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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Continue Implementation and Administration, and Consider Further Development of, California Renewables Portfolio Standard Program.	Rulemaking 18-07-003

DECISION ADOPTING MODELING REQUIREMENTS TO CALCULATE EFFECTIVE LOAD CARRYING CAPABILITY VALUES FOR RENEWABLES PORTFOLIO STANDARD PROCUREMENT

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DECISION ADOPTING MODELING REQUIREMENTS TO CALCULATE EFFECTIVE LOAD CARRYING CAPABILITY VALUES FOR RENEWABLES PORTFOLIO STANDARD PROCUREMENT

Summary

This decision adopts modeling requirements for investor-owned utilities to determine one element of their respective least-cost best-fit methodologies, the Effective Load Carrying Capability (ELCC) values, to be used for the Renewables Portfolio Standard (RPS) program bid ranking and selection. These modeling requirements are as follows:

- The Strategic Energy Risk Valuation Model must be used to determine marginal ELCC values;
- Behind-the-meter Photovoltaic (PV) must be treated as a supply-side resource;
- An annual loss of load expectation study must be conducted;
- Three resource classes (wind, solar PV, and storage) and six resource class subtypes (fixed axis PV, tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage) must be modeled; four geographic locations located in the California Independent System Operator (CAISO) area and three regions located outside of the CAISO area must be modeled; and installed capacities from the Integrated Resource Planning (IRP) proceeding's most recently updated base portfolio (Reference System Plan or Preferred System Plan) must be used;
- The resource portfolio from the 2017-2018 IRP's Preferred System Plan with a study year of 2022, 2026, and 2030 must be modeled for the 2020 procurement cycle. For future procurement cycles, the most recently updated base portfolio from the IRP proceeding must be used with study years of subsequent four-year increments.

The Commission directs the investor-owned utilities to conduct a joint ELCC study utilizing the adopted modeling requirements for use in RPS procurement in 2020. The investor-owned utilities must continue to update the joint ELCC study annually until directed otherwise.

1. Background

The California Renewables Portfolio Standard (RPS) program was established by Senate Bill (SB) 1078, and has been subsequently modified by SB 107, SB 1036, SB 2 (1X), SB 350, and SB 100.[1] The RPS program is codified in Public Utilities Code Sections 399.11-399.33.[2]

The procurement process for compliance with the RPS program has included almost from its inception the use by the investor-owned utilities (IOUs) of a least-cost best-fit (LCBF) methodology for evaluating bids. Section 399.13(a)(4)(A) provides that the Commission must adopt a process that provides criteria for the rank ordering and selection of least-cost and best-fit renewable resources on a total cost basis to comply with the California RPS Program. The LCBF methodology is periodically reviewed by the Commission and has been the subject of several statutory revisions.[3]

Currently, there is no statutory mandate to use Effective Load Carrying Capability (ELCC) or any other standardized method in LCBF valuation to measure contribution of an RPS-eligible resource to reliably meet the demand

[1] SB 1078 (Sher), Stats. 2002, Ch. 516; SB 107 (Simitian), Stats. 2006, Ch. 464; SB 1036 (Perata), Stats. 2007, Ch. 685; SB 2 (1X) (Simitian), Stats. 2011, Ch. 1; SB 350 (De León), Stats. 2015, Ch. 547; SB 100 (De León), Stats. 2018, Ch. 312.

[2] All subsequent code section references are to the Public Utilities Code unless otherwise indicated.

[3] The history of LCBF in the RPS program was reviewed in the Energy Division Staff Paper on Least-Cost Best-Fit Reform, at 1-2, Administrative Law Judge (ALJ) Ruling (June 22, 2016, R.15-02-020). The most recent statutory directives related to LCBF are found in SB 2 (1X) (Simitian), Stats. 2011, Ch. 1, and SB 350 (De León), Stats. 2015, Ch. 547.

and maintain grid reliability under the RPS program. However, pursuant to Section 399.13(a)(4)(A)(vii), the rank ordering and selection of eligible renewable energy resources must consider "…capacity and system reliability of the eligible renewable energy resource to ensure grid reliability" to comply with the RPS program obligations. Similarly, Section 399.13(a)(8) requires that in soliciting and procuring eligible renewable energy resources, each retail seller consider the best-fit attributes of resource types that ensure a balanced resource mix to maintain the reliability of the electrical grid.

