Rulemaking No.: R.12-03-014

Exhibit No.: RB-1

Witness: Jaleh Firooz

Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans	Rulemaking 12-03-014

ERRATA TO TESTIMONY OF JALEH FIROOZ AND ANALYSIS OF LOCAL CAPACITY REQUIREMENTS IN THE WESTERN LOS ANGELES (LA) BASIN SUB-AREA SUBMITTED ON BEHALF OF THE CITY OF REDONDO BEACH (Mark-up, Revised 10/25/13)

Dated: August 26, 2013 (revised 10/25/13)

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 12-03-014

ERRATA TO TESTIMONY OF JALEH FIROOZ ON BEHALF OF THE CITY OF REDONDO BEACH

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

A. My name is Jaleh Firooz. I am employed by Advanced Energy Solutions, 17114 Tallow Tree Lane, San Diego California, 92127. I am president and principle.

Q. Please describe your educational and professional background.

A. I am a licensed Professional Electrical Engineer in the State of California. I hold a Master of Business Administration and a Bachelor of Science degree in Electrical Engineering.

Q. What is your expertise?

A. I am an expert in matters related to transmission and energy planning, operations and regulation. I have more than 32 years of utility and consulting experience in transmission planning, resource planning, generation interconnection, transmission regulatory policy, competitive wholesale energy markets and market design. I have worked over 24 years for San Diego Gas and Electric. Advanced Energy Solutions is a member of Western Electricity Coordinating Council.

Q. What is the purpose of your testimony?

A. I will describe the Local Capacity Requirements study that was completed in June, 2013 by Advanced Energy Solutions on behalf of the City of Redondo Beach to determine if generation capacity at the existing Redondo Beach plant location is needed to meet the Western LA Basin Locational Capacity Requirements (LCR), or if there are environmentally superior alternatives to meet this LCR.

Q. Have you done previous studies of Local Capacity Requirements?

A. Yes. In 2011, on behalf of the California Coastal Conservancy, Advanced Energy Solutions undertook an independent analysis of the need for generation at the location of the existing Redondo Beach generation facility.[1] The analysis determined that the local reliability requirements specified by the CAISO for the Los Angeles Basin and the Western Los Angeles Basin sub-area do not require that there be any generation located at the existing Redondo Beach generation facility through year 2021. The analysis also found that there were no technical studies that indicate the flexible (dispatchable) generation needed to accommodate a significant increase in intermittent renewable generation, is required to be located at the existing Redondo Beach generation facility. The 2011 analysis concluded that all generation at the existing Redondo Beach generation facility can be retired without any adverse impacts on grid reliability.

Q. What were you asked do to do by the City of Redondo Beach for the June, 2013 study?

A. The City of Redondo Beach asked Advanced Energy Solutions to update its 2011 report and determine if the conclusions reached in that report are still correct or whether changes are needed based on information that has become available since December, 2011. Specifically, the City wanted to know if removing all generation and substation facilities, and all connecting transmission lines, from the existing Redondo Beach power plant, in combination with other supply and demand-side options, is environmentally superior to other alternatives for meeting California 's electricity requirements (including the alternative of building new generation at the Redondo Beach location as proposed by the current owner of the Redondo Beach facility (AES)).[2]

Q. Was power flow analysis performed to study and confirm the results?

A. Yes. Power flow analysis was performed to confirm that the supply-side and demand-side solutions[3] discussed in this study will, if implemented, satisfy the Western LA Basin sub-area Local Capacity Requirements (LCRs) identified by the CAISO.

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[1] "ANALYSIS OF THE NEED FOR GENERATING CAPACITY at the REDONDO BEACH GENERATING STATION, Oct 2011."

[2] AES is a corporation which owns and operates power plants in the United States and internationally. Advanced Energy Solutions is an unrelated independent consulting firm located in the San Diego, California.

[3] The demand and supply side values used in the study are based on projections developed by the CPUC and CEC and provided to the CAISO. The CAISO 's analysis made certain modifications to these projections including the assembly of a 'base "Renewable Portfolio Standard (RPS) scenario.

Q. Has new information become available since the initial report of 2011?

A. Yes. New information has become available since the initial report was published in December, 2011. This new information includes the CAISO 's 2012-2013 transmission planning study results and various CPUC decisions. In addition, the possible long term unavailability of the two San Onofre Nuclear Generating Station (SONGS) units in southern California became a reality following a radiation release in January, 2012.

Q. What are the major sources of data used for the June, 2013 report?

A. Major sources of the data for this update include:

- The CAISO Board-approved 2012-2013 transmission plan and associated report. The CAISO 's report includes the results of the CAISO 's no-SONGS mitigation strategy for 2018 (mid-term) and 2022 (long-term).[4] The report includes a summary of the results of power flow studies that back the CAISO 's analysis. The CAISO 's 2012-2013 transmission plan was approved by the CAISO Board on March 20, 2013. According to the associated report, the CAISO "performed a comprehensive study of the ISO transmission grid to meet California 's policy goals, in addition to examining conventional grid reliability requirements and projects that can bring economic benefits to consumers." As part of this work the CAISO identified upgrades needed to meet CAISO grid reliability needs and upgrades to support achievement of the state 's requirement to supply 33% of California 's retail electricity consumption with renewable energy by 2020.

