Rulemaking No.: 13-12-010
Exhibit No.:
Witness: Dr. Karl Meeusen

Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans.

Rulemaking 13-12-010

PHASE I.A. REPLY TESTIMONY OF DR. KARL MEEUSEN
ON BEHALF OF THE
CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans.	Rulemaking 13-12-010

PHASE I.A. REPLY TESTIMONY OF DR. KARL MEEUSEN ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

I. BACKGROUND AND TESTIMONY SUMMARY

Q. What is your name and by whom are you employed?

A. My name is Karl Meeusen. I am employed by the California Independent System Operator (CAISO), 250 Outcropping Way, Folsom, California. I currently work in the CAISO's Markets and Infrastructure Policy group as the Market Design and Regulatory Policy Lead, a position I have held since 2011.

Q. Have you previously submitted testimony in this proceeding?

A. Yes. On August 13, 2014, I submitted initial testimony addressing policy conclusions and recommendations based on the CAISO's Phase 1a deterministic studies conducted as of that date in this Long-Term Procurement Plan (LTPP) rulemaking.

Q: What is the purpose of this reply testimony?

A. The purpose of my testimony is to recommend the conclusions the Commission should draw in Phase 1a of this LTPP proceeding in light of the studies performed to date by the CAISO, Southern California Edison (SCE), and the Office of Ratepayer Advocate (ORA), as well as the testimony submitted by parties not preparing models on September 24, 2014.

Q. What are your recommendations regarding Phase 1a of this proceeding?

A. (1) The studies and testimony filed to date are not sufficient to definitively determine what additional procurement, if any, is needed to meet flexibility and reliability requirements.

(2) The Commission should order additional studies in Phase 1b of this proceeding to determine whether additional procurement is needed and what should be procured. At a minimum, the Commission should study the Trajectory scenario with alternative assumptions regarding the possible level of renewable generation curtailment. The Commission should order a sensitivity analysis that assumes no economic curtailment of renewable generation, in order to provide a bookend for the CAISO's initial deterministic study, and a sensitivity analysis that assumes a reasonable estimate of the level of renewable generation curtailment that is likely to occur based available information regarding economic curtailment terms specified in bilateral agreements.

II. NEED FOR ADDITIONAL CAPACITY

Q. Explain why the modeling conducted to date is not sufficient to determine a need for additional capacity resources.

A. My initial testimony in this proceeding concluded that the CAISO deterministic modeling performed to date was not sufficient to determine what additional capacity resources, if any, are needed to meet flexibility and reliability requirements. The testimony submitted by SCE, ORA and the non-modeling parties supports this conclusion. Indeed, the parties are in broad agreement that (1) observed capacity shortfalls should not lead to a conclusion regarding additional procurement at this point in the proceeding and (2) over-generation and its potential renewable curtailment should be further investigated.[1] The parties, however, differ significantly on how these concerns should be addressed.

[1] *See* Phase 1a Testimony of Robert M. Fagan and Patrick Luckow on behalf of ORA (ORA Testimony) at pg. 7; Phase 1a Testimony of Megan Mao and Tomislav Galjanic on behalf of SCE (SCE

Q. Please summarize the results of the studies performed by SCE and ORA.

A. SCE conducted a stochastic study using the 2014 LTPP High Load scenario. Based on this scenario, SCE found a net shortfall of approximately 8,500 MW, from which it subtracted 2,300 MW[2] of authorized Track 1 and Track 4 resources that were not modeled in the study. SCE also found an expected excess or dump energy of approximately 1,000 gigawatt-hours (GWh) in 2024, with the largest single over-generation event equal to about 14,500 MW.[3]

ORA's study focused on overall capacity need in the month of July 2024. ORA used the underlying load and resource parameters found in the Trajectory scenario and conducted two additional sensitivities one of which modeled high incremental small photovoltaic (PV) customer-side resources and another which modeled a minimum amount of conventional and preferred resources authorized in Track 1 and Track 4 of R.12-03-014 but not included in the Trajectory scenario assumptions. ORA's two sensitivity studies showed maximum capacity shortfalls in July 2024 of 1,188 MW and 164 MW, respectively.[4] The shortfalls found in ORA's sensitivities are less than the shortfalls identified in the ISO's scenarios because of the additional capacity (the small solar PV in one case and the Track 1 and Track 4 capacity in the other). However, the ORA studies did not seek to identify over-generation or related flexible capacity needs.

