**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF CALIFORNIA**

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| Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. | Rulemaking 10-05-006 |

# REPLY COMMENTS OF THE LARGE-SCALE SOLAR ASSOCIATION ("LSA") ON RENEWABLES INTEGRATION MODELS

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October 8, 2010

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# REPLY COMMENTS OF THE LARGE-SCALE SOLAR ASSOCIATION ("LSA") ON RENEWABLES INTEGRATION MODELS

## I. INTRODUCTION

In accordance with the Administrative Law Judge's (ALJ) Ruling Requesting Comments On Renewables Integration Models dated September 8, 2010 and email dated October 1, 2010, the Large-Scale Solar Association ("LSA")[1] submits reply comments on the Renewable Integration Model ("RIM") methodologies presented by the California Independent System Operator Corporation ("CAISO") and Pacific Gas and Electric Company ("PG&E) at the workshops that the Commission's Energy Division staff ("Staff") conducted on August 24-25, 2010.

LSA's reply comments first respond to the comments filed on September 21, and then address the solar generation profile and forecast error issues raised in the ALJ's October 1, 2010 email. While we commend the CAISO and PG&E modeling efforts, and cheer the advances in our understanding of renewable generation integration, we also concur in the multiple comments that discuss the uncertainties and limitations in both models.[2] In the

[1] LSA represents twelve of the nation's largest developers and providers of utility-scale solar generating resources. Collectively, LSA's members have contracted to provide over 5 gigawatts ("GW") of clean, sustainable solar power under contract to California's load-serving entities. Its members develop, own and operate various types of utility-scale solar technologies, including photovoltaic and solar thermal system designs. For more information, see http://www.largescalesolar.org

[2] *See* Comments Of The California Independent System Operator Corporation On Renewable Integration Model Methodologies ("CAISO Comments"), p.3; Comments Of The California Large Energy Consumers Association In Response To The ALJ's Ruling Of September 8, 2010 Requesting Comments On Renewables Integration Models

end, the work to date tells us less about what we do know and more about what we don't know – and urgently need to learn – about the future state of system operations that encompass high levels of renewable generation. In particular, the comments highlight both the gaps in basic data collection underlying the solar variability and forecast error assumptions used in the CAISO and PG&E RIMs and the need to correct those gaps before making major new resource commitments based on the modeling results.

In light of the data gaps and uncertainties, LSA agrees with the comments that emphasize the importance of understanding the timing of integration needs and proceeding cautiously.[3] We share concerns that front-loading procurement of integration resources could result in over-procurement and, in the absence of robust data on renewable generation, lead to the development of integration resources that are not appropriately tailored to actual integration requirements. As other commenters observed, based on the CAISO's presently ample reserve margins and the results of its 20% RPS integration study showing that the existing generation fleet is capable of meeting the regulation and load-following requirements in 2012 with 20% renewable generation, the Commission does not need to rush approval of new integration resources in this proceeding.[4] Instead, the Commission should take the time to gather the critical missing data concerning solar performance over the coming year as new units are expected to become operational. It may then develop a well-supported integration plan based on high quality, high resolution measured data in the next Long-Term Planning Proceeding ("LTPP") rather than one based on constructed data and

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("CLECA Comments"), p.3; Comments Of The Vote Solar Initiative ("Vote Solar Comments"), p.6; Comments Of The Utility Reform Network On Renewables Integration Models ("TURN Comments"), p.2; Comments Of The Division Of Ratepayer Advocates On The California Independent System Operator's And Pacific Gas And Electric Company's Renewable Integration Model Methodologies ("DRA Comments"), p. 1; Comments Of The Western Power Trading Forum On Renewable Integration Models ("WPTF Comments"), p.1; Comments Of The Center For Energy Efficiency And Renewable Technologies On Renewables Integration Models ("CEERT Comments"), p.5.

[3] *See* CAISO Comments, p.3; DRA Comments, p.7; WPTF Comments, p. 7; Vote Solar Comments, p. 2., Comments Of Calpine Corporation On Renewables Integration Models ("Calpine Comments"), p. 6.