- The LCR technical analysis report prepared by the CAISO to estimate LCRs for year 2013 (short-term, without SONGS). On an annual basis the CAISO determines, for the upcoming Resource Adequacy (RA) compliance year, LCRs for transmission constrained areas of the CAISO grid. These annual LCR determinations are used by the CPUC to establish CPUC-jurisdictional load serving entities 'system and local RA obligations. They are used by the CAISO to determine whether the CAISO needs to implement its backstop procurement authority in the event load serving entities fail to contract for generation sufficient to meet the established LCRs.

[4] According to the CAISO: "the mid-term studies addressed the recommendations from the CEC, which were made in consultation with the CPUC, in the 2011 Integrated Energy Policy Report that "to support long-term energy and contingency planning, the California ISO (with support from PG&E, SCE, and planning staff of the CPUC and CEC) should report to the CEC as part of its 2013 Integrated Energy Policy Report (IEPR) and the CPUC as part of its 2013 long-term procurement plan on what new generation and transmission facilities would be needed to maintain system and local reliability in the event of a long-term outage at Diablo Canyon, SONGS, or Palo Verde. ""

- The CPUC's February 13, 2013 *Decision Authorizing Long-Term Procurement for Local Capacity Requirements* (D.13-02-015) in the Western LA Basin sub-area which was issued as part of the CPUC's Long Term Procurement Plan (LTPP) proceeding. While RA compliance is established by the CPUC on a one-year forward basis, the CPUC uses the Local Reliability track of the LTPP proceeding to authorize long-term procurement of generating capacity that meets projected LCRs for the years 2021 and beyond "...to the extent that the Commission finds there is such a need."[5] CPUC D.13-02-015 authorizes Southern California Edison Company (SCE) to procure between 1400 and 1800 megawatts of electrical capacity in the Western Los Angeles Basin sub-area of the Los Angeles Basin area to meet LCRs projected through year 2021. The CPUC decision relies heavily on information provided by the CAISO in the LTPP proceeding.

- Two separate 2022 power flow cases were obtained from the CAISO secure website to perform the power flow analysis used for the instant study: the 2022 starting case for the LCR analysis and a 2022 reliability case for the transmission line reconfiguration/removal study.

Q. Could you briefly describe the LCR analysis performed?

A. The study examined the Western LA Basin sub-area dependable capacity requirement with and without the availability of generation at SONGS for years 2013 through 2022. We have decided not to discuss the with-SONGS results in this testimony as they are no longer relevant.

Q. How were the estimates of Local Capacity Requirements in your study calculated?

A. Tables 3.5-7[6] and 3.5-12[7] in the CAISO's Board Approved 2012-2013 transmission plan document, provide estimates of the LCRs for the Western LA Basin sub-area for the years 2018 and 2022 assuming either or both SONGS and the Diablo Canyon nuclear power plants units are shut down. The CAISO's August 20, 2012 *"2013 Local Capacity Technical Analysis, Addendum to the Final Report and Study Results, Absence of San Onofre Nuclear Generating Station (SONGS)"* provides the Western LA Basin sub-area LCR for year 2013 with and without SONGS. The estimated LCRs for other years during the study horizon were calculated by linear interpolation and extrapolation. The

[5] CPUC Decision 13-02-015, page 6.

[6] CAISO Board Approved 2012-2013 Transmission Plan document: 2018 Local reliability assessment of LA Basin and San Diego areas, page 176.

[7] CAISO Board Approved 2012-2013 Transmission Plan document: 2022 Local reliability assessment of LA Basin and San Diego areas, page 193.

data shows that LCRs vary between 4600 MW in 2013 and 5099 MW in 2022 with no SONGS units available.

Q. What is the likelihood that all of the dependable capacity required by the CAISO-determined Local Capacity Requirements will actually be required to simultaneously operate in order to maintain grid reliability?

A. Extremely low. The CAISO estimates LCRs using a 1-in-10 peak load forecast (there is a 90% probability that actual peak loads will be lower) with an additional 2.5% increase to ensure that even if loads reach the 1-in-10 level, with a 2.5 % margin of security, there will be no voltage instability under contingency conditions. The contingency conditions under which the LCRs are estimated assume the worst case over-lapping outage of two transmission lines (an N-1-1 contingency condition). This contingency condition has a very small probability of occurrence. Roughly speaking, the outage of one line has less than a 1% (0.01) probability of occurrence. The probability of an overlapping outage of two lines is therefore 0.01% (0.0001 = 0.01 x 0.01). The probability that the foregoing worst case N-1-1 contingency condition will occur during a 1-in-10 peak load condition is several orders of magnitudes smaller and therefore very remote.[8] While the N-1-1 contingency condition must be studied under reliability standards, the likelihood that this condition will ever occur approaches statistical insignificance. Accordingly, there is almost no chance that all of the dependable capacity required under the CAISO 's current LCR methodology will need to simultaneously operate in order to meet forecast loads within the relevant LCR areas.

Q. How would you characterize the CAISO 's estimates of the amount of existing conventional generating capacity available to count towards LCRs in their 2012/2013 transmission plan?

