BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations	Rulemaking 11-10-023 Filed October 20, 2011

COMMENTS OF THE CONCENTRATING SOLAR POWER ALLIANCE ON THE ENERGY DIVISION STAFF DRAFT PROPOSAL ON EFFECTIVE LOAD CARRYING CAPACITY ASSESSMENT OF WIND AND SOLAR RESOURCES

Introduction

The Concentrating Solar Power Alliance ("CSPA") appreciates this opportunity to provide comments on the Energy Division's January 16, 2014, Staff Proposal entitled "Effective Load Carrying Capacity and Qualifying Capacity Calculation Methodology for Wind and Solar Resources" (the "Staff Proposal").[1] These efforts are important for the Resource Adequacy ("RA") program, to the grid at large in order to appropriately value and induce optimal deployment of wind and solar resources, and to contribute to the Renewable Portfolio Standard ("RPS") and AB 32 climate goals in a cost-effective manner. The concentrating solar power ("CSP") industry can provide high value solutions to achieving RA, RPS, and climate goals while minimizing cost impacts to ratepayers, but only if the RA valuation accurately reflects CSP's capabilities relative to true grid needs.

The CSPA consists of concentrating solar power developers and suppliers who provide CSP technology and thermal energy storage ("TES"), and who seek appropriate recognition of the value these technologies offer to the energy supply — including, the ability to deliver operational flexibility to grid operations. CSP with TES ("CSP+TES") has certain unique attributes, notably the capability to integrate solar energy with low-cost thermal energy storage systems as single, dispatchable power plants. CSP+TES offers high levels of economic benefit, particularly in power systems with high penetrations of renewable energy.[2]

[1] These comments are provided in accordance with the instructions provided in the Staff Proposal, and are being filed and served accordingly.

[2] *See*, e.g., Denholm, P., Wan, Y-H., Hummon, M., and M. Mehos, "An Analysis of Concentrating Solar Power with Thermal Energy Storage in a California 33% Renewable Scenario," National Renewable Energy Laboratory, Technical Report, NREL/TP-6A20-58186, March 2013; Mills, A., and R. Wiser, "Changes in the Economic Value

Over 20 CSP+TES plants are now operating worldwide, with two coming online in the southwestern United States within next six months and one scheduled for completion in 2016 (the latter with a power purchase agreement with Pacific Gas & Electric Company ("PG&E"), which was approved by the California Public Utilities Commission ("CPUC")). CSP+TES projects are eligible for RPS procurement, as well as for compliance with the newly-approved CPUC Storage Procurement Targets. Accurate evaluation of RA credit for CSP+TES, both generic and flexible, is essential to meeting RA reliability goals in the most cost-effective manner, as well as to sending the appropriate signals for future renewable resource development that best serves California energy customers.

The CSPA appreciates the Energy Division's attention to CSP+TES in this stage of the proceeding, distinguishing it from "co-located storage," which will not be addressed at present. As shown in Figure 6 of the Staff Proposal, CSP+TES facilities generally have high Effective Load Carrying Capacities ("ELCC"), reflecting the inherent ability to reliably generate, or be available to generate. The ELCC of a particular CSP+TES project should vary with the amount of storage and energy collection capacity as well as the quality of the solar resource where the project is located. ELCC values will vary more substantially between CSP+TES facilities and CSP facilities that do no incorporate TES. Depending on how ELCC is ultimately calculated, there could also be significant differences between CSP facilities that do not include TES, i.e. between the parabolic trough and power tower technologies. However, when thermal storage is incorporated into CSP facilities, the modeled ELCC ratings may converge, notwithstanding the sub-type of CSP technology deployed.

Given these differences, and the impact these differences could have on the cost and effectiveness of the RA program, the CSPA is concerned that the single category for all solar thermal in the "aggregated ELCC calculation" approach outlined in the Staff Proposal, will not provide accurate values. It is particularly important that the ELCC implementation approach differentiates CSP+TES projects from CSP projects that do not incorporate TES. The Staff Proposal itself demonstrates the need for sub-dividing this category, in Figures 5 and 6, which show the comparative ELCC of CSP without storage and with storage, respectively.

In light of these and other items discussed below, the CSPA offers the following specific comments on key ELCC implementation issues for CSP resources:

1. A single "technology category" for solar thermal is insufficient to attribute Qualifying Capacity ("QC") to this diverse technology grouping. At a minimum, there should be separate categories for CSP+TES, CSP hybridized with other fuels, and for CSP without storage.

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of Variable Generation at High Penetration Levels: Pilot Case Study of California", June 2012b, Lawrence Berkeley National Laboratory, LBNL-5445E, *available at* http://eetd.lbl.gov/ea/emp/reports/lbnl-5445e.pdf.

