Docket:	:	R.13-12-010
Exhibit Number	:	
Commissioner	:	Michael Picker
Admin. Law Judge	:	David Gamson
ORA Witnesses	:	Robert M. Fagan
	:	Tommy Vitolo

OFFICE OF RATEPAYER ADVOCATES
CALIFORNIA PUBLIC UTILITIES COMMISSION

REPLY TESTIMONY OF ROBERT M. FAGAN AND TOMMY VITOLO, SYNAPSE ENERGY ECONOMICS, ON BEHALF OF THE OFFICE OF RATEPAYER ADVOCATES

Order Instituting Rulemaking to Integrate
and Refine Procurement Policies and
Consider Long-Term Procurement Plans
Phase 1a

R.13-12-010

San Francisco, California
December 18, 2014

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I. INTRODUCTION

Q1. What is the purpose of this testimony?

A. The primary purpose of this testimony is to reply to certain aspects of the Stochastic Study Testimonies submitted by Dr. Shucheng Liu and Dr. Karl Meeusen of the California Independent System Operation Corporation (CAISO) on November 20, 2014. This testimony also briefly replies to Phase 1a testimonies submitted on November 20, 2014 by various witnesses on behalf of Southern California Edison Company (SCE).[1]

II. SUMMARY

Q2. Please summarize your testimony.

A. The Office of Ratepayer Advocates (ORA) concurs with SCE that no additional procurement authorization is needed at this time. While ORA does not agree with all inputs, methodological aspects, or results of the stochastic studies undertaken by SCE, ORA does agree that even if future analysis indicates additional procurement is necessary for the 2024 timeframe,[2] there will be sufficient time available to arrange such procurement after, or pursuant to, the 2016 Long-Term Procurement Planning (LTPP) process.

The CAISO's stochastic studies use a form of stochastic variable estimation not previously seen in the LTPP proceedings. The effect of this use of stochastic variable estimation for load is a set of modeling inputs with exceedingly high peak load values during peak summer hours for many of the 500 iterations considered by CAISO when estimating "capacity shortfall." The maximum values seen in the variable estimation greatly exceed the coincident peak values from the 2013 California Energy Commission's (CEC) Integrated Energy Policy Report (IEPR) load forecasts for both the

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[1] Second Revised Phase 1a Testimony of Southern California Edison Company on Resource Need, (Exhibit (Ex.) SCE-1); Third Revised Appendix A – Technical Appendix for 2014 Long Term Procurement Plan High Load Scenario, (Ex.SCE-2); Revised Reply Testimony of Southern California Edison Company In Phase 1a (Ex. SCE-3); Revised Phase 1a Testimony of Southern California Edison Company on Resource Need – 2014 Long Term Procurement Plan Trajectory Scenario (Ex. SCE-4); Revised Technical Appendix for 2014 Long Term Procurement Plan Trajectory Scenario (Ex. SCE-5), Track 2 Stochastic Study Of 2012 Long Term Procurement Plan Trajectory Scenario (Ex. SCE-6). Exhibits SCE 1-6 were all served on November 20, 2014.

[2] As noted by SCE at SCE-1, p. 4: 1-2.

Trajectory and High Load Scenarios.[3] However, the initial estimation process for stochastic variables and the resulting Plexos modeling process places too much emphasis on extreme events and dramatically overestimates any true capacity shortfalls that might occur by 2024 even if the "high load" forecast for peak demand comes to pass. The analysis that produced these inputs – the "mean reversion" parametric estimation process is an interesting and useful first attempt at capturing the stochastic quality of load (and wind and solar) inputs, but one that requires further study.

The CAISO also presents "adjusted shortfall" results[4] that purportedly show the effect of computed shortfall amounts when "capping" the peak load values at 58,000 megawatts (MW), rather than using the 66,720 MW maximum for the CAISO region load[5] developed with the stochastic load estimation process. However, this post-processing[6] adjustment does not account for the time-differentiation between the hour of peak load, generally occurring at 3 – 5 p.m. on the summer peak day, and the load at the hours during which the CAISO computes and reports most occurrences of capacity shortfall, 5 – 9 p.m., when load is generally a few thousand MW lower than seen at 3 – 5 p.m. This failure to correct for the timing of peak load occurrence underestimates the reduction in magnitude and incidence of capacity shortfall that would otherwise occur when correcting for a forecast peak load cap.

III. NO PROCUREMENT AUTHORIZATION REQUIRED

Q3. Explain why you support no additional procurement authorization at this time.