A. Conservative. The generating capacity values assumed by the CAISO to determine whether there will be sufficient dependable capacity available to meet LCRs are conservatively estimated. The CAISO and CPUC only count Net Qualifying Capacity ("NQC") values towards LCRs. The CAISO sets NQC values for non-dispatchable generators based on the generators 'actual output during historical peak load periods. Accordingly, the NQC values are generally less than these generators 'installed capacity, and can be significantly affected by one-time technical anomalies (e.g., the loss of natural gas compression at a gas-fired generating plant) or atypical commercial conditions (e.g., the historical peak load period may have occurred exactly when the need for process heat

[8] The probability of an N-1-1 contingency occurring at the peak hour of a 1-in10 load forecast is .0001 x 1/ 8760 = 0.000000001, which is about 1 in a billion for the peak hour. Because surrounding hours are likely to approach the peak hour load levels, there will be more than one hour of very high loads during the ten year period, e.g., 200 hours. Multiplying the single-instance probability by 200 yields a probability of 1 in 5 million for the contingency condition studied.

from a cogeneration plant was at a low level due to the manufacturer's particular manufacturing process requirements).

Q. Are the CAISO's estimates of non-conventional generation development also conservative?

A. Yes. The CAISO has chosen a very pessimistic and conservative view of the expected development of demand reduction programs (e.g., currently uncommitted energy efficiency) and non-conventional generation resources (e.g., CHP, non-CHP DG, and DR).[9] In its 2012-2013 Transmission Plan, the CAISO has assumed zero megawatt NQC values in 2022[10] for these resources except for 169 MW (NQC) of distributed generation.

The CAISO's use of conservative assumptions is highlighted in the CAISO's testimony in the CPUC's LTPP proceeding. CPUC D.13-02-015 decision quotes a CAISO witness statement as follows:

"...deliberately conservative forecasts must be employed in the assessment of reliability requirements for capacity in constrained areas since the consequences of being marginally short versus marginally long are asymmetric."[11]

Q. Has the CAISO struck the right balance between the costs of being "marginally long" and the consequences of being "marginally short"?

A. My report agrees with the CPUC that it is reasonable to assume (i) uncommitted energy efficiency will reduce forecast loads below the level assumed by the CAISO and thereby reduce LCRs below the levels estimated by the CAISO, (ii) some amount of dispatchable demand can be counted towards these lower LCRs, (iii) a modest amount of new CHP will be available to count towards the lower LCRs, (iv) future non-CHP distributed generation additions will significantly exceed the low levels used in the CAISO's 2012-2013 base case transmission plan analysis.[12]

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[9] These resources are termed either "incremental" or "uncommitted." Either term refers to resources beyond the amounts embedded in the CEC's demand forecast.

[10] From an e-mail response from the CAISO planning staff.

[11] Page 22 of CPUC Decision 13-02-015.

[12] The amount of Distributed generation assumed by the CAISO in their case for 2022 according to the CAISO planning staff is 169 MW (NQC).

Q. Is the purpose of your report to take issue with the conditions that the CAISO assumes for purposes of establishing LCRs?

A. No. However, it needs to be understood that the combination of numerous conservative assumptions produces an overly-conservative result; the margin of reliability resulting from the CAISO's analysis is larger than may be apparent at first glance. Nevertheless, except for energy efficiency, demand response, non-CHP distributed generation and CHP, the study has accepted all the load, contingency, and generating resource assumptions used in the CAISO's 2012-2013 transmission plan.[13]

Q. What is the relevance of your study to California's Energy Action Plan?

A. My paper examines whether, in comparison with the CAISO's 2012-2013 transmission plan, the use of more reasonable assumptions for the development of preferred resources consistent with the "loading order" in California's Energy Action Plan, would (i) produce a result that is environmentally superior to the construction of new generation at the Redondo Beach facility, and (ii) meet the CAISO's conservative application of reliability standards.

Q. Where do the MW values assumed for the preferred resources come from?

A. The assumed NQC values for preferred resources are taken from estimates provided by the three state agencies (CPUC, CEC and California Air Resources Board) in consultation with the CAISO.[14]

In its estimation of LCRs in the 2012-2013 transmission plan, the CAISO did not include any amount of uncommitted energy efficiency in forecast load levels, or any amount of dispatchable demand response towards estimated LCRs. In addition, while the CAISO assumed that some amount of new distributed generation will get built, its baseline assessment includes the lowest amount of distributed generation among the various renewable resource portfolios provided by the CPUC. The CAISO's baseline assessment included no new CHP generation additions.

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[13] The NQC of existing generation in the Western LA Basin sub-area is obtained from the CAISO's 2013, 2014 and 2018 Local Capacity Technical Analyses reports.

[14] CPUC D.13-02-015, page 21, "A sensitivity analysis performed at the request of this Commission, the CEC and the California Air Resources Board (CARB), to study a variation on the Environmentally Constrained portfolio. As part of the sensitivity analysis, demand reduction from 1950 MW of uncommitted energy efficiency and 201 MW of additional CHP was included in the model, as provided by the three State agencies and adjusted for the LA basin local area (as part of 2461 MW of uncommitted energy efficiency and 209 MW of uncommitted CHP for the entire SCE territory). For the Western LA basin sub-area, 1121 MW of uncommitted energy efficiency was included in this analysis, and 180 MW of CHP." (Internal footnote omitted.)

The CPUC's authorization for SCE to procure up to an additional 600 MW of capacity from preferred resources shows that the Commission favors these resources over fossil-fired generation.