Testimony) at pg. 19-22 and 24-27; Phase 1a Testimony of James H. Caldwell, Jr. on behalf of CEERT (CEERT Testimony) at pg. II-1; Testimony of Janice Lin on Behalf of the California Energy Storage Alliance Concerning Long Term Procurement Planning, Phase 1a (CESA Testimony) at pg. 5-7; Testimony of Virinder Singh on Behalf of EDF Renewable Energy, Inc. Regarding Long Term Procurement Planning, Phase 1a (EDF Renewable Testimony) pg. 4-6; Opening Testimony of William A. Monsen on Behalf of the Independent Energy Producers Association Regarding Phase 1a of the 2014 Long-Term Procurement Planning Proceeding (IEP Testimony) at pg. 30-31; Prepared Direct Testimony of Kathleen T. Treleven on Behalf of the Large-Scale Solar Association (LSA Testimony) at pg. 8; PG&E Opening Testimony in Phase 1a of the Long-Term Procurement Plan (PG&E Testimony) at pg. 1-4; Opening Testimony of Kevin Woodruff on Behalf of The Utility Reform Network (TURN Testimony) at pg. 2; Prepared Opening Testimony of Jimmy Nelson on Behalf of the Union of Concerned Scientists and Sierra Club (UCS/Sierra Club Testimony) at 14.

[2] The exact amount of authorized capacity not included in the Trajectory scenario is 2,315 MW. SCE rounds this figure in determining the shortfall identified in its stochastic analysis.

[3] SCE Testimony at 25.

[4] ORA Testimony at 7.

Q. Do the studies conducted by SCE and ORA definitively determine a need, or lack of need, for additional capacity resources?

A. No. While both studies provide additional data points for the Commission to consider, neither can be used to definitively determine whether there is a need for additional procurement at this time. Similar to the results of CAISO's deterministic study, the SCE results may mask a need for flexible capacity because there is no limit on what SCE refers to as "dump energy." "Dump energy" is energy that cannot be used because of over-generation and is conceptually similar to the "curtailed energy" in the CAISO study. The only difference is that SCE's use of the term "dump energy" is more generic and does not attribute a source to the energy that is dumped. As such, the SCE assessment likely masks flexible capacity needs in much the same way as the CAISO's study does. The SCE study shows up to 250 GWh of dump energy in a single month[5] and probabilities of over-generation in March through May in excess of 10 percent in many hours.[6]

With respect to peak capacity needs, both SCE's and ORA's studies show shortfalls of varying magnitude in the summer of 2024. SCE indicates that the high load forecast used in its study aligns with its own internal forecasts,[7] but then asserts that no new procurement is needed despite a modeled shortfall that totals 8,500 MW. Similar to the CAISO model, SCE's model does not include 2315 MW of approved Track 1 and Track 4 capacity and it is not clear what impact this new capacity will have on over-generation or capacity needs. Before automatically assuming that this additional capacity will resolve both peak and flexible capacity needs without any affirmative demonstration that is does, it is prudent to conduct additional studies to assess the adequacy of the fleet. Indeed, the fact that SCE's study showed a shortfall of 8,500 MW, but failed to account for only 2315 MW of capacity, suggests on its face that a potential need might exist and that further study is necessary. Dr. Liu, in his opening testimony, notes that capacity shortfalls

5 SCE testimony at 25.
6 SCE testimony at 27.
7 SCE Testimony at 15.

identified by the CAISO do not occur during peak hours, but shortly after, when load is still high, but solar output starts to wane.[8] SCE's results mirror these CAISO results, showing that stage 3 emergencies are most probable around hour ending 18.[9] SCE states further that "there is no capacity need in the SP 26 area and California (CA) as a whole to meet the 15% PRM *for peak load hours*. *The PRM analysis does not address capacity need for net load peak hours that occur later in the day." [emphasis added]*[10] SCE acknowledges that the measure of resource adequacy is a 15% PRM during peak, but still shows capacity shortfalls that are most likely to occur after peak hours. Therefore, like the CAISO results, the SCE results only confirm a need for additional studies.