A. ORA concurs with SCE's finding that no additional procurement authorization is required at this time. The basis for this concurrence includes the results of the CAISO's

[3] As seen in Forms 1.5b and 1.5d, for various scenarios, as posted in final form by the CEC in April, 2014. Available at http://www.energy.ca.gov/2013_energypolicy/documents/demand-forecast_CMF/LSE_and_Balancing_Authority_Forecasts/.

[4] See Phase I.A. Stochastic Study Testimony of Dr. Shucheng Liu on Behalf of the California Independent System Operator Corporation, November 20, 2014 (Dr. Liu Stochastic Testimony) Table in Appendix A, p. 26, Table 13, 14.

[5] Maximum value, CAISO load, July 22, 2014, Hour 16.

[6] The post processing adjustment occurs after the completion of the Plexos model capacity shortfall estimation.

deterministic modeling, and Synapse's modeling of the Trajectory Scenario modified by the inclusion of additional resources representing a portion of the 2012 LTPP Track 1 / Track 4 authorized resources, which the standard planning assumptions (SPA) for the Trajectory Scenario did not include.

SCE and the CAISO's stochastic modeling methodologies, inputs, and findings require additional review and refinement of approach. As presented, the "capacity shortfall" amounts, if added to existing and planned procurements, would result in an extraordinary level of planning reserve margin in the CAISO region in 2024: 133.5% using CAISO's 8,292 MW shortfall, 126.3% using SCE's Trajectory Scenario analysis findings (2,300 MW net shortfall after accounting for all Track 1 and Track 4 resources not considered part of the SPA) and 132.8% using SCE's High Load Scenario findings (5,600 MW net shortfall after accounting for the Track 1 / Track 4 resources not modeled).

The CAISO's stochastic modeling methodologies are new to the LTPP proceeding. As currently considered, the methodology is highly complex and the results are not reproducible. The CAISO's testimony describes the parametric estimation process defining the stochastic variables, but includes no additional detail (including regression results for the parameter estimation). As explained in the following section, the nature of the CAISO's stochastic inputs is such that extreme values are generated by the parametric estimation process. The CAISO adjusts its modeling results *ex post*, by using a simple load-capping method to modify the results, purportedly addressing how the results would change if loads no higher than the 90/10 (i.e., 1-in-10, Form 1.5d) CEC IEPR values for high load were used.[7] But that adjustment mechanism does not correctly reflect the nature of load patterns between the peak period of mid-afternoon, and the later hours in the day when the modeling reveals capacity shortfall.

[7] 90/10 IEPR values are the 1 in 10, extreme weather peak load forecasts.

SCE states that even if its results – i.e., capacity shortfall in the Trajectory and High Load Scenario – were determined to be accurate in the next LTPP, there is sufficient time to procure additional resources.

IV. CAISO STOCHASTIC MODELING

Q4. What does this subsection of testimony address?

A. This section addresses the CAISO's stochastic process for developing load inputs[8] that are used in the 500 iterations of the Plexos production cost modeling. The CAISO's stochastic modeling results are driven by a set of inputs that result from the CAISO's parametric estimation process, which includes at its core a regression analysis on nine years of historical load data (2003 – 2012).[9] This section first presents some of those key inputs and then summarizes the results. Finally, this section examines and discusses certain aspects of the modeling methodology.

Q5. Please summarize the key result of the CAISO stochastic analysis.

A. The CAISO's stochastic results show considerably higher levels of capacity shortfall than its deterministic results. The stochastic shortfall total (8,292 MW) far exceeds the deterministic total (1,489 MW). Both of these totals exclude any effect that up to 2,315 MW of additional procurement from 2012 LTPP Track 1 / Track 4 resources will have on modeled capacity shortfall.[10] The difference in estimated shortfall between these results appears to flow in large part from a stochastic load profile that presumes the possibility of much higher levels of load, relative to the deterministic profile.

Q6. Does the CAISO recommend additional procurement based on the higher capacity shortfall seen in its stochastic analysis?

A. No. The CAISO states that additional deterministic analysis is needed to gauge possible flexibility need masked by the original deterministic analysis.[11] The CAISO

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[8] The CAISO also developed wind and solar inputs using a similar parametric estimation process. I focus on the load inputs in this testimony.

[9] Dr. Liu Stochastic Testimony, Appendix A, pp. 8-13.

[10] The Standard Planning Assumptions exclude these resources.