2. Solar thermal technologies integrated with thermal energy storage require additional modeling capabilities beyond those available in the Strategic Energy Risk Valuation Model ("SERVM") in order to accurately assess ELCC and QC values.

3. A single "modeling region" for Sothern California Edison's ("SCE") Transmission Access Charge ("TAC") Area is insufficient to attribute QC to resources across a massive geography, with diverse weather characteristics that substantially modify solar projects' performance.

4. Energy Division's Staff Proposal to assign QC based on an ELCC calculation for 8,760 hours per year is premature, lacks clear connection to the hours most important for reliability, and is potentially discriminatory.

5. This rulemaking must address "grandfathering" of RA-eligible facilities, as well as the ELCC calculation implications for "non-grandfathered" facilities.

6. A process for evaluating and setting QC for new "technology categories" is essential for technologies and projects under contract and under development, to provide market signals and regulatory certainty necessary for cost-effective attainment of RA, project development and overall resource portfolio procurement.

I. Additional Technology Categories are Required for Solar Thermal

Solar thermal comprises a very diverse technology category, including facilities with thermal energy storage, hybridized with other fuels, and without thermal storage (using parabolic trough or solar power tower technologies). CSP+TES projects will produce a significantly superior ELCC rating compared to CSP projects without storage. The single "technology category" for solar thermal in the Staff Proposal would not recognize the differences demonstrated in the examples shown in Figures 5 & 6 of the Staff Proposal, and thus would create significant implementation problems for the RA program.

In the 2015 RA year, at least three differing solar thermal technologies will be operating on the California grid – 1) parabolic trough without thermal storage, 2) power tower without thermal storage, and 3) parabolic trough with supplemental gas. Each configuration will produce significant variations in the amount of annual electricity generation as well as power output capacity in each hour. The solar energy collection system is one primary factor: parabolic trough utilizes single-axis tracking and power tower utilizes dual-axis tracking. The effect of these differences will be higher power output levels for power tower facilities during shoulder hours, especially in off-peak months. The CPUC should consider the appropriate degree of further categorization for CSP technologies without thermal energy storage, such that ratepayers are not adversely impacted in terms of cost or reliability due to overbroad technology aggregation.

As discussed above, CSP with thermal energy storage facilities will possess significantly higher ELCC than facilities without storage. The integration of thermal storage can be expected to minimize ELCC differences solely based on solar energy collection system types – parabolic trough or power tower. The materiality of any difference in ELCC results will depend on the ultimate modeling approach and implementation by Energy Division; therefore, further separation or sub-categorization for CSP+TES should be evaluated at later date when the modeling has further refined.

In sum, the current Staff Proposal could fail to accurately account for the difference in capacity value with a solar thermal "technology category," potentially resulting in costly and unnecessary over-procurement of RA resources. In order for the CPUC to accurately attribute QC to solar thermal facilities, Energy Division will need to recognize the variation in solar thermal technologies, especially solar thermal with storage.

II. Solar Thermal Technologies Integrated with Thermal Energy Storage Require a Specialized Modeling Approach

The ELCC methodology can provide accurate QC assessment of CSP+TES facilities, but will require a specialized modeling approach to account for CSP+TES plant operation and production specifications. Unlike other solar technologies, a fixed electricity production profile cannot be assigned to a CSP+TES facility and incorporated into the ELCC production simulation. CSP+TES is a unique category of generator because:

1. It is energy-limited by solar irradiance[3], and

2. Its thermal energy storage allows it to shift energy, over the operating day or even over a series of days, to the highest value hours (e.g., the highest Loss of Load Expectancy ("LOLE") hours, as identified in an ELCC analysis, or the highest-priced energy or ancillary service hours).

The National Renewable Energy Laboratory ("NREL") has performed similar analyses to those discussed in the Staff Proposal and applied them to CSP+TES. NREL used the PLEXOS production simulation model to optimize CSP+TES energy production against the hourly prices derived endogenously to the model. In this approach, the forecasted state of the storage charge, derived *ex ante* using the NREL Solar Advisor Model ("SAM") tool, provides an input to the production simulation model. Using a modified hydroelectric storage approach,[4] the system-

[3] While CSP without storage is energy-limited on a daily basis depending on the solar irradiance, CSP+TES can provide output on days without sufficient irradiance for CSP without storage to operate, as it can store thermal energy for longer than 24 hours; however, at some point in time, lack of solar irradiance will deplete facility's ability to generate energy.