"SCE is also authorized to procure up to an additional 600 MW of capacity from preferred resources and/or energy storage resources. In addition, SCE will continue to obtain resources which can be used in these local reliability areas."

According to testimony submitted to the CPUC in the LTPP proceeding, most of the interveners, including SCE and the CPUC Division of Ratepayer Advocates (DRA), stated that the CAISO's assumed values for uncommitted energy efficiency, dispatchable demand response, new non-CHP distributed generation and new CHP resources are too low.

Based on the CAISO testimony in the CPUC's LTPP proceeding 869 MW (NQC) of Distributed Generation is assumed available in the Western LA basin in the CAISO "Environmentally Constrained" case in 2021.[15]

Q. How are the RPS scenarios used in your study?

A. The CPUC staff has developed four renewable generation scenarios for meeting California's 33 percent RPS requirement in 2020. These scenarios vary by technology, location, and other characteristics and were developed by considering transmission constraints, cost, commercial interest, environmental concerns, and timing of development. For planning purposes, the CAISO adopted the commercial interest scenario as the CAISO's baseline case. The CAISO also estimated LCRs using the other three scenarios; the cost-constrained scenario, the environmentally-constrained scenario, and the high distributed generation scenario.

The RPS portfolios cover a broad range of plausible renewable generation possibilities. According to the CAISO:

"The generation resources comprising these four portfolios reflect the latest and best available information on the commercial interests of transmission customers, as measured by interconnection queue positions and whether the resources have signed power purchase agreements with California load-serving entities. Other factors such as cost, procurement policies, permitting, and resource financing capabilities were part of the metrics used to evaluate each portfolio."[16]

[15] CPUC D.13-02-015, page 19.

[16] CAISO 2012-2013 Transmission Plan document, page 15.

In D.13-02-015 the CPUC found that it is reasonable to assume that 200 MW of dispatchable demand response will be available in the Western LA Basin sub-area by year 2020:

"We will assume a nominal level of 200 MW of dispatchable demand response...by 2020....there appears to be...549 MW of total demand response resources now..."[17]

SCE 's testimony in the CPUC 's LTPP proceeding indicated that the total amount of demand response available in the Western LA Basin sub-area is about three times higher:

"SCE witness Silsbee testified that at least 549 MW of demand response is currently available in the Western LA Basin..."[18]

To determine the amount of the uncommitted energy efficiency, dispatchable demand response, new CHP and new non-CHP distributed generation available in each year of the study horizon, linear interpolation and extrapolation were used.

Q. Are there other alternatives available for meeting LCRs than adding fossil-fueled generation?

A. Yes. In estimating LCRs, the CAISO assumes controlled load drop is not used as mitigation for the N-1-1 contingency condition. However, both CAISO and NERC reliability standards permit the use of controlled load drop for this contingency condition. Were the CAISO to assume the use of some amount of controlled load drop,[19] there could be a significant reduction in the LCRs. While controlled load drop imposes some amount of inconvenience for some consumers and is not without cost, the likelihood of actually having to trigger such a load drop scheme is, as discussed above, very remote. It should be noted that an automated load drop scheme is more reliable than a comparable amount of additional generation since load drop activation is subject only to limited amount of software and telecommunication equipment, while the availability of generation is subject to a myriad of electronic and manual control systems, fuel inputs, complex thermal and mechanical systems and emission controls. As far as reliability is concerned, controlled load drop is a more reliable way of reducing the possibility of cascading blackouts or system-wide electric supply failures.

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[17] D.13-02-015, page 56.

[18] D.13-02-015, page 52.

[19] Controlled load drop would be prearranged so as to avoid dropping critical loads such as hospitals and sensitive commercial end-uses such as sewage pumping plants.

Although, CAISO statements in the CAISO 2018 Local Capacity Technical report indicates that the CAISO allows controlled load drop for N-1-1 contingency conditions, for purposes of estimating LCRs, the CAISO has, for unspecified reasons, chosen not to do so.[20] It is noteworthy that on May 16, 2013 FERC issued a supplemental notice of proposed rulemaking to approve revisions to a mandatory NERC reliability standard (TPL-001) that would allow a transmission planner to shed non-consequential load in response to a single contingency event (N-1).

Q. Are there other conventional generation alternatives that are superior to new conventional generation at the existing Redondo Beach generating station?

A. Yes. AES, the current owner of the Huntington Beach generating station, has submitted an Application For Certification (AFC) to the CEC for construction of two combined cycle plants at the location of the existing Huntington Beach generating facility. AES's AFC indicates that the first block of the Huntington Beach Project could be on line by the summer of 2019 and the second block by the summer of 2020. While it is uncertain whether AES will be able to secure the required AFC approval from the CEC, and uncertain whether AES will obtain Power Purchase Agreements (PPAs) that provide the financial certainty necessary to proceed with construction, it is clear from the CAISO's, and my own, power flow analysis that generation at the Huntington Beach location is electrically preferred to generation at the Redondo Beach location. The CAISO's Local Capacity Technical Analyses indicate that generation at Huntington Beach is more effective in mitigating the adverse consequences of the worst-case contingency condition than is generation at Redondo Beach; i.e., generation at Huntington Beach has a much higher "effectiveness factor"[21] for the specific contingency condition driving the Western LA Basin local capacity requirements.