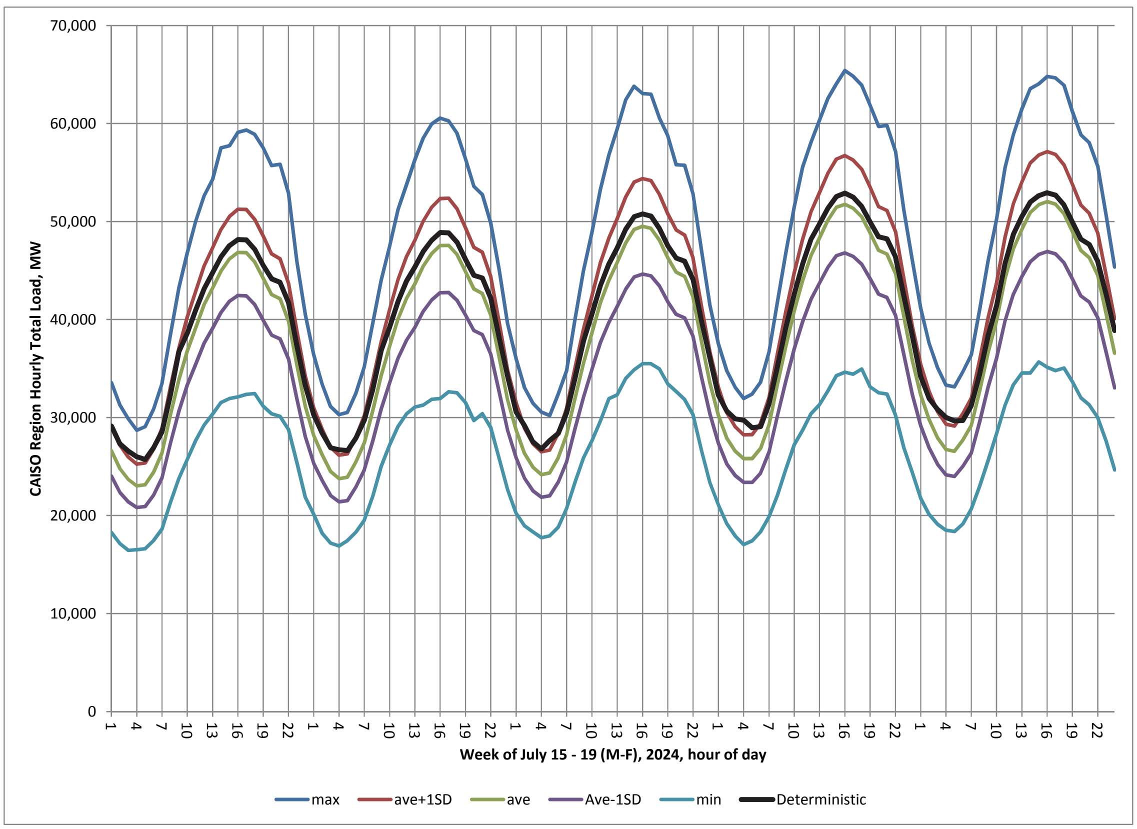
[11] Phase I.A. Stochastic Study Testimony of Dr. Karl Meeusen on Behalf of the California Independent System Operator Corporation, November 20, 2014 (Dr. Meeusen Stochastic Testimony), p. 9: 8-15.

states that the stochastic analysis provides "context and support"[12] for the deterministic results. The CAISO notes that its stochastic study can be used when "balancing costs of additional procurement against…service reliability."[13]

Q7. What load inputs did the CAISO use?

A. Figure 1 below shows an example of the pattern of load used by the CAISO as inputs to its modeling process. It shows load during the highest peak load period of the year.

Figure 1. CAISO Stochastic Load Parameters, and Deterministic Profile, Peak July Week



Q8. Please comment on the load inputs.

A. The CAISO's parametric estimation process that creates a stochastic load variable produces the load inputs. The graph shows the load inputs for the 500 iterations, including average (mean) load, the load levels that are plus/minus one standard deviation from the mean, and the maximum and minimum values. These are seen for each hour of

[12] Dr. Liu Stochastic Testimony, p. 14: 11-12; Dr. Meeseun Stochastic testimony, p. 10: 21-22.

[13] Dr. Liu Stochastic Testimony, p. 14: 15-18.

the period of Monday July 15th through Friday July 19th 2024. This period coincides with roughly half of all capacity shortfall hours seen during the entire year in CAISO's stochastic modeling.[14] The weekday periods in July and August make up roughly 89% of the total hours with capacity shortfall seen during 2024, thus this graph is representative of the stochastic load input patterns seen for most hours with capacity shortfall.