The ORA sensitivities focus solely on capacity needed to meet peak load in July 2024 and do not attempt to address potential flexible capacity needs and over-generation concerns. Given the SCE results and the fact that the ORA results do not address the flexibility needs and over-generation, at this time, one can only conclude that additional studies are needed before the Commission will have sufficient information to determine the appropriate level of need.

Q. Please comment on whether the testimony filed by non-modeling parties supports additional analysis of capacity needs in Phase 1b.

A. The majority of the testimony filed by the non-modeling parties supports continued analysis of capacity needs in Phase 1b of this proceeding. Witnesses for CESA, EDF Renewables, IEP, LSA, PG&E, TURN and UCS/Sierra Club indicate that additional analysis is needed in order to determine whether additional procurement is necessary and what resources should be procured.[11] Several of these parties also propose specific solutions to the operational and policy issues raised by the CAISO,

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[8] Phase 1.A. Direct Testimony of Dr. Shucheng Liu on Behalf of the California Independent System Operator at 37.
[9] SCE Testimony at 21.
[10] SCE Testimony at 23.
[11] CESA Testimony at 5-7; EDF Renewable Testimony at 4-6.; IEP Testimony at 30-31; LSA Testimony at 8; PG&E Testimony at 1-4; TURN Testimony at 2; UCS/Sierra Club Testimony at 14.

such as over-generation and renewable curtailment. However, prior to considering specific solutions, additional work must be done to identify whether there is a capacity need, the cause and scope of any underlying need, and whether the need, if any, is for system or flexible upward and downward capacity.

Q. Does the CAISO expect that the stochastic models, to be filed on November 13, 2014, will be sufficient to definitively determine a need, or lack of need, for additional capacity resources?

A. No. The stochastic models will only provide frequency distributions for the likely shortfalls and magnitudes of over-generation and renewable curtailment. To test the impact of the modeling assumptions, such as the ability to curtail renewable generation, other studies are needed, and the Commission should order these to isolate the impact of those assumptions. The stochastic models do not include the alternative assumptions necessary to evaluate the other scenarios. They will test the impact of uncertainty, but they will not obviate the need for the additional studies. In Section III below, I discuss further specific additional studies that should be conducted in this proceeding.

Q. In your initial testimony you recommended that the CAISO conduct additional studies to better assess system and flexible capacity shortfalls as part of Phase 1b. How might such results be used?

A. Additional studies will help the Commission better understand whether the studies conducted thus far are masking flexible capacity shortfalls due to the assumption that allows for unlimited wind and solar renewable curtailment. Stated differently, an effective assessment of capacity needs requires realistic assumptions regarding the amount of renewable curtailment. Removing the assumption of unlimited renewables curtailment will reveal whether capacity needs exist, which will enable all parties to recommend actions the Commission may take to resolve any identified shortfalls. If the identified shortfalls require additional procurement, then the

Commission's Phase 1b decision should explicitly identify the means of resolving these shortfalls.

Q. Please respond to those parties recommending that no new procurement is necessary in this proceeding.

A. Parties asserting that no new procurement is needed at this time either misinterpret the CAISO's findings or are making a judgment about need before the necessary data has been gathered. With respect to the former, the CAISO clearly stated that more studies are needed before a needs determination can be made. In short, the CAISO believes that the data necessary to make a determination of need is not currently available in this proceeding.