Q. What was the source of the power flow cases used in your study?

A. Two separate 2022 power flow cases were obtained from the CAISO secure website to perform the power flow analysis used for the instant study. For my LCR analysis I used the 2022 "starting point" power flow case developed by the CAISO for its 2012-2013 transmission plan.[22] (2022 CI nosongs starting 2pt5). For the transmission line

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[20] "Generally, Category C describes system performance that is expected following the loss of two or more system elements. This loss of two elements is generally expected to happen simultaneously, referred to as N-2. It should be noted that once the "next" element is lost after the first contingency, as discussed above under the Performance Criteria B, N-1-1 scenario, the event is effectively a Category C. As noted above, depending on system design and expected system impacts, the **planned and controlled** interruption of supply to customers (load shedding), the removal from service of certain generators and curtailment of exports may be utilized to maintain grid 'security.'"

[21] CAISO 2018 LOCAL CAPACITY TECHNICAL ANALYSIS, page 72.

[22] The CAISO refuses to make available to stakeholders the "final" power flow cases which establish the LCR estimates included the CAISO's Local Capacity Technical Analyses and in the CAISO's 2012-2013 transmission plan. This refusal makes it difficult for stakeholders to verify and critique the CAISO's LCR analyses. Moreover, it

reconfiguration/removal study, I used a CAISO 2022 reliability power flow case (RA12 SCE 2022 SP).

Q. How was the power flow analysis performed?

A. Two 470 MW conventional generating units at Huntington Beach[23]; along with uncommitted energy efficiency program impacts, dispatchable demand response, new CHP, and new non-CHP distributed generation assumptions described earlier were added to the CAISO's "starting point" power flow case that the CAISO used to develop the 2022 no-nuclear mitigation plan included in the CAISO's 2012-2013 transmission plan report. This modified case was then tested by taking the worst case contingency identified by the CAISO (the outage of the 230 kV Serrano-Lewis #1 line followed by the outage of the 230 kV Serrano-Villa Park #2 line) and verifying that this modified case did not result in any reliability standard violations.

To determine the amount and location of new dependable capacity that is needed to meet the CAISO's estimated Western LA Basin sub-area LCR, different amounts, and locations, of dependable capacity additions were tested in the power flow program by applying the critical contingency condition identified by the CAISO.[24]

Q. What did your power flow studies show?

A. The iterative power flow analysis showed that distributing load reductions (EE and DR) and resources (DG and CHP) across the Western LA Basin sub-area in proportion to load at the various load buses, is not as effective in mitigating the particular worst contingency-based overload identified by the CAISO as dependable capacity applied at specific buses. That is because the electrical effectiveness of resources in mitigating the critical overload condition depends on the electrical location of the resources relative to the electrical location of the overloaded facility. For the particular contingency described above, generation at the location of the existing Huntington Beach power plant -- and to a lesser degree the Alamitos power plant -- are more effective in mitigating the particular overload identified by the CAISO as worst contingency than resources distributed throughout the Western LA Basin sub-area.

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is not apparent what sensitive information resides in the final cases. Assumptions concerning the generation dispatch patterns used by the CAISO, and CAISO assumptions as to assumed resource additions, are just that—assumptions. They are binding on no party and carry only as much, or as little, weight as individual stakeholders choose to give them.

[23] The use of Huntington Beach plant is for convenience. It is conceivable that other electrical locations within the Western LA Basin sub-area would be more or equally effective as the Huntington Beach location for the development of new generation.

[24] The CAISO's "starting point" no-SONGS power flow case for year 2022 was used for this purpose.

For the above reason, the amount of unconventional and conventional additions (2000 MW + 940 MW = 2940 MW) to be added in the proposed alternative under the without SONGS scenario is higher than the 2460 MW of conventional generation proposed by the CAISO to be added to satisfy the LCR requirements in 2022 without SONGS.

Q. What did you find based on the results of the iterative power flow process?

A. The result of this iterative process for the without SONGS scenario, is that the addition of two conventional generating units at Huntington Beach (940 MW of dependable capacity) coupled with a reduction in the aggregate amount of EE, non-CHP distributed generation, new CHP and dispatchable demand response distributed across the Western LA Basin sub-area (the reduction is from an initial amount of about 2500 MW as estimated by the CPUC and CEC to less than 2000 MW as determined by the instant analysis) will satisfy the Western LA Basin LCR.

Q. What other power flow studies were performed?

A. The proposed reconfiguration of the transmission lines at La Fresa substation, the removal of the Redondo Beach substation and removal of the transmission lines connecting Redondo Beach substation to the electric network, were studied in the power flow program under without SONGS scenarios with all-lines-in-service and contingency conditions assuming high load conditions.[25] Specifically, NERC Category A (all lines in-service), Category B (one line out) and Category C (two lines out) conditions in the La Fresa substation area were tested. No overload was observed for the any of the outages studied.

Q. Have you considered the need for dispatchable generation to accommodate increasing amounts of intermittent renewable generation?

A. Since the release of the original report (in December, 2011) to which this update applies, the CAISO and CPUC have continued to investigate the amount and characteristics of dispatchable generation that will be needed to accommodate the anticipated increase in intermittent renewable generation (mainly wind and solar). Of particular interest is whether, and when, new dispatchable generation will need to be added. This determination depends to some extent on the amount and timing of when existing dispatchable generation, especially generators using Once-Through-Cooling technology, is retired and whether this generation is retooled with air cooling or replaced on-site with new generation.

