10	500	0	488.3	11.7	0	500.0	0	0	10	1,000
	16 Total		**15**	**1,000**	**0**	**488.3**	**11.7**	**280.9**	**500.0**	**0**	**280.9**	**20**	**2,000**
	17	SCE Generic LMS100	10	500	0	346.2	0	149.9	346.2	149.9	0	10	1,000
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	17 Total		**20**	**1,000**	**0**	**846.2**	**0**	**149.9**	**846.2**	**149.9**	**0**	**20**	**2,000**
	18	SCE Generic LMS100	2	100	0	93.2	0	0	93.2	0	0	2	200
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	18 Total		**12**	**600**	**0**	**593.2**	**0**	**0**	**593.2**	**0**	**0**	**12**	**1,200**
	19	SCE Generic LMS100	7	350	0	346.6	0	180.0	346.6	3.4	176.6	10	1,000
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	19 Total		**17**	**850**	**0**	**846.6**	**0**	**180.0**	**846.6**	**3.4**	**176.6**	**20**	**2,000**
	20	SCE Generic LMS100	5	250	0	132.8	0	300.0	132.8	117.2	182.8	9	900
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	20 Total		**15**	**750**	**0**	**632.8**	**0**	**300.0**	**632.8**	**117.2**	**182.8**	**19**	**1,900**
29	14	SCE Generic LMS100	4	400	0	0	0	11.0	0	0	11.0	5	500
		SDGE Generic LMS100	10	500	0	362.0	0	138.0	362.0	138.0	0	10	1,000
	14 Total		**14**	**900**	**0**	**362.0**	**0**	**149.0**	**362.0**	**138.0**	**11.0**	**15**	**1,500**
	15	PG&E_VLY Generic LMS	9	450	0	334.5	0	540.0	334.5	115.5	424.5	17	1,700
		SCE Generic LMS100	10	983	0	0	16.9	0	16.9	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	15 Total		**29**	**1,933**	**0**	**834.5**	**16.9**	**540.0**	**851.3**	**115.5**	**424.5**	**37**	**3,700**
	16	PG&E_VLY Generic LMS	10	500	0	382.6	0	514.7	382.6	117.4	397.3	17	1,700
		SCE Generic LMS100	10	1,000	0	0	0	0	0	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
	16 Total		**30**	**2,000**	**0**	**882.6**	**0**	**514.7**	**882.6**	**117.4**	**397.3**	**37**	**3,700**
	17	PG&E_VLY Generic LMS	9	450	0	396.8	0	540.0	396.8	53.2	486.8	18	1,800
		SCE Generic LMS100	10	760	0	240.5	0	0	240.5	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	134.9	365.1	0	500.0	0	0	10	1,000
	17 Total		**29**	**1,710**	**0**	**772.2**	**365.1**	**540.0**	**1,137.2**	**53.2**	**486.8**	**38**	**3,800**
	18	PG&E_VLY Generic LMS	1	50	0	22.8	0	60.0	22.8	27.2	32.8	2	200

		SCE Generic LMS100	10	500	0	500.0	0	0	500.0	0	0	10	1,000
		SDGE Generic LMS100	10	500	0	314.6	185.4	0	500.0	0	0	10	1,000
	18 Total		**21**	**1,050**	**0**	**837.4**	**185.4**	**60.0**	**1,022.8**	**27.2**	**32.8**	**22**	**2,200**
	19	SDGE Generic LMS100	6	300	0	280.6	0	240.0	280.6	19.4	220.6	10	1,000
	19 Total		**6**	**300**	**0**	**280.6**	**0**	**240.0**	**280.6**	**19.4**	**220.6**	**10**	**1,000**
	20	SDGE Generic LMS100	3	150	0	84.3	0	180.0	84.3	65.7	114.3	5	500
	20 Total		**3**	**150**	**0**	**84.3**	**0**	**180.0**	**84.3**	**65.7**	**114.3**	**5**	**500**
30	13	SCE Generic LMS100	1	68	0	0	0	0	0	0	0	1	100
	13 Total		**1**	**68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**100**
	14	SCE Generic LMS100	4	351	0	0	0	0	0	0	0	4	400
	14 Total		**4**	**351**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**400**
	15	SCE Generic LMS100	5	416	0	0	0	0	0	0	0	5	500
		SDGE Generic LMS100	7	350	162.0	188.0	0	180.0	350.0	0	180.0	10	1,000
	15 Total		**12**	**766**	**162.0**	**188.0**	**0**	**180.0**	**350.0**	**0**	**180.0**	**15**	**1,500**
	16	SCE Generic LMS100	4	307	0	0	0	0	0	0	0	4	400
		SDGE Generic LMS100	4	200	0	200.0	0	240.0	200.0	0	240.0	8	800
	16 Total		**8**	**507**	**0**	**200.0**	**0**	**240.0**	**200.0**	**0**	**240.0**	**12**	**1,200**
	17	SCE Generic LMS100	5	443	0	0	0	0	0	0	0	5	500
		SDGE Generic LMS100	10	500	0	495.8	0	0	495.8	0	0	10	1,000
	17 Total		**15**	**943**	**0**	**495.8**	**0**	**0**	**495.8**	**0**	**0**	**15**	**1,500**