Further, many of the parties asserting that there is no need for additional capacity do so based on inaccurate assumptions. For example, CEJA asserts that there is no additional need based on its recommendation that the Commission use the Expanded Preferred Resource scenario for planning decisions. While this scenario does not show a need for additional system capacity, CEJA fails to address the flexible capacity challenges that are amplified in the Expanded Preferred Resource scenario. Based on the CAISO's results, the Expanded Preferred Resources scenario had 60 percent more renewable curtailments than the 40 percent RPS scenario, but only slightly lower CO_2 emissions. This implies that there may be either little carbon benefit of using this scenario because of renewable curtailment or that it is necessary to procure significant amounts of additional flexible capacity in order to manage the frequent over-generation conditions observed in the Expanded Preferred Resources scenario.

L. Jan Reid states that "modeling the peak load Additional Achievable Energy Efficiency would have reduced the CAISO's estimate for flexible capacity need."[12] However, Mr. Reid does not provide any evidence to support this assertion. To the contrary, the CAISO's initial testimony clearly states that the

[12] L. Jan Reid Testimony at 2.

impact on the need for flexible capacity depends on the portfolio of AAEE resources. AAEE may increase the need for flexible capacity by reducing net load, thereby leading to additional over-generation problems or additional need for ramping resources.

The CAISO agrees with TURN's representation that the potential over-generation issues identified by CAISO and SCE warrant more detailed analysis.[13] That analysis should begin with additional studies that provide insight into the causes, scope and potential solutions for over-generation and renewable curtailment and should be taken up in Phase 1 b of the current proceeding.

Q. Please address the policy implications of using wind or solar resources to provide frequency response or ancillary services.

A. Several parties suggest that wind and solar resources could be used to provide ancillary services or frequency response.[14] From a policy perspective, there are at least two issues that arise from using wind and solar resources to provide ancillary services. First, the CAISO market currently procures all expected ancillary services requirements in the day-ahead market. Wind and solar resources typically do not bid into the day-ahead markets. Assuming a wind or solar resource was certified to provide ancillary service, the CAISO would be required to award ancillary service bids based on resource forecasts, not based on a firm financial commitment. This makes ancillary services provision less certain which could lead to the need for greater ancillary services procurement to cover the uncertainty.

The second, and probably greater issue, is the goal of meeting the defined RPS target. For example, relying on a wind or solar resource to provide frequency response, non-spinning reserves, spinning reserves, or regulation means that the resource must be held back from its maximum potential output. As a result, procuring frequency response or ancillary services from wind and solar may come at

[13] TURN Testimony at 2.
[14] CEERT Testimony at II-10; UCS/Sierra Club Testimony at 16.

the expense of total energy output for these resources. Reduced energy output from wind and solar resources may impact the modeling objective of reaching the defined RPS goals.

III. PHASE 1B ADDITIONAL STUDIES

Q. Why should the Commission direct additional studies in Phase 1b prior to determining whether and what procurement is needed in this proceeding?