Q9. What are the summary results from the CAISO's modeling?

A. Table 1 below shows the results for capacity shortfall from the modeling.

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[14] Synapse, review of entirety of capacity shortfall results as posted in CAISO's file, "ISO Stochastic Results_20141125.xls".

Table 1. Results of CAISO Stochastic Modeling

Hourly Incidence of Capacity Shortfall (MW) Greater than 0

	Hour of Day (Hour ending)											
Month	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Other hours 11-13, 23-24**	**Total**	**% by month**
May					1			4		-	5	0.1%
June				13	24	49	17	17	9	-	129	1.3%
July	110	230	478	920	1,527	1,952	1,160	1,130	668	187	8,362	84.2%
August	2	7	30	131	379	324	167	171	37	7	1,255	12.6%
Sept			1	9	52	27	43	26		-	158	1.6%
Oct					2	2	9	1		-	14	0.1%
Nov					6	5	1			-	12	0.1%
Grand Total	112	237	509	1,073	1,991	2,359	1,397	1,349	714	194	9,935	100.0%
% of hours	1.1%	2.4%	5.1%	10.8%	20.0%	23.7%	14.1%	13.6%	7.2%	2.0%	100.0%	100.0%
								yellow highlight total:			93.7%	
								Total iteration-hours:			4,392,000	
								% hours with shortfall:			0.23%	

Average of Capacity Shortfall (MW) in hours with Shortfall Greater than 0

Month	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Other hours 11-13, 23-24**	**Total**
May					0			0			0
June				1,216	1,994	1,899	1,650	1,307	853		1,664
July	1,238	1,923	2,299	2,658	3,082	3,206	2,763	2,732	2,332		2,771
August	384	1,964	1,468	1,653	1,981	1,783	1,520	1,511	1,455		1,730
Sept			948	718	1,565	1,620	1,448	1,288			1,445
Oct					489	1,004	706	1,268			758
Nov					468	577	781				539
Grand Total	1,223	1,924	2,247	2,501	2,807	2,958	2,546	2,523	2,267		2,597

Maximum of Capacity Shortfall (MW) in hours with Shortfall Greater than 0

Month	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Other hours 11-13, 23-24**	**Total**
May					0			0			0
June				2,361	4,948	6,462	3,688	3,437	1,735		6,462
July	7,584	10,182	13,317	15,297	16,408	15,879	13,419	13,037	10,759		16,408
August	736	4,577	8,110	9,435	9,543	9,308	6,815	6,527	4,602		9,543
Sept			948	2,550	5,164	3,868	3,996	3,574			5,164
Oct					675	1,361	3,555	1,268			3,555
Nov					1,058	1,460	781				1,460
Grand Total	7,584	10,182	13,317	15,297	16,408	15,879	13,419	13,037	10,759		16,408

Source: CAISO posting of full results, "ISO Stochastic Results_20141125.xls" tabulation by Synapse.

Q10. What can one observe from these results?

A. Table 1 above illustrates a number of patterns. First, capacity shortfall occurs for 9,935 hours, or 0.23% of the total hours modeled (4.39 million hours, equal to 8,784 hours per year, times 500 iterations). On a normalized basis, this equates to 19.9 hours per year of capacity shortfall, as noted by Dr. Liu.[15] Those hours are concentrated in July and August, during the hours ending 15 through 22 (93.7% of the total number of hours with any shortfall), with the highest portion during hour 19 in July. The table also shows that maximum shortfall amounts are concentrated in July during these hours.

Q11. Please identify and discuss limitations associated with the CAISO stochastic modeling approach and execution.

A. There are at least three aspects of the CAISO stochastic modeling that are of concern. Further study is required to determine if there are additional concerns; for example, the effect of forced outages on the results is not available from the CAISO.[16]

First, the load inputs are not capped in any way to account for the CEC IEPR forecast values. Second, the estimation process itself produces model inputs based on a regression analysis whose details are not provided, and which may produce biased estimates of the parameter, especially for later hours of the day. Additional examination and stakeholder vetting of this process should be instituted before using these modeling results for any procurement authorization.

Third, the CAISO's post-modeling adjustment to the capacity shortfall values, which attempts to correct for extremely high load values, is flawed as it does not account for the time period differences between when load is expected to peak (2 – 5 p.m.), and when capacity shortfalls are seen (1 p.m. to midnight, but concentrated in the hours of 4 p.m. to 9 p.m.).