[25] The CAISO's no-SONGS reliability case for year 2022 was used for this purpose.

Q. Is there a need for additional dispatchable generating capacity in the area to meet renewable integration requirements?

A. To date, no analysis has identified a specific locational requirement that mandates some portion of this dispatchable generation requirement would have to be located at the existing Redondo Beach generating facility. The finding in the original report still stands:

"According to CTPG's [the California Transmission Planning Group's] interpretation of the OTC owners' implementation plans, and based on the likely construction of new generation outside of the existing OTC sites and within the CAISO BA, there will be enough flexible generating capacity added to meet the CAISO's projected need for 4600 MW of new flexible generation capacity in 2020."

"From 2013 through 2020 no generation capacity at the Redondo Beach Generating Station location is required to integrate intermittent renewable resources."

This finding is extended in the instant update to include year 2022.

Q. Is it likely that some of the dispatchable generating capacity required for renewable integration will <u>have</u> to be located within the Western LA Basin sub-area?

A. No. The simple fact is that except for unusual situations where transmission constraints between different regions of the CAISO grid (such as between northern and southern California) limit the ability to move power, dispatchable generation can be ramped up and down anywhere within the CAISO Balancing Authority to offset a rapid decrease or increase in renewable output anywhere in the CAISO Balancing Authority. Given the wide distribution of dispatchable generation throughout the CAISO's Balancing Authority, and the projected need for dispatchable generation though year 2022, it appears unlikely that any significant locationally-specific dispatchable generation requirements will be found.

Q. Are there any other initiatives underway that could reduce the need for dispatchable generation?

A. There are several initiatives underway which may either reduce the need for dispatchable generation or which may have the effect of expanding the fleet of dispatchable generation. For example, FERC's requirement that Balancing Authorities move to 15 minute scheduling will reduce the amount of dispatchable generating capacity that each Balancing Authority needs to have in order to address intra-hour imbalances. Similarly, the Energy Imbalance Market proposals that are being considered in different areas of the WECC, if implemented, will have the effect of combining different Balancing

Authorities intra-hour imbalances such that the diversity in the separate imbalances will reduce the combined imbalance. It is likely that most new solar photovoltaic additions will incorporate smart inverter technology. Smart inverters provide significant voltage control capability, reducing the need for the voltage control provided by synchronous generators.

Finally, dynamic scheduling between Balancing Authorities can significantly increase the pool of dispatchable generation that is available to a Balancing Authority—such as the CAISO's—that may have significant quantities of intermittent renewable generation. This source of dispatchable generating capacity is likely to become increasingly prominent as significant increases in renewable generation begin to offload existing dispatchable fossil-fired generators. To the extent dispatchable fossil-fired generation output is reduced to accommodate the anticipated increase in renewable generation, an opportunity is created to use this unloaded generating capacity to supply balancing services to those Balancing Authorities with a greater need for such capacity.

Results

Q. What is the conclusion of your study?

A. In the absence of the two SONGS units, the addition of about 2000 MW of demand reduction and distributed generation within the Western LA Basin sub-area, in combination with 940 MW of new generating capacity at the site of the existing Huntington Beach generating station, will satisfy LCRs in the Western LA Basin sub-area through 2022 and allow the shut down and removal of all existing generating and substation facilities at the Redondo Beach plant.

Q. What assumptions were made in your study regarding dependable capacity shortages identified by the CAISO for the San Diego and LA areas?

A. My study includes the amount of dependable capacity required to meet the San Diego area LCR identified by the CAISO (about ~~900~~ **1100** MW). This amount of capacity was modeled by the CAISO in its "starting point" power flow case for the CAISO's 2012-2013 no-SONGS analysis. Therefore, in determining the amount of dependable capacity needed within the Western LA Basin sub-area, my study implicitly assumes San Diego area LCRs are already met. If more than the minimum amount of dependable capacity is found appropriate in the San Diego area then, according to the CAISO, the resource need in the Western LA Basin sub-area would be lowered by more than 1MW for each 1 MW of additional dependable capacity that is added in the northern part of the San Diego area.[26] It was also assumed that the reactive supports identified by the CAISO in San

[26] Robert Sparks Testimony, page 24 (R.12-03-014) "The following table provides a summary of the study results, indicating a1.24 MW reduction in the LA Basin for every 1 MW of generation that is added to San Onofre switchyard."

Diego and LA basin areas were already modeled in the case. If more reactive supports are needed in San Diego and or LA basin (non Western LA), then the Western LA basin capacity need would be lower than shown in my report.

Q. Why was the site of the existing Huntington Beach generating station selected to meet the need for new dependable generating capacity?

A. As mentioned earlier, according to the CAISO LCR study, generation at Huntington Beach and Alamitos are more effective than generation at Redondo Beach in mitigating the overload that establishes LCRs for the Western LA Basin sub-area. Therefore, fewer megawatts of new conventional generation can be added at Huntington Beach than at the Redondo Beach location to satisfy the Western LA Basin sub-area LCRs.

Q. Describe the results of your study as they relate to the existing transmission lines connecting the Redondo Beach generating facility to the remainder of the electric grid?