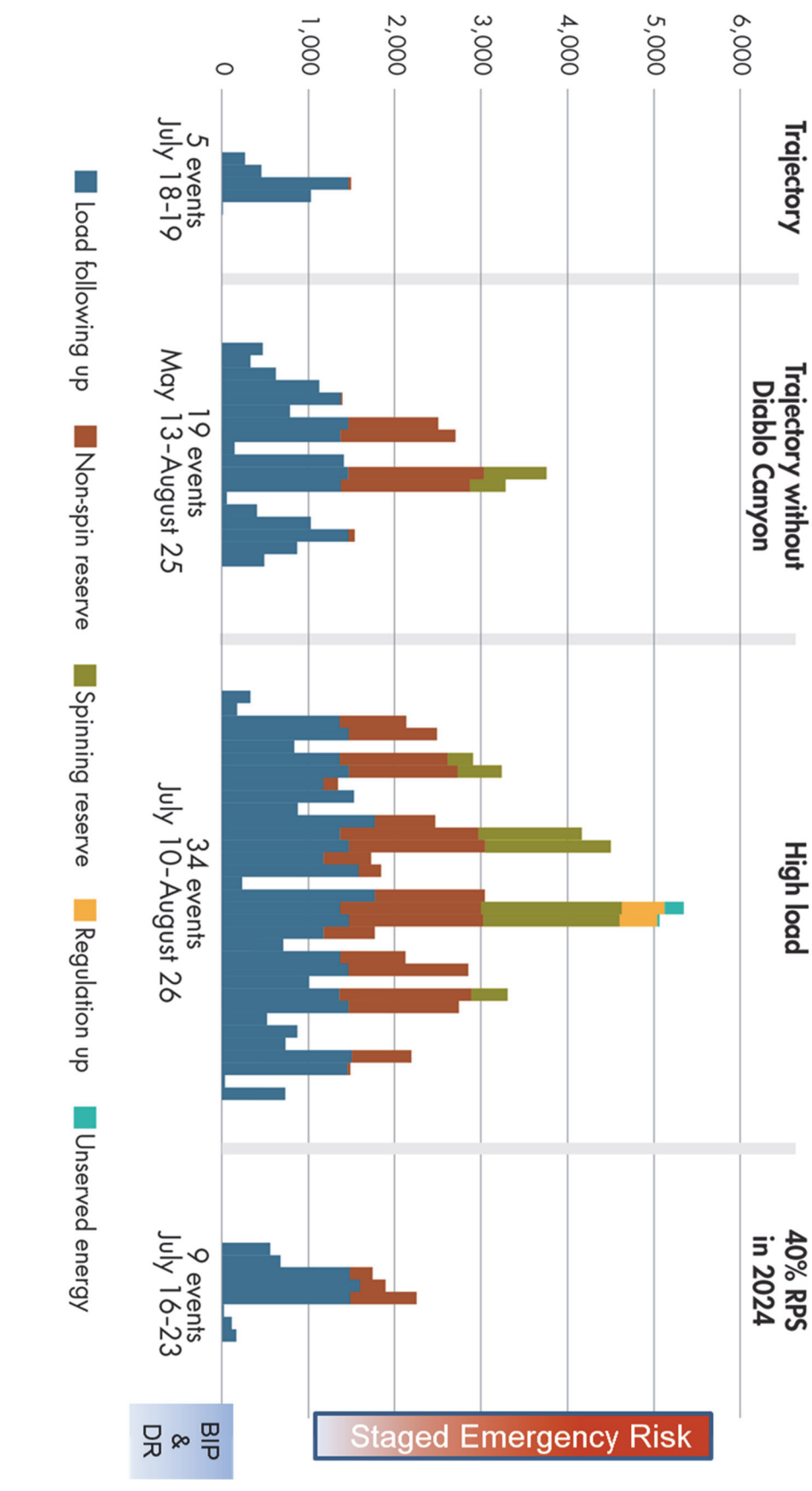
A. As stated in the CAISO's initial testimony, under the current schedule for this proceeding the Commission must make a policy determination based on the Phase 1a studies to guide the scope of this proceeding. If maintaining sufficient system capacity is the highest priority at this time, the Commission may consider using the Trajectory and High-Load scenarios as bookends, with sensitivities that highlight reasonable alternative assumptions likely to affect the projected shortfall periods. However, if the most important priority is over-generation and consideration of the implications of renewable curtailment, the Commission may consider using the Trajectory scenario with sensitivities that model alternate levels of renewable curtailment.