Case AllGas
Month 7

Day	Hour	Generic Unit	Units Committed	Generation	Spining Reserve	NonSpin Reserve	OnLineAS - NSpn	OnlineNspn	OfflineNspn	Unit Need	Capacity Need
22	13	SDGE Generic LMS100	3	150	0	173.2	0	150.0	23.2	4	400
	13 Total		**3**	**150**	**0**	**173.2**	**0**	**150.0**	**23.2**	**4**	**400**
	14	SCE Generic LMS100	2	193	7.1	113.6	7.1	0	113.6	4	400
		SDGE Generic LMS100	10	500	500.0	0	500.0	0	0	10	1,000
	14 Total		**12**	**693**	**507.1**	**113.6**	**507.1**	**0**	**113.6**	**14**	**1,400**
	15	SCE Generic LMS100	2	200	0	47.0	0	0	47.0	3	300
		SDGE Generic LMS100	10	500	500.0	0	500.0	0	0	10	1,000
	15 Total		**12**	**700**	**500.0**	**47.0**	**500.0**	**0**	**47.0**	**13**	**1,300**
	16	SCE Generic LMS100	2	200	0	112.8	0	0	112.8	4	400
		SDGE Generic LMS100	10	500	500.0	0	500.0	0	0	10	1,000
	16 Total		**12**	**700**	**500.0**	**112.8**	**500.0**	**0**	**112.8**	**14**	**1,400**
	17	SDGE Generic LMS100	2	100	12.9	120.0	12.9	87.1	32.9	3	300
	17 Total		**2**	**100**	**12.9**	**120.0**	**12.9**	**87.1**	**32.9**	**3**	**300**
27	16	SDGE Generic LMS100	1	50	31.5	60.0	31.5	18.5	41.5	2	200
	16 Total		**1**	**50**	**31.5**	**60.0**	**31.5**	**18.5**	**41.5**	**2**	**200**
28	16	SDGE Generic LMS100	2	100	81.0	0	81.0	0	0	2	200
	16 Total		**2**	**100**	**81.0**	**0**	**81.0**	**0**	**0**	**2**	**200**
29	16	SDGE Generic LMS100	1	50	0	22.3	0	22.3	0	1	100
	16 Total		**1**	**50**	**0**	**22.3**	**0**	**22.3**	**0**	**1**	**100**
30	14	SDGE Generic LMS100	1	50	0	0	0	0	0	1	100
	14 Total		**1**	**50**	**0**	**0**	**0**	**0**	**0**	**1**	**100**

California Independent System Operator
Response to
California Wind Energy Association
Data Request No. 2
In R. 10-05-006
(Long-term Procurement Planning Case)

July 29, 2011

California ISO
Shaping a Renewed Future

California Independent System Operator Corporation

July 29, 2011

VIA ELECTRONIC MAIL

Mr. R. Thomas Beach
Crossborder Energy
2560 Ninth Street
Suite 213A
Berkeley, CA 94710

Re: ISO Response to the California Wind Energy Association Data Request No. 2

Dear Mr. Beach:

Enclosed please find the ISO response to the California Wind Energy Association Data Request No. 2 propounded in the Long Term Procurement Proceeding, CPUC Docket R.10-05-006.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Judith B. Sanders
Senior Counsel
California Independent System Operator

cc: Service List R.10-05-006

BEFORE
THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Integrate	**)**	
And Refine Procurement Policies and	**)**	**R.10-05-006**
Consider Long-Term Procurement Plans	**)**	

RESPONSE OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION TO THE SECOND SET OF DATA REQUESTS OF THE CALIFORNIA WIND ENERGY ASSOCIATION

Below are responses by the California Independent System Operator Corporation (ISO) to the Second Set of Data Requests of the California Wind Energy Association (CALWEA).

Request No. 1:

Pages 43-44 and **Slide 10** show that the Trajectory-Base Load, Environmentally Constrained, and Trajectory-High Load cases result in load-following down shortages equal to 506 MW, 539 MW, and about 830 MW, respectively. No downward load- following capacity shortages occurred in the Cost Constrained, Time Constrained, and All-Gas cases.

a. Please provide data on the number of hours of load-following down violations that were experienced in the Trajectory-Base Load, Environmentally Constrained, and Trajectory-High Load cases.

ISO RESPONSE TO No. 1a:

The need run process consists of two steps. First, a linear programming (LP) simulation (i.e., the same setup as the need run but without unit commitment decision) for the full year of 2020 is conducted to identify the months in which the highest load following-down shortfall may occur. The LP run, however, cannot accurately determine the magnitude of the shortage. Second, a need run (i.e., with unit commitment decision and monthly maximum regulation and load following requirements for each hour) is conducted only for the months identified in the LP run to determine the actual load following-down shortage. The purpose of taking this approach is to avoid unnecessarily long simulation times.