[4] *See* ISO Study of Operational Requirements and Market Impacts of 20% RPS (September 17, 2010) ("CAISO 20% RPS Study"), p. 92.
Available at: http://www.caiso.com/2812/281211b8156550.pdf.. *See also* TURN Comments, p.2; DRA Comments, pp. 1, 7; Calpine Comments, p. 6.

conjecture in this LTPP. LSA accordingly joins with the multiple commenters who have called for the Commission to undertake a "least regrets" approach in this LTPP.[5]

## II. RESPONSE TO OPENING COMMENTS

LSA concurs with the comments that emphasized the importance of producing data and developing an understanding in this LTPP of the following renewable integration-related topics (Issue II):

- model results for years before 2020 to understand the timing of the need for new resources;[6]
- examination of how greater flexibility could be obtained using existing resources, including hydro and self-scheduled generation;[7]
- definition of the frequency and duration of integration needs;[8]
- exploration of CAISO operational and market changes to improve integration and reduce integration costs, including sub-hourly scheduling;[9]
- consideration of the potential impacts of enhanced balancing area cooperation;[10] and
- examination of a range of alternatives for integration which assume continued technology progress.[11]

With respect to validation of the CAISO 33% Renewable Integration Study (Issue III.B), the Commission should also review the CAISO's financial modeling, including the impact of its market pricing assumptions on merchant renewable projects and on gas-fired generation retirement scenarios. The CAISO's 20% RPS integration study provides an initial look at potential changes in energy market revenue in a 20% RPS case relative to a 2012 base case. (CAISO 20% RPS Study, p. 90) As the study notes, further analysis is needed to

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[5] *See, e.g.,* CAISO Comments, p. 4; CLECA Comments, p. 3; Post-Workshop Comments Of Southern California Edison Company(U 338-E) On Renewable Integration Models ("SCE Comments"), p. 3.
[6] *See* note 3, infra.
[7] Vote Solar Comments, p. 4; CLECA Comments, pp. 5-6; Comments Of Sierra Club California On Ruling Requesting Comments On Renewables Integration Models (Sierra Club California Comments"), pp. 5-6.
[8] Vote Solar Comments, p. 3; CLECA Comments, p. 7; Calpine Comments, p. 7.
[9] CEERT Comments, p. 5; Vote Solar Comments, p. 3.
[10] Vote Solar Comments, p. 3.
[11] DRA Comments, p. 9; Comments Of The Green Power Institute On The Renewables Integration Models ("GPI Comments"), p.2.

understand the interplay between energy market prices and high levels of renewable generation with extremely low marginal operating costs. (Id. at p. 93) The interaction needs to be understood not only in terms of the revenue impact to generation resources contributing to system flexibility, but also to the energy costs ultimately reflected in retail customers bills. While the immediate focus of the CAISO studies is on the integration challenges and costs associated with increasing levels of renewable generation, the Commission must also evaluate the potential for reduced energy market prices and other cost savings, such as reduced carbon emission costs, to offset any increases in integration costs.[12]

With respect to the solar profile assumptions used in the CAISO and PG&E RIMs (Issues III.A.d and IV.A.d), LSA strongly endorses the comments pointing out the problems with the solar variability and forecast deviation data used in the models, and the need to obtain real data from real solar projects in geographically diverse locations, as more projects deploying an array of technologies start to operate across California and the rest of the WECC.[13] As the CAISO observes in its comments, "the experience with modeling the level of variability associated with large scale solar PV geographical diversity is very much in the early stages. In two years, it can be expected that the body of knowledge on this topic will increase greatly as it is informed by actual data of larger scale PV projects. (CAISO Comments, pp. 3-4) We discuss our concerns in greater detail below, in response to the supplemental questions presented in the ALJ's October 1, 2010 email.

CalWEA proposes to remove solar thermal resources from the diversity factor calculation for purposes of forecasting wind and PV solar Net Qualifying Capacity (NQC) in the LTPP modeling. CalWEA's analysis shows that the current NQC counting rules are disconcertingly sensitive to the categorization of resources as either intermittent or not intermittent. The analysis also discloses that the NQC rules rely on broad resource categories that fail adequately to reflect significant differences among technology types. The results

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12 The Western Wind and Solar Integration Study ("Western Integration Study"), which was prepared for the National Renewable Energy Laboratory ("NREL"), examined the impact of up to 35% renewables on the WestConnect group of utilities in Arizona, Colorado, Nevada, New Mexico and Wyoming. The study found that in the 30% case, WECC annual operating costs would be 40% lower due to reduced fuel and carbon emission costs. GE Energy, Western Wind and Solar Integration Study (May 2010), NREL Report No. SR-550-47434, p. 16. www.nrel.gov/wind/systemsintegration/pdfs/2010/wwsis_final_report.pdf

