

**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 10-05-006

**POST NOVEMBER 30, 2010 WORKSHOP REPLY COMMENTS OF THE
LARGE-SCALE SOLAR ASSOCIATION**

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I. INTRODUCTION

In accordance with the December 23, 2010 ruling by Administrative Law Judge (“ALJ”) Allen Requesting Post-Workshop Comments (“Ruling”), the Large-Scale Solar Association (“LSA”) submits reply comments responding to the comments filed on January 14, 2010 regarding the November 30, 2010 workshop on renewable integration modeling results.

Like LSA, many parties prefaced their responses to the detailed questions posed in Appendix A of the Ruling with expressions of concern for the intended use of the models in this proceeding. Success in meeting California’s renewable energy and greenhouse gas reduction goals depends on developing a deep understanding of how electric system operations can optimally accommodate high levels of renewable generation. LSA greatly appreciates the contribution that the considerable efforts of the California Independent System Operator (“CAISO”), Pacific Gas and Electric Company (“PG&E”) and Commission staff in this proceeding have made to the understanding of renewable integration challenges and opportunities. However, it is also increasingly clear that the current schedule for Track I of this Long Term Plan Proceeding (“LTPP”) does not give the integration analysis now underway adequate time to address, let alone incorporate, answers to basic questions related to the

performance of renewable technologies, the potential to accommodate higher levels of renewable generation through modification of grid market rules and operational practices, and alternative ways of meeting the remaining system flexibility needs that are more in line with the Energy Action Plan II's preferred loading order than the conventional gas-fired resources analyzed to date.

As discussed below, LSA believes that the issues and questions regarding the integration analysis identified in the comments and in the Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory report entitled "Review of PG&E Renewable Integration Model and CAISO 33% RPS Analysis" attached to the Ruling ("LBNL/NREL report") must be addressed, even if the Track I schedule has to be extended to accomplish those revisions. LSA also contends that the solar variability and forecast assumptions must be revised to reflect the best available data and research. LSA objects to proposals to allocate ill-defined integration costs to variable renewable resources as premature and inappropriate. Finally, LSA urges careful scrutiny and appropriate revision of integration cost categorizations.

II. DISCUSSION

A. The Shortcomings In The Integration Analysis Identified In Comments And In The LBNL/NREL Report Should Be Corrected Notwithstanding Delays To The Track I.

Many parties have expressed concern with the limitations of the current renewable integration analysis and cautioned that its use in this LTPP should be circumscribed accordingly. These parties include the CAISO. In earlier comments, the CAISO stated:

...[T]he level of unknowns and the likelihood that our understanding and technologies will change significantly over the next few years is great. For example, 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. For this reason, the ISO recommends the Commission and stakeholders seize the opportunity presented by the LTPP to seek to understand the variables of the renewable integration, potential methodologies, and use the body of data available and information at this point to identify the minimum measures that must be taken now to allow for the process to mature and evolve between now and the anticipated 33% RPS objective in 2020.¹

¹ Comments of the California Independent System Operator Corporation on Renewable Integration Model Methodologies, Sept. 21, 2010, pp. 3-4.

Many parties made similar observations in the January 14, 2010 comments², just as they did in prior comments.³

Much of the discussion in the January 14 comments focused on whether the issues and questions regarding the integration analysis identified in comments or described in the LBNL/NREL report need to be addressed even though such revisions would require delay to the Track I schedule. In LSA's view, the immediacy of the need for addressing these issues depends on the intended use for the results. The December 3, 2010 Scoping Memo suggests that the results of the integration analysis may be used to make transmission and RPS procurement decisions in other proceedings as well as to determine the need for new system resources in this proceeding. LSA contends that these ambitions for the use of the renewable integration modeling results must be adjusted in recognition that, as The Utility Reform Network ("TURN") observed, only rough approximations of integration needs can be developed under the current schedule for this proceeding.⁴ While the analysis is being refined, and while the appropriate regulatory framework and market design are being developed,⁵ such rough approximations provide an insufficient foundation for major resource commitments or procurement decisions in this or other proceedings. As many parties have pointed out, the rough nature of these estimates at minimum necessitate a "least regrets" approach to examine the need for new system resources