For the Trajectory-Base and Environment cases, the need run was done for only February and March. B Trajectory High Load case the need run was done for February, March, and July (the latter was for the purpose to identify capacity need to meet upward ancillary service and load following-up requirements). The maximum load following-down shortage of the three cases are 506, 539, and 856 MW respectively. Hourly shortage data are presented in the "LFD Shortage" sheet in the attached spreadsheet file ("CalWEA Data Request 2_Data Sheets.xlsx").

b. Please provide data on the distribution of the magnitude of the load-following down violations that were experienced in the Trajectory-Base Load, Environmentally Constrained, and Trajectory-High Load cases.

ISO RESPONSE TO No. 1b:

See answer to Data Request No. 1.a.

c. Please provide data that will allow CalWEA to understand the distribution across the months of the year and the hours of the day of the load-following down violations that were experienced in the Trajectory-Base Load, Environmentally Constrained, and Trajectory-High Load cases.

ISO RESPONSE TO No. 1c:

See answer to Data Request No. 1.a.

d. Please confirm that the statement on page 43-33 is incorrect that "No downward load following shortfalls or needs were observed in the All Gas or Trajectory High Load scenarios." Also, please indicate the exact amount of capacity in MW that is shown for the Trajectory-High Load case on Slide 10.

ISO RESPONSE TO NO. 1d:

The All Gas case has no load following-down shortfall but does have capacity need. The Trajectory High Load case has load following-down shortfall and capacity need. The statement on page 43-30 (instead of 43-33) was intended to say that the Cost Constrained and Time Constrained cases do not have any load following (down and up) or ancillary service shortfall. Therefore there is no need for additional capacity in these two cases.

The number load following-down shortfall for Trajectory High Load case on Slide 10 is 856 MW.

Request No. 2:

P. 14 – L. 21-25: "a statistical model was developed using historical ISO data from several existing wind farms to capture the 1 minute variability (compared to a 10 minute average) as a function of the size of the plant/wind farm. This statistical model captures the standard deviation of the 1 minute variability as it varies with wind farm size."

Where in California did the 1 minute wind generation variability come from?
Was the same 1 minute variability superimposed on all wind generators across the studied region (CA) in the CAISO Step 0 analysis?

ISO RESPONSE TO No. 2:

The 1 minute historical data are the 2010 real production data for four existing wind sites in California. The statistic model calculated 1 minute variability for each site and aggregated adjacent sites. A curve was developed to show the typical relationship between wind farms (or CREZ) nameplate and the standard deviation for 1-minute variability. The curve showed that the variability did not increase as fast as nameplate capacity due to geographic diversity.

No, the 1 minute variability was not superimposed on all wind generators across the studied region. The same methodology was used to superimpose 1 minute variability on the wind plants in the Western US. As indicated earlier, this methodology captures the fact that the 1 minute variability varies with the size of the wind plant. The methodology also uses a random process to determine the actual 1 minute variability to add to the profiles.

Request No. 3:

P. 14 – L. 27-29: "Finally, using this 1 minute statistical model, variability was then added to each 1 minute splined set of data using a process that adds variability randomly as a function of the wind farm size.

How did the model distinguish the level of superimposed 1 minute variability based on the plant size? Did this mean lower variability for larger plant sizes? Were the results ever tested against the actual output plants of various sizes to ensure the accuracy of this assumption? Finally, were these simulated variabilities added to the outputs of various wind plants with a random phase shift so that all such simulated variability would not have an artificial cumulative effect?

ISO RESPONSE TO No. 3:

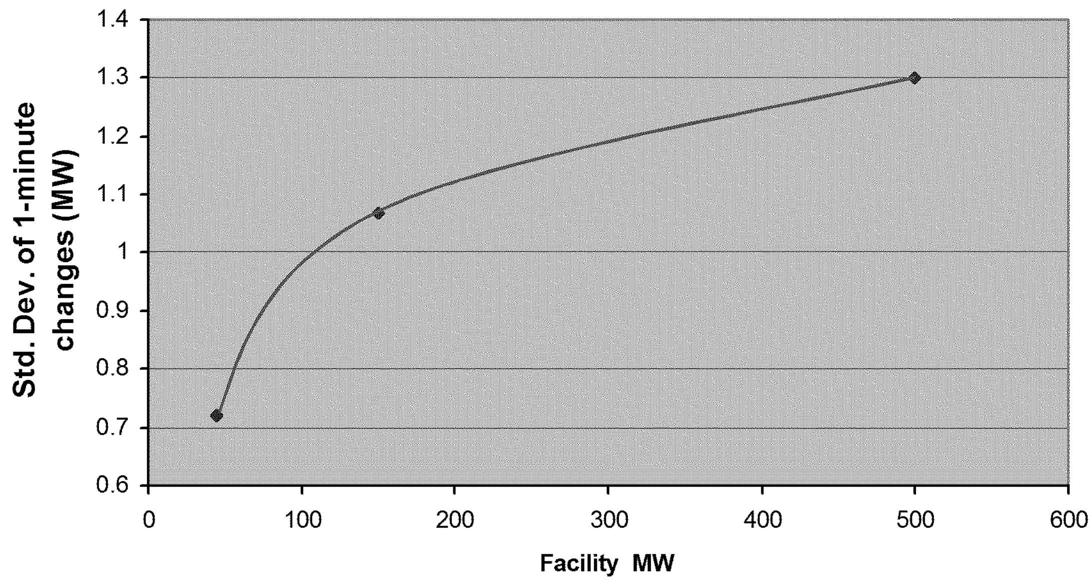
Based on the "typical" function between plant size and 1 minute variability, for different plant sizes, different 1 minute variability was applied; for the same size wind plants at different locations, the same 1 minute variability was applied. Note that the wind plant 10 minute profiles are location specific; the 1 minute variability was superimposed on the location specific wind profile.