13 *See* Comments Of The Interstate Renewable Energy Council On Step 1 Of The Renewables Integration Models, p.3; CAISO Comments, pp. 3-4; DRA Comments, p. 11; Vote Solar Comments, p. 5.

also raise flags about whether the methodology is fair, since CalWEA's analysis suggests that the system diversity benefits are not being properly attributed to the producers of the energy creating the diversity benefits. These deficiencies demonstrate the need for the NQC counting rules to be reexamined at an early date before significant amounts of additional solar and other renewable resources become operational.

LSA's more immediate concern here is with the factual predicate for CalWEA's proposal: "During the peak summer hours over which [Resource Adequacy] capacity is counted (1 p.m. to 6 p.m. daily), solar thermal is not an intermittent technology; it is forecasted to operate with a capacity factor of 96% to100% during these hours." (CalWEA Comments, pp.10-11) While the CAISO's 33% RPS study presentation at the August does not explicitly describe the basis for the solar thermal assumptions, it does state that "Solar Thermal ranges from 91% of nameplate to 99% (result of high capacity factor units from RETI study)."[14]

If the CAISO and PG&E RIM methodologies indeed assume that all solar thermal resources will have a summer peak capacity factor that exceeds 95%, there is a more fundamental problem in play than the NQC diversity factor calculation. While solar thermal plants with significant storage or supplemental gas firing can reach these capacity factors, other solar thermal technologies and configurations will not. Assuming a 95% or greater capacity factor for peak solar thermal performance strongly suggests that the assumption has been derived from a single or small subset of solar thermal technologies that do not adequately represent the solar thermal generation expected to deliver to California markets in the study period. The CAISO and PG&E need to detail the solar thermal performance assumptions used in their RIMS, and explain the derivation of those assumptions. LSA strongly recommends that the Commission continue to update the modeling inputs as solar thermal generation develops and new generation data becomes available.

LSA disagrees with SDG&E's proposal for the CPUC and CAISO to endorse a policy of allocating integration costs to non-dispatchable renewable resources. As SDG&E itself

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14 *See* ISO Study of Operation Requirements and Market Impacts at 33% RPS (August 24, 2010), slides 104-105. Available at:http://www.cpuc.ca.gov/PUC/energy/Renewables/100824_workshop.htm
The CAISO's reference to RETI does not sufficiently clarify the basis for its assumptions. The RETI Phase 1B and 2B studies used parabolic trough without storage as a proxy for all solar thermal technologies, but also presented performance data with storage. (Renewable Energy Transmission Initiative Phase IIB Final Report, May 2010, pp. 4-5, 4-6, 7-21). Available at http://www.energy.ca.gov/reti/documents/index.html

points out, there is a basic lack of understanding of the models and their assumptions, and an overly narrow focus on using conventional gas-fired resource to meet integration needs. According to SDG&E, the "workshop presentations highlight the fact that a great deal of analysis is still required to determine how best to integrate higher levels of renewable power" and "many questions regarding the proposed methodologies remain unanswered and more analysis is required to determine whether either model produces results that can be relied upon in making resources commitments." (SDG&E Comments, p. 2) The CAISO's 20% RPS integration study demonstrates that integration challenges arise not simply from the addition of new wind and solar generation, but from the combined impact of all non-dispatchable generation delivering to the CAISO grid. (CAISO 20% RPS Study, p. 92)

Until both the problem and the full range of potential solutions are much better understood, it is premature to even address, let alone adopt, cost allocation policies as SDG&E has urged. LSA lauds the efforts of the CPUC and CAISO in gathering stakeholder input in evaluating the appropriate market changes and policy mechanisms to meet the state's renewable goals. CPUC and CAISO endorsement of a particular approach for allocating integration costs now would be particularly inappropriate in light of the ongoing processes to address integration based on thorough review and full stakeholder input.