A. A relatively minor transmission line reconfiguration at La Fresa substation will allow all four of the existing 230 kV transmission lines between the Redondo Beach substation and La Fresa substation to be de-energized and removed without any adverse affect on grid reliability. These transmission lines could be removed without increasing LCRs in the Western LA Basin sub-area.

Q. According to your study, when does the need for additional capacity in the western LA basin area arise?

A. The need for additional capacity in the area does not arise until 2021. This date is after the assumed retirement date for over 2000 MW of existing OTC generation capacity at the Alamitos generating facility consistent with the SWRCB 's OTC unit compliance schedule.

Q. What can be done to gauge the progress of non-conventional generation additions through the study horizon?

A. It is assumed that the addition of incremental non-conventional generation will begin in year 2013 and increase linearly through year 2022. The actual rate at which these resources are added is an important indicator of whether the projected penetration by year 2022 is likely to materialize.

Q. What if the rate of additions is less than projected?

A. If the rate of additions is less than projected, further analysis could be done at that time to evaluate the best course of action for the later years. For example, if forecast distributed generation additions or demand reduction impacts do not happen, the CAISO could use a

Remedial Action Scheme to drop load on controlled basis as mitigation for the critical N-1-1 contingency condition. Note that this critical condition is assumed to occur at very high (1-in-10) load levels. As I note above, simple analysis shows that the probability of a critical N-1-1 contingency event occurring during a 1-in-10 year weather event is very remote.

Q. Compared to alternatives which rely only on conventional generation to satisfy the Western LA Basin sub-area LCRs, is the alternative described in the preceding paragraphs environmentally superior?

A. Yes. Compared to alternatives which rely only on conventional generation to satisfy the Western LA Basin sub-area LCRs, the solution described above is an environmentally superior alternative. Load reductions (including Energy Efficiency and Demand Response) and distributed generation additions (including dual purpose CHP (Combined Heat and Power)) mean a reduction in natural gas consumption and therefore lower air emissions.[27]

Q. What are the LCRs that you used for the Western LA Basin sub-area?

A. Table 1 below shows the Western LA Basin sub-area LCRs for years 2013 through 2022 under a "Without SONGS" assumption. The LCRs are calculated by the CAISO for some years, with other years estimated through interpolation and extrapolation of the CAISO's estimates. The tables show total dependable capacity (NQC) of existing generation (including plants currently under construction) and remaining generation after the planned retirement of the Once Through Cooling (OTC) units.

Table 1. Western LA LCR and Resources Without SONGS (MW)

Year:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
W LA Basin LCR based on CAISO's Category C:	4597*	4664	4731	4797	4864	4931*	4973	5015	5057	5099*
W LA Basin: Effective existing Gen (NQC)**	6364	7345	7345	7345	7345	7345	7345	7345	7345	7345
retire El Segundo OTC unit 3:	0	(335)	(335)	(335)	(335)	(335)	(335)	(335)	(335)	(335)
retire El Segundo OTC unit 4:	0	0	0	(335)	(335)	(335)	(335)	(335)	(335)	(335)
retire Alamitos OTC units 1 - 6:	0	0	0	0	0	0	0	0	(2010)	(2010)

[27] Load reductions have the ancillary benefit of reducing transmission and distribution losses. Similarly, distributed generation is electrically close to load and therefore also helps to reduce transmission and distribution losses.

retire Huntington Beach OTC units 1 - 2:	0	0	0	0	0	0	0	0	(452)	(452)
retire Redondo Beach OTC units 5 - 8:	0	0	0	0	0	0	0	0	(1356)	(1356)
Total Retirements	0	(335)	(335)	(670)	(670)	(670)	(670)	(670)	(4488)	(4488)
W LA Basin Gen after OTC retirements (NQC) (MW)	6364	7010	7010	6675	6675	6675	6675	6675	2857	2857

The highlighted values are from CAISO previous testimony. Values for other years are determined through linear interpolation/extrapolation.
* 2013 LCR value is from CAISO's August 20, 2012 "*2013 Local Capacity Technical Analysis, Addendum to the Final Report and Study Results, Absence of San Onofre Nuclear Generating Station (SONGS)*". 2018 and 2022 LCR values are from CAISO's 2012-2013 Transmission Plan, Table 3.5-7 and Table 3.5-12.
** The NQC values for year 2013 are from the CAISO's August 20, 2012 "*2013 Local Capacity Technical Analysis, Addendum to the Final Report and Study Results, Absence of San Onofre Nuclear Generating Station (SONGS)*".

Q. What are the projected additional resources, conventional and unconventional) used in your study?

A. Table 2 below shows projected uncommitted Energy Efficiency program impacts, non-CHP distributed generation additions, new CHP additions, dispatchable demand response program impacts, and the addition of strategically-located conventional generation additions, where needed. Finally, the tables calculate a nominal local capacity shortage or surplus in the Western LA Basin sub-area.