The statistic analysis on the production data shows a relationship between facility (or CREZ) nameplate and the standard deviation for 1-minute changes, and also shows that the standard deviation did not increase as fast as nameplate capacity due to geographic diversity. The larger plant has a higher standard deviation of 1 minute variability, but the ratio of standard deviation/plant size is decreased, which means that larger plant size shows lower variability.

The results were not tested against actual plant output, however the 1 minute variability was developed using actual plant data for four sites of varying sizes.

The variability was added for each plant based upon its size using a random number generator in Matlab. It is not the case that each plant received the same "shape" of random variation when this was performed. Rather, each has its own random pattern of variation superimposed on the randomness already in the data. Hence there should be no (or very low) correlation between the randomness added in one curve and that found in any other curve.

Based on the actual observed 1 minute variability from four wind sites the, following relationship between plant size and 1 minute variability was determined. Based on the size of the plant, the ISO used the variability levels from this relationship.



Request No. 4:

Pages 43-44 and Slide 11 show that the High Load – Trajectory case has an additional A/S and load following up requirement of 4,600 MW. The All-Gas case has an additional load following up requirement of 1,400 MW.

a. In the High Load – Trajectory case, can the CAISO determine how much of the increased integration needs in this case are the result of the higher loads, and how much are the result of the additional renewables needed to reach a 33% RPS at the higher loads?

ISO RESPONSE TO REQUEST No. 4a:

The ISO is currently exploring Market enhancement options and 15-minute scheduling is an option. At this point, it is uncertain what the new market structure would look like in 2020 since there are several unknowns associated with 15-minute dispatch and the design has to go through a stakeholder process. Should the 15-minute option be adopted, it is also possible that the necessary timeline to submit 15-minute bids before the market closes could conceivably be 30 minutes or longer which means that the 15-minute wind and solar forecast would have to be done closer to 45-minutes or longer in advance of the market closing.

Thus, the ISO believes a T-1 persistence model assumption is reasonable at this time. For comparison, the mean absolute error using empirical data for 2010 for five large wind farms was approximately 7.8%. The hour ahead wind forecast errors used in the LTPP simulations were 4%, 3.8%, 3.2% and 3.1% for spring, summer, fall and winter respectively.

b. Does CAISO use the persistence method for forecasting wind output during its periods of fast ramp up and ramp down? If yes, why does CAISO not follow its own approach which abandons persistence method during fast ramp conditions for solar generation? In total, why wouldn't CAISO use a more advanced method of short-term wind/solar generation output forecasting for its analysis?

RESPONSE TO REQUEST No. 4b:

In the ISO Step 1 analysis a persistence model was used for wind production in real-time which means that the wind production was constant for a five-minute period, so fast wind ramps do not skew the regulation requirement. In the Step 1 model, the ISO also used a persistence model for the clearness index for solar resources which means that the clearness index remained constant for a five-minute period. For the hour-ahead forecast, the persistence model was not used for solar resources nor was it used for wind resources. The solar ramps during sunrise and sunset are predictable during the morning and evening hours with the exception of cloudy days. Thus, using a T-1 persistence model for solar resources during sunrise and sunset hours was not practical because of the expected ramp up and ramp down in production respectively. On the other hand, wind ramps can occur during any hour of the day so it's not practical to exclude certain hours.

Request No. 5:

P. 34 – L. 16-20: "Step 2 production simulation is an hourly deterministic production simulation of the WECC, including California hourly dispatch with the objective of minimizing cost while meeting the hourly load, spinning reserves, non-spinning reserves, regulation requirements and load following requirements, subject to resource and inter-regional transmission constraints."

a. We understand that CAISO treats all reliability requirements, namely spinning reserve, non-spinning reserve, and regulation for every time interval (one hour) as capacity requirements across the time interval both in practice and as part of its Step 2 studies here. However, load following has never been treated as a capacity requirement by the CAISO in practice. Why would CAISO then model load following requirement as a capacity requirement as part of its Step 2 studies?

ISO RESPONSE TO No. 5a:

Currently, the variability and uncertainty in operating the grid is primarily based on load since the level of wind and solar does not have a significant impact on operations. Thus, load-following was never treated as a capacity requirement because the load demand curve is predictable for each season. For example, during the summer months the load gradually increases from about 0400 hours through 1700 hours and then drops off so conventional resources can be dispatched to follow this predictable pattern.