² See Comments Of Sierra Club California Following November 30, 2010 Workshop On Renewable Integration Methodologies And Response To Administrative Law Judge's Ruling Regarding Planning Assumptions, p. 3; Fit Coalition Comments On Renewables Integration Models 3rd Phase 1 Workshop, p. 1; Comments Of The Vote Solar Initiative, p. 2; Comments Of The California Wind Energy Association On Renewable Integration Modeling Methodologies Per ALJ Allen's Ruling Of December 23, 2010, pp. 2-3; Responses Of The Division Of Ratepayer Advocates To Questions Concerning Renewable Integration Model Methodologies, p. 11; Pacific Environment's November 30 Workshop Comments, p. 2 ; Comments Of The California Large Energy Consumers Association In Response To The ALJ's Ruling Requesting Comments Following The November 30, 2010 Workshop, p. 6.

³ See Comments Of The California Independent System Operator Corporation On Renewable Integration Model Methodologies (Sept. 21, 2011), 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 (Sept. 21, 2011), p.3; Comments Of The Vote Solar Initiative (Sept. 21, 2011), p.6; Comments Of The Utility Reform Network On Renewables Integration Models (Sept. 21, 2011), 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 (Sept. 21, 2011), p. 1; Comments Of The Western Power Trading Forum On Renewable Integration Models (Sept. 21, 2011), p.1; Comments Of The Center For Energy Efficiency And Renewable Technologies On Renewables Integration Models (Sept. 21, 2011), p.5.

⁴ Comments of the Utility Reform Network in Response to December 23 ALJ Ruling (Jan. 14, 2011), p. 2.

⁵ E.g., the CAISO's initiative to address market design for purposes of renewable integration and the CPUC's possible consideration of operational attributes in the annual RA proceeding.

in this proceeding. In this circumstance, LSA encourages the Commission to address the issues and questions identified in the LBNL/NREL report and party comments as soon as possible.

However, if the more ambitious uses identified in the December 3, 2010 Scoping Memo are intended, the schedule must be revised to provide the needed time up-front to develop answers to the fundamental questions repeatedly raised in party comments which must be resolved if the results of the integration analysis are to drive major resource commitments and procurement decisions. The schedule should also incorporate the time required to validate the results against operational data and conduct sensitivity tests for key model assumptions such as forecast error, as discussed further below. Moreover, as suggested in the LBNL/NREL report at pages 51-52, and as also conducted in the CAISO's study of integration under a 20% RPS, LSA endorses additional "stress tests" of particular days that provide more focused simulation of hourly and intra-hourly conditions in order to obtain further insight into whether the hourly production simulation models used so far are appropriately estimating the generation fleet's operational capabilities.

The Assigned Commissioner's And Administrative Law Judge's Scoping Memo For Track II Bundled Procurement Plans issued on January 13, 2011 in this proceeding provided extremely helpful clarification of the purpose and scope of Track II. While LSA appreciates the guidance regarding Track I objectives contained in the Dec. 3, 2010 Scoping Memo, additional clarification for Track I comparable to that provided for Track II would greatly assist resolution of the debate over the critical work and priorities for Track I. Both parties and the Commission would benefit from additional clarification about the Commission's overall goals and intended outcomes for Track I. Such clarification would help ensure that participants focus on the key aspects of the modeling and integration planning needed to support these outcomes.

B. Solar Forecast And Variability Assumptions Should Be Revised

LSA disagrees with PG&E's claim that the "T-2 persistence method is the most realistic assessment of the forecast errors that can be demonstrated today." LSA also disputes its assertion that the CAISO's "Improved Error" assumptions are not reasonable, because they

cannot be demonstrated today.⁶ The May 2010 North American Electric Reliability Council (“NERC”) report referenced in LSA’s Jan. 14, 2011 comments discusses multiple forecast methods in addition to the persistence method which are already used to forecast wind generation and are available for use in forecasting solar generation.⁷ Moreover, the NERC report observes that solar forecasting can benefit from an additional method as well, as “[s]hort-term solar power forecasts are aided by the fact that clouds can be observed” and “[s]ky imagers near solar plants can be used to indicate approaching clouds and predict the impact the clouds will have on output.”⁸ The NERC report also anticipates improved forecasting, noting that “solar power forecasting will benefit from further development of weather models and datasets.”⁹

LSA’s comments also discussed a study of two solar forecasting methods that significantly outperform the persistence method.¹⁰ One method is operationally employed by transmission system operators in Germany and has already achieved accuracy levels in the same range as current operational wind power prediction systems. The other method is a new approach that the study concludes will result in considerable improvement in the existing operational method. Reliance on the lessons derived from an operationally deployed forecast method better responds to PG&E’s call for “actual data and actual forecasts” than does use of a T-2 persistence forecast method.¹¹