Some parties recommend considering curtailment of wind and solar generation to address integration concerns.[15] While curtailment should be considered as part of the array of potential options to provide adequate flexibility for system operational needs, the possibility of obtaining greater flexibility from all types of resources must first be thoroughly reviewed (i.e., creating and appropriately compensating new or revised capacity products). Among the questions that should be examined are whether fundamental safety, environmental, resource or technology constraints drive the base load or non-dispatchable treatment accorded to a particular type or unit of generation, or whether the drivers instead are contractual or permit restrictions that can potentially be revised, economic calculations that can be adjusted, or simply historic practice that should be revisited. Wind and solar generation should not be curtailed just because they are the newest kids on the block. Curtailment of renewable resources that provide carbon-free energy at extremely low marginal operating costs should be a last resort, not a first.

[15] See CLECA Comments, p. 5; Calpine Comments, p. 1; SDG&E Comments, p. 4; SCE Comments, p. 8.

## III. RESPONSE TO SUPPLEMENTAL QUESTIONS

LSA responds to Questions 1 and 2 of the supplemental questions contained in the ALJ's October 1 email, and reserves comment on the remaining questions.

*1) With regard to the data used to develop wind and solar generation profiles:*
*a) Is the data used by CAISO and PG&E adequate and appropriate?*
*b) If the data inadequate or inappropriate, what alternative data is currently publicly available?*
*c) Would using any alternative data have a material impact on the model's results? Please explain.*
*d) What impact would changing the data have on the timing of the release of updated model results with the updated assumptions that will be employed in the 2010 LTPP cycle?*

The solar generation profiles used in the CAISO and PG&E models should be thoroughly vetted and updated to reflect new research.[16] This research strongly suggests that the CAISO's solar generation assumptions do not adequately reflect the dampening impacts of geographic diversity on variations in aggregate solar PV generation and therefore significantly overstate short-term solar variability. At minimum, the CAISO's assumptions should be updated to incorporate the findings of this research.

Without opportunity for review of the technical appendices to the CAISO's 33% RPS study presented at the workshops, the details regarding the actual source of the data and the methodology used to construct profiles for new resources remain unclear. The information describing solar generation profile development that the CAISO has published is not adequate to assess the accuracy of the methodology. In addition, before this profile data should be deemed appropriate for use in integration studies, it should be validated based on actual solar generation.

While the CAISO provided some information about how it developed the profiles, the CAISO did not include information describing the character of the profiles, which limits

[16] *See* Implications of Wide-Area Geographic Diversity for Short-Term Variability of Solar Power, Andrew Mills and Ryan Wiser, Lawrence Berkeley National Laboratory (September 2010).
Available at: http://eetd.lbl.gov/ea/ems/reports/lbnl-3884e.pdf

assessment of whether the profiles are appropriate. Additional data that would help assess the generated profiles include:

a. MW/minute ramps for facilities
b. Ramp duration
c. Ramp frequency
d. Single plant and aggregated profiles: standard deviations of ramps and duration curves (similar to the data presented for regulation in the CAISO's 20% RPS Study)

The data used for the CAISO's analysis appears to have been created by extrapolation from limited operational performance rather than observation of the actual performance of multiple solar plants. According to Vote Solar's Comments (pp. 5-6), the CAISO derived its assumptions about PV solar variability from limited operational data taken from a single plant. If additional data finds that larger projects have less variability or if the correlation between sites is lower than assumed in the CAISO's model, then the resulting amounts of regulation and load following may be reduced materially.

In addition, as discussed earlier, the CAISO's solar thermal profile appear to be based on a single or small subset of solar thermal technologies or plants. Other types of solar thermal plants will have different ramping and operating characteristics. Reliance on a single technology such as parabolic trough will not adequately represent the solar thermal generation expected to become operational during the LTPP planning period. Roughly half of the more than 4,000 MW of solar thermal projects approved or pending approval by the California Energy Commission represent parabolic trough technology, but the rest represent solar tower or solar dish Stirling systems.[17] LSA is also concerned that extrapolating solar thermal ramps based on one technology will not produce profiles representative of the solar generation from other technologies, and may not accurately reflect the contribution of solar thermal resources to the morning and evening ramps. Examination of the ramping and operating characteristics of multiple solar thermal technologies will provide better insight into integration issues associated with solar thermal generation. In light of the limited data on solar generation, the current models cannot adequately describe the integration needs of solar generation across the California grid.