Q. What does the CAISO believe is most important priority to be addressed in this proceeding?

A. Although the results of all studies in this proceeding show system capacity deficiencies, the CAISO believes that the most important priority at this time is to identify the need for flexible capacity and to address the related issues of over-generation and renewable curtailment. This is primarily attributable to the fact that, while not certain, the CAISO is reasonably confident that the additional 2,315 MW of approved Track 1 and Track 4 capacity will likely address the identified system capacity shortfalls. As noted in the CAISO's initial testimony, the unlimited renewable curtailment modeled in the CAISO's deterministic study could be masking additional flexible capacity needs and, in any event, is not likely a

reasonable solution to over-generation given current contract provisions and state RPS policy goals. As such, the record in this proceeding has not adequately fleshed out and assessed flexible capacity needs and the risks associated with any flexible capacity deficiencies. The Commission needs to thoroughly address these issues before making any findings of need or lack thereof.

While this proceeding's highest priority is to identify the need for flexible capacity and mitigating over-generation, the following chart, produced from the CAISO's deterministic study results, shows that the CAISO's modeling also identified capacity shortfalls. This figure shows that the CAISO is at risk of staged emergencies in all scenarios except the Trajectory case.


Trajectory
Trajectory without Diablo Canyon
High load
40% RPS in 2024
6,000
5,000
4,000
3,000
2,000
1,000
0
5 events July 18-19
19 events May 13-August 25
34 events July 10-August 26
9 events July 16-23
Load following up
Non-spin reserve
Spinning reserve
Regulation up
Unserved energy
BIP & DR
Staged Emergency Risk

1

This figure is based on all of the shortfalls identified in the CAISO deterministic studies for the Trajectory, Trajectory without Diablo Canyon, High Load and 40% RPS in 2024 scenarios. This figure offers a significant amount of information regarding the implications of shortfalls identified by the CAISO. First, it should be noted that in every event included in this chart all demand response and base interruptible program resources have been called before the deficiency is identified. Second the "Staged Emergency Risk" bar on the right side of the chart is used to indicate the risk of a staged emergency. Note that the risk of staged emergencies occurs prior to depleting all load following resources. An inability to follow load means that the CAISO is unable to ensure that its supply is equal to its demand. If the CAISO is unable to follow load, it must lean on adjacent balancing authority areas to provide the additional energy. Sustained leaning on neighboring balancing authorities is prohibited by NERC balancing standards and therefore presents a Stage 1 emergency risk.

The risk and level of staged emergency increases with the magnitude of the shortfall. As the CAISO depletes non-spinning reserves, it almost certainly moves from a Stage 1 to Stage 2 emergency, depending on the level of load and other system conditions at the time. Further, as spinning reserves are used, the CAISO risks a Stage 3 emergency. The CAISO results for the High Load Scenario, show that there are at least two days in which CAISO is at risk of Stage 2, and possible Stage 3, emergencies. The results for the high load scenario show even greater risk and a higher probability that the CAISO may be forced to shed firm load in order to maintain grid reliability.

Q. If the Commission agrees that flexible capacity, over-generation and related renewable curtailment are the most important priorities to address in this proceeding, what studies should be conducted in Phase 1b of this proceeding to determine need?

A. It is critical to remove the factors that may be masking the need for flexible capacity. To do so, parties should be provided an opportunity to run an additional

sensitivity analysis that assumes renewable resources are must take resources, *i.e.*, no curtailment of such resources is permitted. The results of such a sensitivity will indicate the potential range of flexible capacity needs. In other words, this sensitivity will provide a bookend to the previous studies that assumed unlimited renewables curtailment. The CAISO also recommends another sensitivity that assumes a reasonably likely level of allowable economic curtailment for renewable resources. This will provide a more realistic picture of actual conditions and will allow for a more accurate, real-world assessment of flexible capacity needs. The CAISO recommends running these sensitivities in the Trajectory scenario.

Q. Should the information provided by LSA and IEP regarding the contractual provisions for curtailment of renewable generation be used to inform alternative assumptions about economic renewable curtailment?

A. Yes. As the CAISO noted in its opening testimony, having the bookends is important, but so is having a forecast that assumes a reasonable level of curtailment based on expected actual conditions. To the extent that LSE, IEP or any other party has specific knowledge of the contractual provisions that govern allowable economic curtailment of renewable resources, that information should be considered by the Commission in developing the sensitivities to be conducted in Phase 1b.