In LSA’s view, it is entirely realistic to expect that multiple and evolving forecast methods will be used to develop increasingly accurate forecasts of solar generation by 2020. What is unrealistic is the assumption that in 2020 solar forecasting will rely just on the persistence method. It is equally unrealistic to assume that those forecasts will be no more accurate in 2020 than they were in 2010, notwithstanding exponential increases in world-wide solar generation and the lessons from a decade of operational experience and new research. For example, on Jan. 24, 2011, the U.S. Departments of Energy and Commerce announced an

⁶ Pacific Gas and Electric Company, Comments On Renewable Integration Models (Jan. 14, 2011), p. 2.

⁷ North American Electric Reliability Council (“NERC”), NERC IVGTF Task 2.1 Report Variable Generation Power Forecasting For Operations (May 2010), pp. 7-9.

⁸ *Id.* at p. 9.

⁹ *Id.*

¹⁰ Elke Lorenz, et al., *Regional PV Power Prediction for Improved Grid Integration*, Progress in Photovoltaics, Sect. 5.1 & Tables I, II (Published online Sept. 8, 2010), <http://onlinelibrary.wiley.com/doi/10.1002/pip.1033/full>.

¹¹ Pacific Gas and Electric Company, Comments On Renewable Integration Models (Jan. 14, 2011), p. 2.

agreement to collaborate on renewable energy modeling and weather forecasting.¹² Moreover, as the LBNL/NREL report notes, high solar forecast errors will create incentives to invest in improved forecasting, since “[i]t may be significantly less expensive to improve forecasting capabilities than it would be to build new conventional capacity to stand-by to balance large forecast errors”¹³ Further, those existing or new conventional plants may be operating at low efficiency to provide reserves, emitting greenhouse gases at higher levels and thus raising their operating costs. With improved forecasting, both capital and operating costs of conventional generation providing integration services would be reduced. In addition, LSA notes also that there will other economic incentives that could foster increased attention to improved forecasts, such as the participation in the CAISO day-ahead market of convergence bidders who will be seeking to forecast next day market prices. LSA therefore urges assuming that solar forecast error rates become at least as low as those for wind and that the sensitivity cases examine both significantly improved and, as an upper bound, zero forecast errors.

PG&E also recommends against changing solar variability assumptions based on Tom Hoff’s research presented at the Nov. 30, 2010 workshop. PG&E states that it expects Hoff’s methodology will yield values similar to those used by PG&E over longer time intervals. PG&E cites to Hoff’s Slide 16 showing a 0.28% variability of PV installed capacity for a 1 minute time interval, and compares that number to PG&E’s assumed variability for a 5 minute time interval of 0.6% to 1% of PV installed capacity.¹⁴ According to PG&E’s documentation of the RIM inputs, PG&E derived these 5 minute variability assumptions from the CAISO’s “1 minute simulated actual generation.”¹⁵ As pointed out in LSA’s January 14 comments at page 5, unlike the PG&E and CAISO assumptions, the 0.28% of PV fleet capacity from Hoff’s model represents a worst case scenario situation only. Yet, the 0.28% variability factor is almost a third lower than the CAISO’s assumed 1 minute variability of 0.41% of PV fleet capacity averaged over the full year. Since PG&E’s 5 minute interval assumptions are derived from the CAISO’s 1 minute variability data, Hoff’s reduced variability findings have direct applicability to PG&E’s

¹² See Press Release, Departments of Energy and Commerce Announce New Partnership to Further Cooperation on Renewable Energy Modeling and Forecasting, available at <http://www.energy.gov/news/10024.htm>

¹³ LBNL/NREL report, p. 57.

¹⁴ Pacific Gas and Electric Company, Comments On Renewable Integration Models (Jan. 14, 2011), p. 3 and n.1.

¹⁵ Notice Of Availability Of Pacific Gas And Electric Company’s (U 39 E) Renewable Integration Model And Results (August 16, 2010), Appendix: Documentation of RIM’s Inputs, p. 12.

variability assumptions, and should not be dismissed without more compelling justification than PG&E has so far provided.