[17] *See* California Energy Commission, Energy Facility Status, Power Plant Projects Since 1996, Updated: Oct. 6, 2010. Available at: http://www.energy.ca.gov/sitingcases/all_projects.html

The solar generation profiles used in PG&E's RIM, which were taken from the CAISO's work, likewise require further explanation and updating.[18] At the August 25, 2010 workshop, Philip Hanser, a principal of the Brattle Group and member of the team that created PG&E's RIM, emphasized the paucity of the data underlying the renewable generation variability profiles used in the PG&E RIM as well as other integration analyses. He stated that the lack of granular historical data tracking moment to moment variability in renewable energy output has created challenges to all renewable integration analyses. He discussed the lack of sufficient historical data to assess changes in renewable generation variability from location to location, and between different technologies. According to the Brattle Group presentation at the August 25, 2010 workshop, the "[l]ack of granular historical data requires using assumptions to forecast future renewable energy production patterns" and "[t]hese intra-hour volatility assumptions drive results."[19]

A special report of the North American Electric Reliability Corporation (NERC) entitled "Accommodating High Levels of Variable Generation" reinforces the Brattle Group's observations about the problems with the variability data that have been used in renewable integration studies. According to the NERC special report,

> The necessary detailed data sets to study all types of variable generation are not yet available. To ensure the validity of variable generation integration study results, high-quality, and high resolution (sub-hourly if possible) output data is required. Currently, historical data of variable generation performance is very limited and difficult to obtain. As substantial amounts of variable generation are expected to be added to the bulk power system during the next ten years, industry must begin obtaining the data as required to design robust bulk power systems. To this point in time, extensive modeling has been used to generate simulated data either directly or indirectly from historical weather data. The use of indirect data is far from ideal and, as real data becomes available, the validity of original results should be reviewed.[20]

Failure to utilize the best available forecasting and variability information could significantly exaggerate the integration requirements of both large scale and geographically

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[18] *See* Notice Of Availability Of Pacific Gas And Electric Company's (U 39 E) Renewable Integration Model And Results (August 16, 2010), Appendix A, p. 9.

[19] The Brattle Group, Renewable Integration Model Presentation LTPP Workshop (August 25, 2010), Slide 4. Available at http://www.cpuc.ca.gov/PUC/energy/Renewables/100824_workshop.htm

[20] North American Electric Reliability Corporation, "Special Report: Accommodating High Levels of Variable Generation (April 2009), p 46. Available at http://www.nerc.com/files/IVGTF_Report_041609.pdf

dispersed solar generation.[21] As high frequency, high resolution data regarding actual solar generation performance from multiple plants and locations becomes available, the data must be used to update and validate all modeling efforts submitted in this proceeding. If the modeling work in this proceeding cannot be timely updated, then even more focus must be given to questions about the timing of required new system integration resources and the need for the Commission to authorize them in this proceeding based on incomplete and flawed data, rather than consider them in the next LTPP when significantly better data will be available. Lagged updates would also provide additional impetus for the Commission to pursue a "least regrets" approach in this proceeding.

*2) With regard to adjusting forecast errors associated with renewable generation to reflect the geographic diversity of generation:*

*a) What inputs and methodologies for development of wind and solar forecast errors should be used?*

*b) Would using this data have a material impact on the model's results? Please explain.*

*c) What impact would changing the data have on the timing of the release of updated model results with the updated assumptions that will be employed in the 2010 LTPP cycle?*

The CAISO study uses a persistence model for forecasting solar output. Further, the solar forecast errors in the study were calculated based on a generated output profile (as opposed to an actual profile). At a minimum, the forecast errors resulting from this approach should be verified relative to actual plant output. To determine the best approach to use in the RIM methodologies, the adequacy of various forecasting strategies should be assessed by looking at their relative ability to forecast accurately the actual output of solar generating facilities. The strategy with the lowest forecast errors based on the actual output of a solar generating facility should be selected and the associated forecast errors should be used in the modeling efforts as representative of current "state-of-the-art" forecasting.

Significant R&D attention is being placed on development of alternate forecasting strategies, which may improve forecast accuracy. The forecast error assumptions should consider use of current state-of-the art forecasts, but should also examine the impacts of advancements in forecasting, particularly of solar generation. In testimony to the U.S. House of Representatives Committee on Science and Technology on June 16, 2010, Dr.