[4] *Supra* fn. 1 (discussion in Denholm et al., (2013).

level model then assigns the exogenously derived hourly storage charge to power block operations to maximize value across energy production (or energy production and ancillary services provision).[5] This kind of model can also be run to estimate maximum capacity value, instead of highest value energy production, for example, by placing an adder on the highest LOLE hours since these may differ from the highest value hours for energy production (and ancillary services provision).

To assess the ELCC rating of CSP+TES using the SERVM model, a similar process of adaptation would be required. First, a CSP+TES "technology category" must be established, as noted above. Then, a solar thermal production tool, such as NREL SAM, would generate "fuel" availability based on solar Direct Normal Irradiance ("DNI") data and a pre-determined set of plant technical characteristics, such as solar field size, storage capacity size, minimum generation levels and facility ramp rates. It should be noted that CSP+TES facilities can store energy for more than 24 hours, similar to hydroelectric storage facilities; to accurately model accurately the ELCC value, the SERVM model dispatch and unit commitment time horizon may therefore need to cover more than a single day of operations.

The California ISO ("CAISO") has already adapted its modeling approach to reflect the qualities of CSP+TES in the 2012 LTPP simulations.[6] The CSPA is willing to facilitate any discussions necessary to assist the Energy Division in adapting its ELCC modeling approach to accommodate and accurately model CSP+TES. The Energy Division may also wish to engage NREL to run its model to assist the CPUC in determining the ELCC of CSP projects.

III. A Single Modeling Region for SCE's Transmission Access Charge Area is Insufficient

Energy Division proposes modeling 18 regions ("modeling regions"), and to assess the ELCC for each portfolio of "technology type" in each region. These regions cover large areas that vary widely in the solar characteristics that are critical to determining solar energy performance. NREL's Western Wind and Solar Integration Study, cited in the Staff Proposal,[7] is one of many studies to conclude that geographic location is extremely important for both solar and wind resources, both with respect to "extreme events" as well as "overall variability."[8] While geographic diversity helps smooth differences overall to the benefit of grid reliability, it is simply not the case that all geographies are equal; weather variation within coastal areas can be

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[5] *Supra* fn. 1 (references); *see also* additional references upon request.

[6] This was done to incorporate Solar Reserve's Rice CSP+TES project.

[7] *See* Staff Proposal at fn. 9.

[8] Wind and Solar Integration Study at 93, *available at* http://www.nrel.gov/docs/fy10osti/47434.pdf

expected to produce differing output profiles relative to desert areas with more constant and higher-intensity solar irradiation.

Most concerning, the SCE TAC Area, which is host to a significant portion of the solar resources providing RA to California's investor-owned utilities ("IOUs"), is a massive graphic area with a wide spectrum of weather attributes, ranging from coastal to desert climates. Use of a single weather profile for the entire SCE TAC Area will result in under-crediting resources in higher solar insolation areas and over-crediting resources in lower solar insolation areas. This would create a perverse benefit to existing facilities that are not truly providing the assessed benefit, and, perhaps more importantly, an incentive to future facilities to be located in *worse* solar insolation areas and likely inferior portfolio reliability characteristics, as any increase in costs associated with better insolation areas would not be offset by any formally recognized increase in capacity value – no matter how large the increase in actual reliability value may be. While additional modeling regions, especially for SCE's TAC Area, would create additional permutations and distinct ELCC values, this additional work is necessary in order to avoid perverse and adverse outcomes for state electric reliability and ratepayer cost responsibility.

IV. The Calculation of Effective Load Carrying Capacity Based on 8,760 Hours of the Year Is Premature

The Energy Division proposes to calculate ELCC based on "reliability contributions" during all modeled hours, which would include all 8,760 hours of the year. The decision to expand the hours of observation for reliability assessment purposes, from the hours used for the current Exceedence methodology for QC, to a larger subset of hours particularly 8,760 hours, does not convey any clearly articulated or substantiated benefit; to expand to all hours of the day and year would be premature at this time. This change, applying only to solar and wind resources, would also be discriminatory; conventional resources do not currently have an "all year" reliability requirement for purposes of QC setting. It is not appropriate for *only* wind and solar resources to have a significantly more stringent evaluation approach, and it is not clear that an "all year" reliability requirement would yield increases in actual reliability that merit increased cost or the discrimination against wind and solar resources.

At this time, the CSPA proposes the following alternatives to an 8,760 hour evaluation of ELCC for purposes of QC setting:

1. Until such time other resources, such as thermal, hydroelectric, geothermal, biomass and combined heat and power generators, are assigned QC based on a consistent ELCC methodology, wind and solar resources should be evaluated based on the same Availability Assessment Hours during which these other resources are evaluated.