At the beginning of each RPS solicitation cycle, the IOUs submit their respective RPS procurement plans and bidding protocol to the Commission for approval. Filed with each plan and bidding protocol is a detailed description of the IOU's LCBF methodology, which is the methodology the IOU uses for ranking and selecting bids from its RPS procurement solicitations. In their respective LCBF valuations, the IOUs include the capacity benefits by valuing the resource adequacy (RA) benefits expressed in the form of an assigned net qualifying capacity of each bid,[4] which may be based on various methods, including the ELCC method.

2. Procedural History

On September 12, 2018, the Administrative Law Judge's Ruling Requesting Comments on Staff Proposal on Effective Load Carrying Capability, Time of Delivery Factors, and Project Viability (September 2018 Ruling) was issued in Rulemaking (R.) 18-07-003. The September 2018 Ruling continued the Commission work to reform the LCBF methodology used in the RPS procurement by considering three factors of the LCBF methodology: effective

[4] Net qualifying capacity is the net amount of a resource's capacity, after an adjustment has been made for deliverability restrictions, that can be counted for meeting the Commission's resource adequacy procurement obligation.

load carrying capability, Time of Delivery (TOD) factors, and project viability. The ruling asked parties to comment on the staff proposal and respond to questions.

Comments were filed on October 5, 2018, by American Wind Energy Association California Caucus (AWEA); California Energy Storage Alliance (CESA); California Large Energy Consumers Association (CLECA); California Wind Energy Association (CalWEA); Calpine Corporation (Calpine); Green Power Institute (GPI); Defenders of Wildlife and Sierra Club (jointly, collectively, Conservation Parties); Large Scale Solar Association (LSA); Pacific Gas and Electric Company (PG&E); Public Advocates Office; Southern California Edison Company (SCE); San Diego Gas & Electric Company (SDG&E); Small Business Utility Advocates (SBUA); and Western Power Trading Forum (WPTF). Reply comments were filed on October 15, 2018 by California Independent System Operator (CAISO); CESA; Conservation Parties; LSA; GPI; PG&E; Public Advocates Office; SBUA; SCE; and SDG&E.

3. Staff Proposal on Effective Load Carrying Capability

In this decision, the Commission determines whether to adopt the staff proposal on ELCC included in the September 2018 Ruling.

The staff proposal defines ELCC as an indicator that shows "how well a facility is able to meet reliability conditions and reduce expected reliability problems or outage events caused by capacity shortfalls."[5] According to the staff proposal, ELCC values are calculated via probabilistic reliability modeling and yield a single percentage value for a given facility or group of facilities. ELCC can also be thought of as a derating factor that is applied to a facility's maximum

[5] September 2018 Ruling at 2.

output in order to determine its qualifying capacity. Because this derating factor is calculated considering both system reliability needs and facility performance, it will reflect not just the output capabilities of a facility but also the usefulness of this output in meeting overall electricity system reliability needs.

The staff proposal identifies two reasons for switching from using a resource adequacy net qualifying capacity value to using the proposed ELCC method:

(1) An ELCC value provides a more reliable and accurate measure of the qualifying capacity of renewable resources. While the current method measures resource capacity contributions only during peak times, ELCC measures resource capacity contributions over an entire period.

(2) Due to increasing penetration of renewable resources, it is prudent and essential to align RPS procurement with future system reliability conditions for effective planning and procurement of renewables. ELCC achieves this objective by establishing capacity value of new renewable resources in relation to the whole electric system.

The proposed method to determine ELCC values for a resource includes the following modeling requirements: First, to promote consistency with the Integrated Resource Planning (IRP) modeling requirements set forth in Decision (D.) 18-02-018, staff proposes to utilize the same modeling conventions for calculating ELCC values in RPS procurement. Staff proposes using the same probabilistic reliability model, Strategic Energy Risk Valuation Model (SERVM) and the Reference System Plan, which is used in the IRP proceeding for production cost modeling.