With wind and solar resources making up a significant portion of the supply by 2020, the variability and uncertainty associated with the expected variable supply has to be mitigated with conventional resources within the operating hour. For example, conventional resources may have to be dispatched upwards even though load demand is decreasing from one hour to the next if wind and/or solar production drops off. As more and more renewable resources are integrated into the supply mix, the dispatch pattern of conventional resources is not expected to follow the predictable load curve patterns of today. Therefore, a load-following capacity requirement has to be made available for the CAISO's real-time 5-minute economic dispatch application in order to meet the anticipated increase in load and any expected loss of supply from wind and solar resources during the operating hour.

b. Based on its approach which treats load following as a fixed capacity requirement across each one hour time interval in the Step 2 annual production simulation studies, why does CAISO assume that all the resources that provide load following at the end of each hourly time interval are incapable of (or have been disallowed from) providing load following during the hour?

ISO RESPONSE TO No. 5b:

The four priority CPUC scenarios did not identify any load following up shortfalls and needs. Each operating hour is independent and a certain level of load following capacity is needed to meet the expected variability and uncertainty associated with wind and solar production during an operating hour. The ISO does not preclude the use of the load-following capacity requirement from being used in any hour. The load-following capacity requirement is not intended to cover the expected increase in load demand from one hour to the next. The load following requirement for each hour is determined through Step 1 and is intended to cover the uncertainty of load forecast errors and the uncertainty and variability of the supply from wind and solar resources which would have to be made up by conventional resources during an operating hour.

c. We understand that the actual CAISO process which determines the load following requirement is the CAISO Real Time Market, correct? In that case, why didn't CAISO use a simulation of its Real-Time market in its Step 1 and/or Step 2 studies during a few critical time periods of the year to determine the load following requirement as well as the resources needed to meet such requirements?

<u>ISO RESPONSE TO No. 5c:</u>

The assumption "…the actual CAISO process which determines the load following requirement is the CAISO Real Time Market" is incorrect. The load-following capacity requirement is not intended to cover the expected increase in load demand from one hour to the next. The load following requirement for each hour is determined through Step 1 and is intended to cover the uncertainty of load forecast errors and the uncertainty and variability of the supply from wind and solar resources which would have to be made up by conventional resources during an operating hour.

The question suggested that, "….CAISO use a simulation of its Real-Time market in its Step 1 and/or Step 2 studies during a few critical time periods of the year to determine the load following requirement as well as the resources needed to meet such requirements." While the suggestion makes sense, it is not a simple task to identify a few critical periods, since, as stated above, the load following requirement is determined by several critical input parameters associated with load, wind and solar. In addition, the ISO Real Time market system is not able to perform stochastic simulations at this time.

d. We understand that when modeling load following and regulation as capacity requirement in its Step 2 studies, CAISO uses the maximum of the maximum hourly capacity requirements determined in Step 1 for all the like hours of that month. Since CAISO does have the maximum capacity requirement for every hour of the month, why does it not use the relevant capacity value of each hour when performing its production simulation runs rather than smearing the maximum of the maximum hourly capacity requirement across all the like hours of the month?

<u>ISO RESPONSE TO No. 5d:</u>

The monthly load following and regulation up and down requirements were used in production simulation to determine if there are any capacity shortfalls and determining any additional capacity needed to meet A/S and load following up requirement (this is referred to as the "need run"). The hourly load following and regulation up and down requirements for the entire year were used for a production simulation run for purpose of determining cost, fuel utilization and emissions.

Request No. 6:

P. 35 -- L. 17-18: "The load pattern in California was modified to reflect assumptions in the scoping memo including accounting for energy efficiency and demand response."

How were energy efficiency and demand response modeled in modifying the load pattern used for in the CAISO studies?

ISO RESPONSE TO No. 6:

Based on the CPUC scoping memo (LTPP Technical Attachment v.5), energy efficiency (7,005 MW) was modeled as a deduction from the load forecast.

The CPUC scoping memo has four types of demand response: Non-Emergency DR, Emergency DR, Total AMI Enabled DR, and Non-Event Based DR. Non-Event Based DR was also modeled as a deduction to the load forecast. The other three types of DR were modeled as supply-side resources, each has a different cost.

Request No. 7:

P. 35 -- L. 21-22: "The maximum import capability into California was modified to reflect expected condition." Please explain how the maximum import capability was modeled in the CAISO Step 2 studies.

ISO RESPONSE TO No. 7:

The Step 2 model has a California maximum simultaneous import limit. The total import into California at any hour cannot exceed the limit. The flow on each transmission path connecting California and an outside region is also subject to the maximum transfer capability limit of the path.

Request No. 8:

P. 36 -- L. 5-6: "Southern California Import Transmission (SCIT) and Path 26 interface limits were modified."

a. Please explain the SCIT limit and explain whether CAISO is considering whether the concept behind the SCIT limit, which sets the import limit based on the inertia within the SCIT region basin, will be relevant in the long-term.