2. Wind and solar resources should continue to be evaluated for QC based on the current Exceedence hours or a modification of those hours to cover the periods of greatest concern.

3. As identified an alternative in the Staff Proposal, the QC should be set at the higher of the ELCC calculated for all 8,760 hours and the Availability Assessment Hours.

If a subset of hours is selected for evaluating ELCC, Energy Division will need to consider how production will be modeled in the specific hours of interest. For example, the CSP+TES portfolio could be dispatched to maximize ELCC under the current Staff Proposal; however, if a more limited set of hours are evaluated, the CSP+TES portfolio may be dispatched in different manner to maximize ELCC. The SERVM model should allow a resource to obtain its assessed highest value by prioritizing those hours of operation over others. If the alternative approach is selected by Energy Division, as noted in (3) above, then modeling of the CSP+TES portfolio would need to be run twice with presumably different production profiles. That is, simply removing the non-Availability Assessment Hours LOLE contributions from the average monthly LOLE would not be appropriate; rather, two separate production simulations would need to be run to capture different operating profiles under each ELCC evaluation approach.

V. The CPUC Should Address "Grandfathering" of RA Resources Before Implementing ELCC for Wind and Solar Resources

As currently proposed by Energy Division, all resources within the same "technology category" and "modeling region" would receive the same ELCC credit per MW, regardless of when installed or contracted. Under this approach, referred to herein as "No-Grandfathering," new resources as of the 2016 RA Year would be assigned the same ELCC value as existing resources. The disadvantage of this approach is that resources designed to meet the reliability needs perceived contemporaneously with their development – and for which financing assumptions depend on a stable RA value – could find that a changing resource portfolio erodes that RA value overtime. This, in turn, could destabilize investment and chill innovation that could reduce costs to meet reliability needs.

Alternatively, new resources – either yet to be contracted or installed – could be grouped into new "categories," while existing resources are retained in historic categories. This approach could be referred to as "Grandfathering." Grandfathering would enable the CPUC to provide a clearer signal to prospective resources about the incremental RA value provided to the system; it would also better sustain the value of jurisdictional entities' current contributions of RA from the wind and solar portfolios over time. Using the approach, the CPUC would need to consider multiple issues:

1. Will there be a single cutoff date for grandfathering when ELCC is implemented for wind and solar resources? If so, would it based on the installation, contract execution or contract approval date?
2. How would existing and new conventional resources be identified based on vintage at some point in the future?

3. How would repowers of existing wind and solar facilities be treated?
4. How does a "Grandfathered" facility retain its status if an IOU does not continuously include its capacity in its annual RA showing?

If the CPUC proceeds with a No-Grandfathering approach, significant issues for future wind and solar resource procurement would require further consideration. Specifically, since procurement of new wind and solar resources could reduce portfolio ELCC for the same category of resource, the resulting decay in portfolio value would need to be accounted for in procurement of new resources and the assessment of the resources' net market value, or Least-Cost Best Fit, calculation for a new resource.

VI. The CPUC Should Establish a Process for Evaluating New "Technology Categories"

The Staff Proposal currently identifies three solar and two wind technologies for ELCC calculation in each modeling region. As discussed by several parties in the Workshop on January 27, 2014, additional technologies, or minor modifications to technologies in the existing categories, may well present different reliability value and, therefore, require additional review for accurate ELCC evaluation. An ongoing and expeditious process for reviewing and analyzing new technology configurations is needed to promote ratepayers' interests in obtaining the least-cost, most effective means of achieving RA objectives through innovation. This process must occur well ahead the QC setting process for each RA year; to provide the best results for California's grid, developers and technology providers should be able to request and receive ELCC evaluation before submitting offers to the IOUs. This should result in these offers being granted an appropriate QC, which could be relied upon by IOUs when evaluating these offers.

For technologies exhibiting similar operating profile characteristics to existing "technology categories," Energy Division could compare the hypothetical ELCC value of the existing category and the "similar" technology category, by substituting (or overlaying) the new operating characteristics on the existing "technology category." Rather than creating an additional "technology category" altogether, the similar technology could receive an "adjusted" ELCC, in which the assigned ELCC is a fixed percentage point value greater than or less than the ELCC for the existing "technology category." The technology "adder" could be adjusted over time as well, if necessary. In instances where an "adder" approach not appropriate, a new "technology category" should be considered to fairly value the reliability characteristics of the new technology configuration.

Conclusion

The CSPA appreciates this opportunity to provide its comments on the Staff Proposal. The CSPA stands ready to work with the Energy Division, NREL and others to develop appropriate tools to accurately apply ELCC evaluation to resources, including addressing the need for differentiation of CSP+TES from other CSP technologies.

Respectfully Submitted,

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