Table 2 Projected Western LA Resources Without SONGS (MW)

Year:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Uncommitted EE within W LA (NQC):	75	151	226	301	377	452	527	603	678^	753
Uncommitted CHP Within W LA (NQC):	20	40	60	80	100	120	140	160	180^	200
Dist Generation within W LA (NQC):	97	193	290	386	483	579	676	772	869&	966
Dispatchable Demand Response (NQC):	25	50	75	100	125	150	175	200#	225	250
1st block of AES's proposed Huntington Beach CC plant:	0	0	0	0	0	0	470	470	470	470
2nd block of AES's proposed Huntington Beach CC plant:	0	0	0	0	0	0	0	470	470	470
Total W LA Basin Expected Gen/Demand Response	6581	7444	7661	7543	7760	7976	8663	9349	5748	5965

LCR Apparent Surplus/(Deficiency)	1984	2780	2930	2745	2895	3045	3690	4334	691	866

The highlighted values are either from California state agencies as described below.
^ Page 21 of D.13-02-015. The power flow analysis confirmed that not all 1247 MW is needed.
& From Table 4 (Environmentally Constrained case) in D.13-02-015. Page 19
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Q. How is the LCR surplus/deficiency calculated in the above table?

A. The Apparent LCR is calculated by subtracting the "W LA Basin LCR based on CAISO's Category C" row in Table 1 above from the "Total W LA Basin expected Gen/Demand" Response row in table 2 . The reason it is named "apparent" is because, as the CAISO has pointed out, this value could change due to the location of the resources added and their effectiveness in mitigating a particular contingency condition. This is why power flow analysis was performed for 2022; this analysis is needed to verify that the above resources can meet the Western LA basin sub-area LCR.

Q. What is the 2000 MW of non-conventional resources comprised of?

A. The 2000 MW of additional demand reduction and distributed generation proposed in this study are intended to be in place by year 2022 and are comprised of: 200 MW of new Combined Heat and Power (CHP), 797 MW of new non-CHP Distributed Generation (DG)[28], 250 MW of dispatchable demand response (DR), and 753 MW[29] of currently uncommitted Energy Efficiency (EE) programs. As was described earlier, these values are assumed to be dependable capacity (Net Qualifying Capacity or "NQC") and are based on forecasts from State agencies. Of the 966 MW of DG shown in the table 2 above, 169 MW is not counted toward the 2000 MW of "additional" resources needed since it was already modeled by the CAISO in their power flow case.[30]

Q. Why was the power flow analysis performed only for year 2022?

A. The power flow analysis was performed for year 2022 since it has the highest LCR. Power flow analysis confirms that with the dependable capacity assumed to be available in the Western LA Basin sub-area, the CAISO's projected Western LA Basin sub-area LCR would be met though year 2022 without reliability standard violations.

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[28] In addition to 169 MW of DG assumed for 2022 by the CAISO in its studies.

[29] The forecast values for uncommitted EE in year 2022 are based on the State agencies 'forecast of 1121 MW in 2021. The analysis conducted for this paper indicates that between 753 MW and 1000 MW of currently uncommitted EE, in combination with other proposed resource additions, is sufficient to meet the Western LA Basin sub-area LCRs for with and without SONGS scenarios.

[30] From an email from the CAISO planning staff.

Q. How were the locations of load reduction and distributed generation selected?

A. The power flow analysis shows that the specific locations of load reduction and distributed generation within the Western LA Basin sub-area are important in determining how effective these options are in satisfying the Western LA Basin sub-area LCRs. For purposes of this analysis, the load reductions and distributed generation additions were distributed across the Western LA Basin sub-area, generally in proportion to load levels at each load bus.[31]

Q. Are your analysis different than the analysis used by the CAISO in the *"TRACK 4 TESTIMONY OF ROBERT SPARKS ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION."*?

A. My analysis uses the same methodology as the CAISO to determine the amount of dependable capacity needed to satisfy applicable Local Capacity Requirements. I note that the power flow case used for my analysis was the "starting point" case developed by the CAISO for the CAISO's 2012-2013 transmission plan study without SONGS. There are differences between the CAISO's 2012-2013 transmission plan "starting point" power flow case and the power flow cases used to support Mr. Sparks' testimony in this proceeding.

Q. What are the major differences between the assumptions used in your study and the CAISO's Track 4's?

A. The following are the major differences between my studies' assumptions and the CAISO Track 4 analyses:

- Added benefits of the distributed Load reductions and generation in reducing distribution losses were not taken into account. If the added benefits are taken into account and modeled there would be about 5% reduction in the capacity need.[32]

- The difference in the study areas (Western LA versus SONGS area) was explained earlier. The difference in study area also involves the difference in the worst contingencies studied.

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[31] If the load reductions and distributed generation additions were distributed in a more targeted fashion—focused on the substations with the higher effectiveness factors for the critical overload which establishes the Western LA Basin sub-area LCR—it is possible that there would be no need for any new conventional generation anywhere in the Western LA Basin sub-area.

[32] According to the CAISO Track 4 testimony distribution loss saving are estimated at about 4.75.

- The differences for non-conventional resources are listed in the table 3 below. The total difference is about 300 MW. Although the locations of the resources added vary slightly.

Table 3 Non-Conventional Resource Additions in 2022

Resource Type and Location	My Report Dependable MW	CAISO Assumptions Dependable MW
Uncommitted Energy Efficiency In W LA or LA	753	787
EE in SCE (non LA Basin)	0	232
EE in SD	0	196
Combined Heat & Power	200	0
Distributed Generation in W LA or LA	966	247
Distributed Generation in SD	0	210
Dispatchable Demand Reduction in W LA or LA + SD	250	197.95
Total	2169	1869.95

Dated: August 26, 2013 (revised 10/25/13)

Respectfully Submitted,

/s/
Jaleh Firooz