<u>ISO RESPONSE TO No. 8a:</u>

The SCIT limit is basically a simultaneous import limit for the southern California load pocket. The ISO long-term studies of future transmission scenarios include transient stability analysis of the southern California system and detailed modeling of system parameters including inertia. Observations from various long-term studies were utilized in determining the interface limits. Detailed long-term transmission analysis was not performed to establish future SCIT limit.

b. Please explain how SCIT and Path 26 interface limits were modified in the CAISO Step 2 studies.

<u>ISO RESPONSE TO No. 8b:</u>

The SCIT limit was adjusted based on the potential changes on the system inertia. The impact of both the OTC unit retirement and the incremental renewable generation were considered in determining inertia change hence potential change on SCIT limit. Path 26 limit was not changed.

c. Please explain whether CAISO believes that the addition of several new and approved major transmission projects such as the Devers Palo Verde Line No. 2 (aka Valley - Colorado River 500 kV project), Tehachapi Renewable Transmission Project, and the Sunrise Powerlink will have an impact on SCIT limit.

<u>ISO RESPONSE TO No. 8c:</u>

Observations from various long-term studies, which included these transmission projects, were utilized in determining the interface limits. No detailed long-term transmission analysis was conducted for this purpose.

d. Please explain whether CAISO considered the impact of changes in the SCIT limit due to the addition of the major transmission lines mentioned above in its Step 2 studies as part of the basecase or any of the sensitivity runs. If the impact was studied as part of a sensitivity run, what were the results?

<u>ISO RESPONSE TO No. 8d:</u>

The impact of the new additions was considered in SCIT calculation for all the cases. It is not treated as a sensitivity.

Request No. 9:

P. 42 -- L. 14-16: "There are three pumps that can operate simultaneously from January to May and from October to December. There will be only one pump available for the rest of year 2020."

There are numerous efforts underway, including specific proposals by PG&E, to make sure that all Helms units can pump and generate at all times during the year. Why has the CAISO assumed that only one pump is available for system operation from June to September?

ISO RESPONSE TO No. 9:

The ISO's annual transmission planning process approves transmission upgrades that we demonstrate to be needed and constructed. The need for transmission upgrades that would result in the ability to allow all Helms units to pump and generate at all times during the year that this operability is desired has not been established through the transmission planning process yet. The ISO has assessed the need for these upgrades in past transmission planning cycles, and will do so again in the ongoing 2011/12 planning cycle. However, until such upgrades are approved by the ISO, we must continue to assume that they will not be in-service during the ten year planning horizon. Without such upgrades, the ability to pump with Helms can be limited by the transmission system to less than two or three pumps, depending on typical system conditions such as Fresno customer demand level and summer versus winter conductor ratings.

Request No. 10:

P. 43 -- L. 28-30: "We observed 1400MW of upward load following need in the All Gas scenario. 4600MW of incremental upward load following need was observed in the High Load Trajectory scenario to resolve the load following upward shortfalls."

a. How often did the CAISO observe the need for incremental upward load following need in the High Load Trajectory scenario? We understand that the maximum amount of the incremental upward load following need in the High Load Trajectory scenario was calculated to be 4600 MW. Did CAISO develop a distribution curve for the incremental upward load following need in the High Load Trajectory scenario? Could CAISO share that distribution with us?

ISO RESPONSE TO No. 10a:

Please refer to the ISO response to the first set of CALWEA data requests, Request 4c.

b. We also understand that the additional resources to meet the 4600 MW of incremental upward load following need (we assume to be 4600 MW of new CT resources and we call them "integration resources") are on top of all the planned (new) resources needed to meet the system PRM needs (we assume them to be mainly CCGT resources). Has CAISO considered that the addition of this 4600 MW of integration resources should result in a reduction of PRM resources of certain amount – up to 4600 MW?

ISO RESPONSE TO No. 10b:

The ISO has not considered the 4600MW in any of the reserve margin values presented. The ISO expects that if resources were added to meet integration needs would contribute to meeting planning reserve margin.

Request No. 11:

P. 48 -- L. 27-30: "the ISO performed a sensitivity run on the Trajectory Base Load scenario assuming Helms could pump with 3 pumps year round. The total annual production costs to meet California load was reduced by $2.3 million when Helms was not restricted."

We understand that the sensitivity case that removed restriction on Helms units operation resulted in lower annual production cost without any violation of operating conditions – i.e., the need for 506 MW of incremental downward load following for this scenario was also fully mitigated. In light of such results, why would CAISO restrict the operation of the two Helms unit during the summer months in 2020 based on a general and unsubstantiatedclaim that (P. 43 – L. 2-3): "the ISO determined that the Helms pumping window would be restricted to one pump due to the load level in the Fresno area"? After all, unless the production simulation model and the associated runs are suspect, they should capture any real operating infeasibilities such as the one loosely used here to restrict the operation of the Helms units in 2020!!