[21] *See* fn. 16, above.

David Mooney, Director of the Electricity, Resource and Building Systems Integration Center of the National Renewable Energy Laboratory, stated that "[w]hile today's state-of-the-art [wind and solar generation] forecasts are proving to be very valuable in renewable generation adoption, there remains considerable room for improvement."[22] He also noted that because much more wind generation has been installed in the United States than solar generation, the "state-of-the-art forecasting is therefore more advanced for wind than it is for solar." He explained:

> The errors in solar forecasting are primarily the result of forecasting errors in how clouds form and dissipate at different layers in the atmosphere. This involves complex physical processes, and better understanding and representation of these processes will lead to better solar forecasting.[23]

It is therefore reasonable to assume that as more solar generation is installed, state-of-the art solar forecasting will advance and become significantly more accurate.

The simplest and most straight-forward approach for evaluating the potential impacts of improvements in wind and solar generation forecasts is to consider cases in which zero forecast error is assumed. In both its 33% and 20% RPS studies, the CAISO examined forecast sensitivities based on current forecasting, improved forecast error, and zero forecast error.[24] The CAISO's "Improved Forecast Error" assumes that the solar forecast errors for summer and fall months are reduced by 50% from what the CAISO describes as "current forecast errors", while the error for spring and winter months remain unchanged. The rationale for limiting the "Improved Forecast Error" to the summer and fall months is unclear, and requires further review. In addition, the "Improved Forecast Error" should reflect the potential for adoption of finer-grained time intervals for forecasting, which should reduce forecast errors. A greater ability to forecast in the sub-5 minute timeframe would allow the use of lower reserves.

The degree of forecast error has a significant impact on model results. Qualitatively, a more accurate forecast would lower requirements for load following, improve the operating

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[22] Written Statement of Dr. David Mooney, Director, Electricity, Resource and Building Systems Integration Center, National Renewable Energy Laboratory, Presented to the U.S. House of Representatives Committee on Science and Technology, Subcommittee on Energy and Environment, p.2. http://gop.science.house.gov/Media/hearings/energy10/jun16/Mooney.pdf

[23] Id. at pp. 5-6.

[24] CAISO 33% Study, slide 59; CAISO 20% Study, Appendix A, p. A-17.

strategy for regulating reserves and allow the grid management to be more proactive. The CAISO's 33% study presented at the August workshop shows that forecast error assumptions substantially affect its load-following results. (CAISO 33% Study, slide 85) According to the sensitivity analysis performed as part of the CAISO's 20% RPS study, "a 10 percent improvement in forecast error could result in a reduction in several hundred MW of load following capability in the upward and downward direction." (CAISO 20% Study, Appendix A, p. A.20) NREL's Western Wind and Solar Integration Study ("Western Integration Study") found based on a 27% wind and solar penetration that use of day-ahead wind and solar forecasts in operations, compared to not using a forecast at all, would save $5 billion per year across the Western Electricity Coordinating Council.[25] The Western Integration Study also showed that if the forecast were perfect, those savings would increase by 10% or about $500 million per year. These studies and others strongly indicate that forecast error assumptions will have a material impact on the CAISO and PG&E RIM results.

## IV. CONCLUSION

LSA appreciates the opportunity to comment on CAISO and PG&E RIM methodologies presented at the August 24-45 workshops, and looks forward to working with the CAISO and other parties to develop better assumptions for the integration studies, particularly regarding solar generation performance.

Respectfully submitted,

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October 8, 2010

[25] GE Energy. May 2010. Western Wind and Solar Integration Study, NREL Report No. SR-550-47434, p. 20. www.nrel.gov/wind/systemsintegration/pdfs/2010/wwsis_final_report.pdf

## CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the foregoing ***Comments of the Large-Scale Solar Association ("LSA") on Procurement Requirements Summary Document (A.K.A. "Rulebook") – Track III*** on all parties of record in R.10-05-006 by transmitting an email message with the document attached to their email addresses of record and, for those parties without an email address of record, by mailing a properly addressed copy by first-class mail with postage prepaid to each party on the Commission's official service list for this proceeding.

This Certificate of Service is executed on October 8, 2010, at Berkeley, California

*/s/ Linda Agerter*
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R.10-05-006

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