Q. Should the Commission use the additional studies to make a determination of need in Phase 1b?

A. Yes. A need determination cannot be made in Phase 1a because the information gathered to date is insufficient to do so. The studies that have been conducted do not demonstrate a definitive lack of need. As such, the Commission should not preclude its ability to make a need determination in Phase 1b if the evidence supports it.

Q. Should the Commission issue an order for additional new generation for any identified shortfall?

A. Not necessarily. As noted in the CAISO's response to TURN Data Request No. 2, not every shortfall may require new resource capacity. However, based on the record developed thus far, no party has demonstrated that the shortfalls identified in this proceeding do not require Commission action. If shortfalls requiring new procurement are identified, the Commission should then determine the solution that resolves the concern. The solution may be something other than new generation capacity, such as retrofits to existing resources, storage, demand response, new rate designs, or other alternatives. Regardless of the nature of the solution, however, the Commission should establish explicit procurement targets to ensure that the needed solution can be procured in the timeframe in which it is needed for reliability or flexibility purposes. The Commission must identify not only the shortfall requiring procurement, but also the appropriate procurement solution, and the proceeding in which the solution will be implemented. Final procurement and approval of the specific resources needed to meet the targets can be resolved in the context of an appropriate Commission proceeding outside of the LTPP. For example, if the Commission determines that energy efficiency is the preferred solution to meet an identified need, the Commission should make an explicit finding regarding (1) the amount of energy efficiency to be procured and (2) the appropriate Commission proceeding to determine how the procurement target will be met. As SDG&E recommends in its opening testimony, the results of the studies conducted in this LTPP should be used to inform other proceedings.[15]

Q. Should the Commission include contingency plans if procurement targets are not on track to address shortfalls identified by the Commission?

A. Yes. Assuming the resources selected for procurement address the identified shortfall, the CAISO would consider the resources a viable solution. However, similar to the CAISO's transmission planning process, off-ramps should be created to address the possibility of selected resources not being developed in a timely

[15] SDG&E Testimony at pg. 4-6.

manner. In the transmission planning process, these off-ramps allow for additional transmission upgrades to be developed in case non-transmission alternatives do not progress at a rate that would avoid the need new transmission. A similar approach may be needed in this and future LTPPs to allow adequate time to develop alternative solutions to address shortfalls in the event the resources selected by the Commission to address an identified need are not on track to fill the need in a timely manner.

Q. Please comment on CESA's recommendation that three alternative storage sensitivities should be conducted in this proceeding.

A. One of the goals of Phase 1b is to determine the best means of addressing an identified need. However, at this time, the focus Phase 1b should remain on fully identifying the need by conducting the studies identified above and in the CAISO's opening testimony. The storage sensitivities proposed by CESA are more related to determining how best to address a need rather than identifying that a need exists. As such, these sensitivities should not be run until the needs have been identified.

Q. Please summarize your recommendations.

A. The studies performed to date in Phase 1a have identified capacity shortfalls, over-generation and renewable curtailment. The stochastic analyses to be filed on November 13, 2014 should continue to inform the Commission about the frequency distributions and ranges of the shortfall and curtailment. However, the Commission should not rely on these results to definitively determine procurement needs because the results will be based on the same renewable curtailment assumptions used in the CAISO deterministic study and will not provide the Commission with a full range of flexible capacity needs. Instead, based on the extent of the of the shortfalls identified to date, the CAISO recommends that the Commission consider additional, targeted studies in Phase 1b of this proceeding to identify specific flexible capacity needs and, potentially, procurement needs.

The CAISO recommends that the focus of Phase 1b should be on identifying flexible capacity needs and related opportunities to mitigate potential over-generation and renewable curtailment. To do so, additional sensitivities must be run that limit the allowable curtailment of renewable generation to realistic levels, thereby providing a more realistic picture of flexible capacity needs.

Q. Does this conclude your testimony?

A. Yes, it does.