The first two of these concerns are addressed in this subsection and the last concern is addressed in the next subsection of this testimony.

Q12. In what way are the uncapped load inputs a concern?

A. The load inputs for many of the iterations include very high CAISO-region coincident peak forecast values, well beyond coincident peak values estimated by the CEC in the 2013 IEPR, even for "high load" scenarios. Table 2 below shows a

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[15] Dr. Liu Stochastic Testimony, p. 11: 8.

[16] Response of Dr. Liu to question posed at the December 2, 2014.workshop on stochastic simulation results.

comparison between the CAISO's stochastic parameters, parameters used in its deterministic modeling, and the SPA values and a selection of CEC 2013 IEPR values.

Table 2
Comparative Load Values – Stochastic and Deterministic Modeling, SPA, CEC 2013 IEPR Peak Load

Load Case	CAISO Coincident Peak, MW	Time of Peak	Comments
Stochastic Modeling, Maximum Peak Load	66,720	HR End 16, 7/22/2024	Iteration # 466
Stochastic Modeling, Load at Max Capacity Shortfall	62,609	HR End 19, 7/22/2024	Iteration # 466
Standardized Planning Assumption	Mid-load, Mid-AAEA. 51,003 MW from Scenario Tool.	Not specified	Deterministic modeling based on this assumption.
Deterministic Modeling, Maximum Peak Load	52,935	HR End 15, 7/19/2024	Adjusted for AAEA, small PV. Associated with SPA
IEPR 1 in 2, Mid Case, Mid AAEA	51,003	Not specified	Form 1.5b statewide
IEPR 1 in 10, Mid Case, Mid AAEA	55,361	Not specified	Form 1.5d statewide
IEPR 1 in 10, Mid Case, Low-Mid AAEA	57,412	Not specified	Form 1.5d statewide
IEPR 1 in 2, High Load Case, mid AAEA	53,964	Not specified	Form 1.5b statewide
IEPR 1 in 10, High Load Case, mid AAEA	58,589	Not specified	Form 1.5d statewide
IEPR 1 in 10, High Load Case, low AAEA	60,607	Not specified	Form 1.5d statewide

Source: IEPR load values: April 2014 posting of final load forecast data forms. Note: CAISO Adjusted non-coincident peak load, Trajectory Scenario, reported as 53,349 MW (Dr. Liu, Direct Testimony Phase 1a, Table 7, page 23).

Q13. Please explain the comparative load forecast values seen in Table 2.

A. Table 2 illustrates the fundamental divergence of the CAISO's stochastic load input values from the CEC's peak load forecast estimates for 2024. The CAISO's parametric estimation process does not correct, adjust, or otherwise account for the differences in forecast peak values between its process, and that of the CEC, which also used sophisticated regression analyses. The disparity between the values produced by each forecast must be reconciled before giving any weight to the CAISO's stochastic analysis results in making procurement authorization decisions.[17]

Q14. In what way does the estimation process itself present concerns?

A. Some of the problems associated with applying the mean reversion process can be seen in the load data presented in the CAISO's testimony.[18] Figure 5 of Dr. Liu's Appendix A data (page 12) is a histogram of the generated load data, compared with the historic data set. Although it is stated that "the two set of data match significantly" they differ in major ways at the low and high ends of the distribution, with those iteration values for load appearing with much higher probabilities. This indicates a potential methodological problem that needs to be addressed, through close examination of the parametric estimation results, and investigation of alternative forms of specifying the stochastic variable. This is especially important because the more extreme situations appear to be driving the results.

Q15. Please describe your concern with the random walk error propagation term.

A. The way that the stochastic random walk process is implemented magnifies the error term effects for higher values. This is because the stochastic variable is generated in a normalized form and then multiplies a reference value. Thus, the absolute error is greater with higher values. How reasonable this is depends on how the statistics were developed for the stochastic variable. If they were generated based on a normalized data series, then this would introduce a bias in the results. When using a normalized stochastic load variable, the absolute error term scales with load – e.g., it gets larger in the later afternoon hours of the summer. Further study is necessary to determine the proper stochastic formulation for representing the characteristics of the historic data series.

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[17] ORA notes that "The CPUC has identified the *Integrated Energy Policy Report* (IEPR) process as "the appropriate venue for considering issues of load forecasting, resource assessment, and scenario analyses, to determine the appropriate level and ranges of resource needs for load serving entities in California,"" from page 9, Chapter 1 of the *California Energy Demand, 2014-2024 Final Forecast, Volume 1: Statewide Electricity Demand, End User Natural Gas Demand, and Energy Efficiency*. CEC-200-2013-004-SF-V1, December 2013.