The failure to account properly for geographic diversity will overstate solar variability, forecast error, flexibility needs, and integration costs. According to the LBNL/NREL report, the methods underlying the CAISO and PG&E variability and uncertainty assumptions “may have overstated the hour-ahead forecast error of variable generation by not taking into account the impact of geographic diversity on smoothing hour-ahead forecast errors.”¹⁶ The report emphasizes the importance of ensuring that the forecast error assumptions “are carefully estimated to realistically represent aggregate output profiles for future portfolios of dispersed variable generators.”¹⁷ As discussed above in Section A, if the modeling results are to intended drive significant procurement commitments and policy decisions, the modeling assumptions must be based on the best available data and research.

At minimum, as recommended above and as suggested in the LBNL/NREL report, studies should be performed to assess the sensitivity of the final integration need and cost results to changes in estimates of forecast errors.¹⁸ Southern California Edison (“SCE”) suggests that the CAISO should focus on completing the Trajectory Base and High Load and the Environmentally-Constrained Scenarios before conducting any sensitivity studies.¹⁹ LSA, however, sees little value in completing the scenarios without understanding the sensitivity of the results to changes in assumptions, and urges that higher priority be given to the recommended sensitivity studies.

C. Cost Allocation Recommendations Are Premature And Attribution Of Costs To Renewable Integration Needs Should Be Closely Scrutinized

SCE states that “[i]f additional reserves are necessary to balance these intermittent resources, these reserves should be procured separately from those paid for by load, and the VER generators that are responsible for creating the intermittency that require these additional reserves should be obligated to pay for their procurement.”²⁰ LSA disagrees with SCE’s

¹⁶ LBNL/NREL report, pp. 34-35.

¹⁷ *Id.* at p. 57.

¹⁸ *Id.*

¹⁹ Southern California Edison Company’s Post-Workshop Comments and Responses to Questions Regarding November 30, 2010 Renewables Integration Models Workshop (Jan. 14, 2011), p. 2.

²⁰ *Id.*

proposition for the same reasons that it opposed San Diego Gas and Electric Company's similar proposal in prior comments.²¹

Proposals to allocate the costs of renewable integration on a "cost causation" basis are premature. The CAISO modeling to date has made it clear that analysis conducted ten years before the fact under the LTPP is indicative rather than determinative; moreover, the actual costs will be a function of many variables that can only be actually known in real-time operations associated with the renewable portfolio and particular system conditions in each year (i.e., forecast error, the actual variability, correlation of wind and solar ramps, etc.). Consequently, costs cannot be adequately defined or allocated while the modeling produces only rough approximations of integration needs and the options for meeting those needs have not been fully defined, let alone adequately evaluated. Furthermore, those costs will also be a function of the technologies and price incentives deployed to meet or modify operational requirements. As SCE itself recognizes, "there are other potential future technologies and practices that may prove to be effective for meeting renewable integration needs" beyond conventional generation resources which have yet to be explored.²² SCE recognizes that the cost allocation issue does not belong in this proceeding, even as it raises it.²³ The Commission should confirm that allocation of integration costs is outside the scope of this proceeding.

Moreover, in LSA's view, questions of cost allocation should not be raised in any forum until the Commission and the CAISO, with their respective responsibilities, are prepared to look at these issues broadly for all relevant sources of ancillary service requirements, including all generation, whether existing or new, conventional or renewable. Fundamentally, 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.²⁴ As a result, cost attribution requires a deeper examination than a superficial comparison between incremental resource additions. If the costs of incremental increases in procurement of regulation and possibly existing or newly defined operating reserves (such as a load-following reserve) are to be

²¹ See Reply Comments of the Large-Scale Solar Association ("LSA") On Renewables Integration Models (Oct. 8, 2010), pp.5-6.

²² Southern California Edison Company's Post-Workshop Comments and Responses to Questions Regarding November 30, 2010 Renewables Integration Models Workshop (Jan. 14, 2011), p. 10.