ISO RESPONSE TO No. 11:

See answer to Data Request No. 9.

Request No. 12:

Did CAISO model the flexibility of Hydro Resources in its Step 0, Step 1 and/or Step 2 studies or did the CAISO assume Hydro resources have a fixed generation profile?

ISO RESPONSE TO No. 12:

The ISO models two types of hydro resources in Step2. The first type has fixed generation profiles. It is for run-of-river hydro resources and hydro resources that do not have much operation flexibility due to regulatory restrictions. The other type is dispatchable hydro, subject to total energy limit. The generation schedules of this type of hydro resources are optimized.

Step 0 and Step 1 do not need to consider flexibility of hydro generation.

Request No. 13:

Did CAISO account for maintenance/fueling outage of nuclear resources in its Step 0, Step 1 and/or Step 2 studies or did the CAISO assume that nuclear resources will be up and running at all times?

ISO RESPONSE TO No. 13:

The model does account for maintenance/fueling outage of nuclear resources.

Request No. 14:

Did CAISO allow for the import of any of the ancillary services (Regulation, Spinning Reserve, and/or Non-spinning Reserve) from outside BAs in its Step 0, Step 1 and/or Step 2 studies? If yes, has the CAISO modeled any limits on such imports?

ISO RESPONSE TO No. 14:

In the model there are a few resources providing ancillary service and load following to the ISO located outside the CAISO balancing area. There resources are: HOOVER, APEX_2_MIRDYN, MRCHNT_2_MELDYN, MSQUIT 5 SERDYN, and SUTTER 2 PL1X3. This is because these resources are dynamically scheduling with the ISO and are capable of providing ancillary service currently.

In the model the import of ancillary service is not subject any limit other than the physical capability to provide ancillary service (capacity and ramp rates) of these resources.

ATTACHMENT A

Case	Year	Month	Day	period_of_day	name	Value
Trajectory	2020	2	1	18	LoadFollowingDown	0
Trajectory	2020	2	2	5	LoadFollowingDown	1
Trajectory	2020	2	2	12	LoadFollowingDown	1
Trajectory	2020	2	4	17	LoadFollowingDown	0
Trajectory	2020	2	16	17	LoadFollowingDown	2
Trajectory	2020	2	16	18	LoadFollowingDown	0
Trajectory	2020	2	17	17	LoadFollowingDown	1
Trajectory	2020	2	20	17	LoadFollowingDown	257
Trajectory	2020	2	20	18	LoadFollowingDown	21
Trajectory	2020	2	25	17	LoadFollowingDown	1
Trajectory	2020	3	2	15	LoadFollowingDown	2
Trajectory	2020	3	5	5	LoadFollowingDown	1
Trajectory	2020	3	5	8	LoadFollowingDown	0
Trajectory	2020	3	5	10	LoadFollowingDown	0
Trajectory	2020	3	5	15	LoadFollowingDown	0
Trajectory	2020	3	5	18	LoadFollowingDown	244
Trajectory	2020	3	6	12	LoadFollowingDown	1
Trajectory	2020	3	10	18	LoadFollowingDown	16
Trajectory	2020	3	12	18	LoadFollowingDown	0
Trajectory	2020	3	17	18	LoadFollowingDown	26
Trajectory	2020	3	18	18	LoadFollowingDown	69
Trajectory	2020	3	19	3	LoadFollowingDown	0
Trajectory	2020	3	19	6	LoadFollowingDown	1
Trajectory	2020	3	19	10	LoadFollowingDown	0
Trajectory	2020	3	19	11	LoadFollowingDown	0
Trajectory	2020	3	21	18	LoadFollowingDown	1
Trajectory	2020	3	27	11	LoadFollowingDown	1
Trajectory	2020	3	27	18	LoadFollowingDown	57
Trajectory	2020	3	29	9	LoadFollowingDown	0
Trajectory	2020	3	30	18	LoadFollowingDown	506
Envir	2020	2	1	7	LoadFollowingDown	0
Envir	2020	2	2	18	LoadFollowingDown	72
Envir	2020	2	3	4	LoadFollowingDown	1
Envir	2020	2	4	15	LoadFollowingDown	1
Envir	2020	2	5	9	LoadFollowingDown	0
Envir	2020	2	6	14	LoadFollowingDown	0
Envir	2020	2	6	17	LoadFollowingDown	50
Envir	2020	2	6	18	LoadFollowingDown	386
Envir	2020	2	7	7	LoadFollowingDown	0
Envir	2020	2	9	7	LoadFollowingDown	0
Envir	2020	2	11	18	LoadFollowingDown	120
Envir	2020	2	11	22	LoadFollowingDown	1
Envir	2020	2	12	18	LoadFollowingDown	1
Envir	2020	2	13	18	LoadFollowingDown	1
Envir	2020	2	15	9	LoadFollowingDown	0
Envir	2020	2	15	14	LoadFollowingDown	0