[18] Dr. Liu Stochastic Testimony, Appendix A, p. 12.

V. ADJUSTMENT BY THE CAISO – 58,000 MW LOAD CAP

Q16. In what way is the CAISO's post-processing load capping adjustment mechanism deficient?

A. The CAISO's load capping adjustment mechanism fails to fully capture the effect of a lower peak load, one that would be considered capped at 58,000 MW for modeling purposes. A CAISO-region coincident peak load at 58,000 MW, occurring between 2 and 4 p.m., implies lower hourly load values at later hours in the afternoon and early evening. The CAISO's adjustment recalculates[19] the capacity shortfall only if the load exceeds 58,000 MW in the hour in which the shortfall is reported. However, it does not remove from the results any hours where the load is less than 58,000 MW, even though on that day, for that iteration, the load may have exceeded 58,000 MW at the peak hour, usually between 3 to 5 p.m.[20]

Table 3 below shows the results for an alternative load capping process, one with peak load values capped at 58,000 MW for peak load hours at 3 – 4 p.m. (these iterations will have loads less than 58,000 MW during the predominate shortfall hours of 6 – 9 p.m.).

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[19] The CAISO's posted results for the stochastic modeling. The CAISO identifies hours with load greater than 58,000MW, and then reduces the "capacity shortfall" by the difference between the reported load, and 58,000 MW.

[20] The CAISO region historical peak (between 1998 and 2013) has occurred during summer months between roughly 2:30 and 5 p.m. (see, e.g., "California ISO Peak Load History, 1998 through 2013," available at https://www.caiso.com/Documents/CaliforniaISOPeakLoadHistory.pdf). While forecasted net peak load (i.e., load net of wind and solar output) will be shifting to later hours, especially because of the presence of small-scale solar resources, LTPP deterministic modeling inputs for 2024 includes small-scale solar resources on the supply side, and thus summer peak load as represented in the CAISO's stochastic modeling in Plexos still occurs during this earlier afternoon window. Figure 1 of this testimony illustrates the peak load periods for the week of July 15, 2024, with maximums occurring between 3 – 5 p.m.

Table 3
Recalculated Capacity Shortfall

Reliability Standard Considered: Hours per 1-Year	0.1	0.7	2.4
Top Down Iteration to Determine Shortfall	51st	351st	1201st
Recalculated Capacity shortfall after removing iterations w/ Hour 15 or Hour 16 Peak Load > 58,000 MW	8,402	5,648	3,732
CAISO Original Result, MW Capacity Shortfall	11,822	8,292	5,414
Recalculated shortfall as % of CAISO Original Result	71%	68%	69%
CAISO Adjusted Results w/ 58,000 MW Load Cap	10,635	7,660	5,158
Recalculated shortfall as % of CAISO's adjusted results	79%	74%	72%

Source: Synapse filtering of CAISO results, based on removing iterations with hour 15 or hour 16 July 19th load greater than 58,000 MW.

Q17. Please explain the development of the values in Table 3.

A. Table 3 uses the full set of posted CAISO results that listed the capacity shortfall incidence for 9,935 different hours across the 500 iterations. It also relies on the CAISO-posted load input data, which contained the hourly load for each of 500 iterations. First, ORA identified any iteration that contained an hour 15 or hour 16 (2 – 4 p.m.) load for July 19th that exceeded 58,000 MW. July 19th is the single day of the year with the highest peak load. This included 62 separate iterations, essentially representing the portion of the iterations with the highest load level. Next, ORA filtered the results to exclude these iterations, and then recalculated the capacity shortfall at the 51st, the 351st, and the 1201st level, in the same manner as the CAISO did with the original results.

Q18. Please explain what Table 3 indicates.

A. Table 3 indicates that when using the CAISO's method for estimating capacity shortfall based on different reliability criteria, and using the CAISO's stochastic analysis results, lower levels of capacity shortfall result if only the results of iterations with load capped at 58,000 MW are used. In this instance, the amount of shortfall is lower than the CAISO's original results. Instead of 8,292 MW shortfall for the 0.7 hours-in-one-year "standard," the results indicate 5,648 MW of shortfall. For the 2.4 hours-in-one-year "standard," the results show 3,732 MW shortfall, instead of the original result of 5,414 MW. The table also shows that recalculated shortfall amounts are only 72 – 79% of what the CAISO indicated with its adjustment that was stated by the CAISO as accounting for a 58,000 MW load cap.[21]

Q19. Can you show the incidence of capacity shortfall in terms of number of hours with shortfall, and when those hours occur?