²³ Southern California Edison Company's Post-Workshop Comments and Responses to Questions Regarding November 30, 2010 Renewables Integration Models Workshop (Jan. 14, 2011), p. 4

²⁴ Reply Comments of the Large-Scale Solar Association ("LSA") On Renewables Integration Models (Oct. 8, 2010), p. 6.

charged to new wind and solar generators, then the costs of existing reserves should likewise be allocated in part among existing generators. For example, currently operating reserves exist to ensure system reliability in the event of unplanned outages of major generation and transmission components and other factors.²⁵ Under SCE's logic, all generators that experience or have the potential to experience an outage, especially very large units, are responsible for creating the need for operating reserves and should be obligated to pay some proportional share. While LSA does not concur with either SCE's logic or its recommendation, if SCE's proposal is pursued it should, in principle, be applied even-handedly to all generators that affect ancillary service procurement. Similarly, under a true cost causation approach, the application of this principle would extend to certain large variable loads, which can require regulation procurement. It is not appropriate to single out wind and solar generation to bear system costs that other types of generators and sources of ancillary service requirements do not.

D. The Modeling Methodologies Should Be Revised As Required To Ensure A Better Distinction Between Capacity Added To Meet Load Reliably And Capacity Added To Address Integration Requirements.

Finally, LSA notes that as described in the LBNL/NREL report, some modeling results may be artifacts of the current approach to determining NQC.²⁶ Notably, the RIM model, because it only calculates the operational needs to address incremental load between the base-year and 2020, has the outcome that given the NQC rules for solar, the peak hourly net incremental load shifts at fairly low solar penetration from the daily peak load hours to the shoulder load hours.²⁷ As a result, as solar capacity increases from fairly low levels, the model appears to build additional conventional capacity to serve the new peak net load, ostensibly to meet integration requirements. However, as the report shows, such capacity is being added to serve load, not to serve integration requirements; the model does not appropriately distinguish

²⁵ As per the CAISO Business Practice Manual (BPM) for Market Operations: "CAISO establishes minimum AS requirements for the "Expanded System Region," for each AS type, taking into consideration: Hydro-thermal Supply resource proportions; Path Contingency deratings; Path Operating Transfer Capability (OTC); [and] Largest single Contingency (on-line Generating Unit). CAISO may establish minimum and/or maximum AS procurement limits for each AS Region, taking into consideration one or more of the following factors: Hydro versus thermal Supply resource proportions; Path Contingency deratings; Path OTCs; Largest single Contingency (on-line Generating Unit or in-service transmission); Forecasted path flows; [and] Other anticipated local operating conditions for Load and/or Generation pocket AS Regions. (65-66).

²⁶ See discussion in LBNL/NREL report, Appendix, pp. 60-79.

²⁷ LBNL/NREL report, p. 68, figure 11.

between these causation factors. The CAISO model, in contrast, uses total (rather than incremental) 2020 load in its simulations. According to the LBNL/NREL report, the NQC calculation does not assign enough capacity value to solar to create this effect in the CAISO model at around 33% RPS, but likely would at higher RPS.²⁸ The upshot is that the RIM model contains distortions in the evaluation of integration needs created by the NQC rules for solar. These must be addressed before this model is used, even simply as a screening tool for integration costs of alternative renewable portfolios.

Apart from suggesting that the RIM model revisions, the LBNL/NREL report also suggests that NQC be estimated in a way that “integration needs” would be related to generator flexibility and increased operational flexibility requirements while “reliability need” would be based on expectations of the capability of conventional and variable generation to meet demand reliably.²⁹ LSA supports this approach. Even if it is not possible to reexamine the NQC methodology in this proceeding, the resulting categorization of integration and reliability needs should be carefully scrutinized and adjusted as necessary to avoid results that simply reflect shortcomings in the current NQC methodology.

²⁸ *Id* at p. 66.

²⁹ *Id* at p. 62.

III. CONCLUSION

LSA appreciates the opportunity to participate in the November 30, 2010 integration workshop and respond to the parties' comments. LSA urges that the issues and questions regarding the integration analysis identified in the comments and in the LBNL/NREL report be addressed, even if the Track I schedule has to be extended. LSA also recommends that the solar variability and forecast assumptions be revised to reflect the best available data and research. LSA objects to integration cost allocation proposals as premature and inappropriate in this proceeding. Finally, LSA advises that appropriate revisions of the RIM methodology (and the CAISO method if similar issues are identified) be undertaken to ensure a better distinction between capacity added to meet load reliably and capacity added to address integration requirements.

Respectfully submitted,

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January 26, 2011

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the foregoing ***POST NOVEMBER 30 WORKSHOP REPLY COMMENTS OF THE LARGE-SCALE SOLAR ASSOCIATION*** 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 a functioning 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 January 26, 2011, at Berkeley, California.

s/ Linda Agerter

Linda Agerter