Case	Year	Month	Day	period_of_day	name	Value
Envir	2020	2	15	18	LoadFollowingDown	241
Envir	2020	2	20	17	LoadFollowingDown	381
Envir	2020	2	20	18	LoadFollowingDown	539
Envir	2020	2	21	2	LoadFollowingDown	0
Envir	2020	2	21	15	LoadFollowingDown	0
Envir	2020	2	21	17	LoadFollowingDown	1
Envir	2020	2	22	15	LoadFollowingDown	0
Envir	2020	2	22	18	LoadFollowingDown	15
Envir	2020	2	25	17	LoadFollowingDown	1
Envir	2020	2	26	18	LoadFollowingDown	44
Envir	2020	2	27	18	LoadFollowingDown	1
Envir	2020	2	29	11	LoadFollowingDown	0
Envir	2020	3	1	17	LoadFollowingDown	86
Envir	2020	3	1	18	LoadFollowingDown	420
Envir	2020	3	6	13	LoadFollowingDown	1
Envir	2020	3	16	18	LoadFollowingDown	0
Envir	2020	3	18	15	LoadFollowingDown	1
Envir	2020	3	27	18	LoadFollowingDown	1
Envir	2020	3	30	7	LoadFollowingDown	0
HiLoad	2020	7	17	23	LoadFollowingDown	4
HiLoad	2020	7	6	4	LoadFollowingDown	1
HiLoad	2020	7	2	22	LoadFollowingDown	0
HiLoad	2020	2	20	18	LoadFollowingDown	709
HiLoad	2020	2	20	17	LoadFollowingDown	693
HiLoad	2020	2	6	18	LoadFollowingDown	546
HiLoad	2020	2	15	18	LoadFollowingDown	420
HiLoad	2020	2	6	17	LoadFollowingDown	346
HiLoad	2020	2	15	17	LoadFollowingDown	247
HiLoad	2020	2	11	18	LoadFollowingDown	233
HiLoad	2020	2	26	17	LoadFollowingDown	211
HiLoad	2020	2	2	18	LoadFollowingDown	200
HiLoad	2020	2	12	18	LoadFollowingDown	157
HiLoad	2020	2	26	18	LoadFollowingDown	148
HiLoad	2020	2	22	18	LoadFollowingDown	145
HiLoad	2020	2	3	18	LoadFollowingDown	142
HiLoad	2020	2	19	18	LoadFollowingDown	85
HiLoad	2020	2	25	18	LoadFollowingDown	82
HiLoad	2020	2	1	18	LoadFollowingDown	72
HiLoad	2020	2	22	17	LoadFollowingDown	7
HiLoad	2020	2	8	4	LoadFollowingDown	1
HiLoad	2020	2	26	13	LoadFollowingDown	1
HiLoad	2020	2	22	9	LoadFollowingDown	1
HiLoad	2020	2	13	18	LoadFollowingDown	1
HiLoad	2020	2	8	7	LoadFollowingDown	1
HiLoad	2020	2	24	4	LoadFollowingDown	1
HiLoad	2020	2	2	1	LoadFollowingDown	1

Case	Year	Month	Day	period_of_day	name	Value
HiLoad	2020	2	1	9	LoadFollowingDown	1
HiLoad	2020	2	5	13	LoadFollowingDown	0
HiLoad	2020	2	22	6	LoadFollowingDown	0
HiLoad	2020	2	5	24	LoadFollowingDown	0
HiLoad	2020	2	17	18	LoadFollowingDown	0
HiLoad	2020	2	4	18	LoadFollowingDown	0
HiLoad	2020	2	1	11	LoadFollowingDown	0
HiLoad	2020	2	2	2	LoadFollowingDown	0
HiLoad	2020	2	23	23	LoadFollowingDown	0
HiLoad	2020	3	30	18	LoadFollowingDown	856
HiLoad	2020	3	5	18	LoadFollowingDown	607
HiLoad	2020	3	18	18	LoadFollowingDown	423
HiLoad	2020	3	27	18	LoadFollowingDown	397
HiLoad	2020	3	17	18	LoadFollowingDown	386
HiLoad	2020	3	10	18	LoadFollowingDown	331
HiLoad	2020	3	19	18	LoadFollowingDown	311
HiLoad	2020	3	1	18	LoadFollowingDown	299
HiLoad	2020	3	24	18	LoadFollowingDown	180
HiLoad	2020	3	14	18	LoadFollowingDown	41
HiLoad	2020	3	5	19	LoadFollowingDown	41
HiLoad	2020	3	22	18	LoadFollowingDown	25
HiLoad	2020	3	9	17	LoadFollowingDown	1
HiLoad	2020	3	22	12	LoadFollowingDown	1
HiLoad	2020	3	20	4	LoadFollowingDown	1
HiLoad	2020	3	27	12	LoadFollowingDown	1
HiLoad	2020	3	14	11	LoadFollowingDown	1
HiLoad	2020	3	22	7	LoadFollowingDown	0
HiLoad	2020	3	23	10	LoadFollowingDown	0
HiLoad	2020	3	25	18	LoadFollowingDown	0
HiLoad	2020	3	15	18	LoadFollowingDown	0