A. Yes. Table 4 shows the same information as provided in Table 1, but for the recalculated capacity shortfall dataset.

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[21] Dr. Liu Stochastic Testimony, Appendix A, p. 25. "For hours with a capacity shortfall, if the stochastic load value was higher than the limit, the amount in excess of the limit was reduced from the shortfall."

Table 4
Results of the CAISO's Stochastic Modeling with Synapse Recalculation of Capacity Shortfall Level

Hourly Incidence of Capacity Shortfall (MW) Greater than 0													
	Hour of Day (Hour ending)												
Month	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**Grand Total**
May						1			4				5
June					10	19	38	16	16	8			107
July	3	26	93	256	588	1068	1434	765	748	381	33	2	5397
Aug	1	2	7	28	119	335	280	151	154	32	6		1115
Sept				1	8	43	22	36	21				131
Oct						2	2	8	1				13
Nov						5	5	1					11
Grand Total	4	28	100	285	725	1473	1781	977	944	421	39	2	6779
													0.18%
													15.5
Average of Capacity Shortfall (MW)													
Month	13	14	15	16	17	18	19	20	21	22	23	24	Grand Total
May						0			0				0
June					1,151	1,950	1,970	1,529	1,174	793			1,617
July	69	306	868	1,377	1,872	2,449	2,614	2,135	2,085	1,631	418	64	2,174
Aug	61	384	1,964	1,527	1,681	2,029	1,845	1,558	1,539	1,590	190		1,774
Sept				948	757	1,562	1,667	1,394	1,344				1,445
Oct						489	1,004	688	1,268				750
Nov						561	577	781					588
Grand Total	67	311	945	1,390	1,819	2,310	2,460	1,996	1,954	1,612	383	64	2,079
Max of Capacity Shortfall (MW)													
Month	13	14	15	16	17	18	19	20	21	22	23	24	Grand Total
May						0			0				0
June					2,361	4,801	6,462	3,688	3,063	1,735			6,462
July	141	2,260	4,226	6,420	9,167	11,319	11,822	9,437	10,077	7,342	1,939	109	11,822
Aug	61	736	4,577	8,110	9,435	9,543	9,308	6,815	6,527	4,602	993		9,543
Sept				948	2,550	5,164	3,868	3,996	3,574				5,164
Oct						675	1,361	3,555	1,268				3,555
Nov						1,058	1,460	781					1,460
Grand Total	141	2,260	4,577	8,110	9,435	11,319	11,822	9,437	10,077	7,342	1,939	109	11,822

Source: Synapse recalculation of capacity shortfall results.

Q20. Does this recalculation represent ORA's opinion on the level of capacity shortfall?

A. No. This recalculation only indicates that the results as presented by the CAISO do not adequately adjust for load capping concerns. As one example of the type of changes that could be considered, if a stochastic estimation process were to cap peak load at, say, 58,000 MW, then a full set of 500 iterations would involve many more iterations (e.g., 62 more, to make up for those higher-load iterations screened out in this recalculation) with peak load lower than 58,000 MW than is reflected in this recalculation of capacity shortfall incidence and magnitude.

VI. SCE TESTIMONIES – SALIENT POINTS AND CRITIQUES

Q21. Please identify the major concerns you have with the stochastic analyses put forward by SCE.

A. SCE's method of "stratified sampling" requires additional development. It is unclear from SCE's testimony exactly why SCE chose to stratify sampling in the way that it did. For example, in Figure IV-5 of Exhibit SCE-2 (Technical Appendix to the High Load Scenario analysis) SCE lists the "Number of Net Load Day Samples" from defined "Stratification" groups, but it does not support why they chose the number of samples presented in that table. Also, SCE does not support its contention that the "high load" forecast is better than the "trajectory" forecast for planning need requirements. As part of the ongoing assessment of stochastic methods, stakeholders must evaluate SCE's input assumptions before the Commission can rely on this approach for future procurement authorization.

VII. CONCLUSIONS / NEXT STEPS

Q22. Please identify the ongoing technical issues and describe additional analytical necessary to answer outstanding questions concerning procurement need issues for 2024.

A. Additional exploration of stochastic modeling methods is required. Both the CAISO and SCE stochastic methods require further investigation to determine whether or not the modeling constructs reasonably predict 2024 patterns, and whether or not planning reserve margin (PRM) potentially on the order of 130% is truly necessary. A PRM equal to roughly 130% far exceeds the 115 - 117% margin that is the current guideline for LTPP processes.

Additional deterministic modeling is required to understand (1) how Track 1 / Track 4 authorizations not included in the SPA will affect procurement need, and (2) how renewable curtailment issues identified in the CAISO's initial Phase 1a modeling can be resolved.

Q23. What are ORA's recommendations for procurement authorization at this time?

A. ORA recommends that the Commission find that no additional procurement authorization is required at this time.

Q24. What are ORA's recommendations for a process to address these ongoing technical issues?

A. ORA recommends that the Commission modify the scope of the Phase 1b proceedings to allow for further exploration of stochastic methods used to assess potential capacity need. ORA supports the nine-point plan set forth by Administrative Law Judge (ALJ) Gamson at the December 9th Status Conference meeting.

Q25. Does this complete your testimony?

A. Yes.

APPENDIX A

Witness Qualifications

PREPARED TESTIMONY AND QUALIFICATIONS OF ROBERT M. FAGAN

Q. Please state your name, position and business address.

A. My name is Robert M. Fagan. I am a Principal Associate with Synapse Energy Economics, Inc., 485 Massachusetts Ave., Cambridge, MA 02139. I have been employed in that position since 2005.

Q. Please state your qualifications.

A. My full qualifications are listed in my resume, on the following pages. I am a mechanical engineer and energy economics analyst, and I have examined energy industry issues for more than 25 years. My activities focus on many aspects of the electric power industry, especially economic and technical analysis of electric supply and delivery systems, wholesale and retail electricity provision, energy and capacity market structures, renewable resource alternatives including on-shore and off-shore wind and solar PV, and assessment and implementation of energy efficiency and demand response alternatives. I hold an MA from Boston University in Energy and Environmental Studies and a BS from Clarkson University in Mechanical Engineering. I have completed additional course work in wind integration, solar engineering, regulatory and legal aspects of electric power systems, building controls, cogeneration, lighting design and mechanical and aerospace engineering.

Q. Have you testified before the CPUC before?

A. Yes. I testified in Track 1 and Track 4 of the R.12-03-014 proceeding, and in the A.11-05-023 SDG&E Resource Adequacy proceeding. I have been involved in California renewable energy integration and related resource adequacy issues as a consultant to the ORA since the late fall of 2010. I have also testified in numerous state and provincial jurisdictions, and the Federal Energy Regulatory Commission (FERC), on various aspects of the electric power industry including renewable resource integration, transmission system planning, resource need, and the effects of demand-side resources on the electric power system.

Q. On whose behalf are you testifying in this case?

A. I am testifying on behalf of the California Public Utilities Commission's Office of Ratepayer Advocates (ORA).

PREPARED TESTIMONY AND QUALIFICATIONS OF THOMAS VITOLO, PhD

Q1. Please state your name, position and business address.

A1. My name is Tommy Vitolo. I am an Associate with Synapse Energy Economics, Inc., 485 Massachusetts Ave., Cambridge, MA 02139. I have been employed in that position since 2011.

Q2. Please state your qualifications.

A2. My full qualifications are listed in my résumé, on the following pages. I am a mathematician and energy economics analyst. I have been employed in the energy industry for four years, and was employed as a mathematician with a focus on stochastic processes and graph theory for four years prior to that. My activities focus on many aspects of the electric power industry, especially economic and technical analysis of electric supply and delivery systems, energy and capacity market structures, the modeling of intermittent generating resources, renewable resources, and distributed energy resources.

I hold a PhD from Boston University in systems engineering; a MSc in financial and industrial mathematics from Dublin City University, Ireland; and bachelor of science degrees in applied mathematics, computer science, and economics from North Carolina State University.

Q3. Have you testified before the CPUC before?

A3. No. I have filed expert testimony before the Public Service Commission of South Carolina regarding the calculation of costs and benefits of distributed energy resources, and the Missouri Public Services Commission on an integrated resource planning matter. I have reviewed and critiqued the numerical analysis, modeling, and decision strategies of resource plans and certificate of public convenience and necessity applications submitted by utilities located in Colorado, Florida, Georgia, Illinois, Kansas, Kentucky, Michigan, Missouri, Nebraska, New Mexico, New York, North Carolina, and Tennessee.

Q4. On whose behalf are you testifying in this case?

A4. I am testifying on behalf of the California Public Utilities Commission's Office of Ratepayer Advocates (ORA).