Second, staff proposes determining ELCC values for a marginal resource for RPS procurement (marginal ELCC), as opposed to average ELCC values.

Third, staff proposes five modeling requirements for resource and location granularity: (1) Behind-the-Meter (BTM) Photovoltaic (PV) must be treated as a supply-side resource; (2) A monthly loss of load expectation (LOLE) study should be conducted; (3) Three resource classes (wind, solar PV, and storage) and five resource class subtypes (tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage) should be modeled; (4) Four geographic locations (Northern California, Southern California, the Northwest, and the Southwest) should be included; and (5) Installed capacities from the IRP Reference System Plan (currently 7,926 megawatts (MW) of wind and 16,445 of solar PV) should be used. For resources paired with storage, staff proposes analyzing 4-hour duration batteries.

Finally, staff proposes that the resource portfolio from the IRP's Reference System Plan with a study year of 2022 should be modeled to determine ELCC values.

4. Discussion

The Commission concludes that the staff proposal on ELCC method is supported by the record and should be adopted as modified. The purpose of the modifications is to respond to party comments on the staff proposal and ensure consistency between modeling conventions used in this proceeding and the IRP proceeding, to the extent it is reasonable to do so. We discuss specific elements of the staff proposal below.

In summary, we direct the IOUs to conduct a joint study to determine ELCC values by utilizing the following modeling requirements:

1. The IOUs must use SERVM to determine marginal ELCC values for additional RPS-eligible resources;
2. Behind-the-meter (BTM) Photovoltaic (PV) must be treated as a supply-side resource;

3. An annual loss of load expectation (LOLE) study must be conducted;
4. Three resource classes (wind, solar PV, and storage) and six resource class subtypes (fixed axis PV, tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage) must be modeled; four geographic locations located in the CAISO area (Northern California, Southern California) and three regions located outside of the CAISO area (the Northwest and the Southwest) must be included; and installed capacities from the IRP proceeding's most recently updated base portfolio (Reference System Plan or Preferred System Plan) must be used.
5. The resource portfolio from the IRP's Preferred System Plan with a study year of 2022, 2026, and 2030 must be modeled to determine ELCC values for the 2020 procurement cycle. For future procurement cycles, the most recently updated base portfolio from the IRP proceeding must be used with study years of subsequent four-year increments.

A comparison table summarizing the differences between the ELCC modeling requirements (1) used in the IRP proceeding, (2) proposed by staff in this proceeding, and (3) adopted by this decision is listed below.

Table I: Modeling Requirements for the 2020 ELCC Study

	IRP Final Methodology for ELCC Modeling (Updated Nov 2018)[6]	Staff's Post-Workshop Proposal for RPS – ALJ Ruling Sept 12, 2018.	Adopted
Method to account for BTM resources	supply-side resource with ELCC values (BTM PV only, other resources such as AAEE remain load-modifiers)	supply-side resource with ELCC values (BTM PV only, other resources such as AAEE remain load-modifiers)	supply-side resource with ELCC values (BTM PV only, other resources such as AAEE remain load-modifiers)
ELCC Value	Average	Marginal	Marginal
ELCC Study	Annual	Monthly	Annual
LOLE Metric	0.1	0.3	0.1
Number of resource classes and resource class subtypes	All generators treated as one category in Portfolio ELCC	3 resource classes (wind, solar PV and storage) and 5 resource class subtypes (tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage)	3 resource classes (wind, solar PV and storage) and 6 resource class subtypes (fixed axis PV, tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage)
Number of locations	8 distinct regions in California and 16 outside of California based on utility service areas	4 (Northern CA, Southern CA, Northwest, and Southwest)	4 (**NorCal**- PGE Valley, PGE Bay, **SoCal** – SCE, SDGE, **NW** – BPAT for wind, and **SW**-AZPS for solar, PNM_EPE for wind)
Installed capacities	IRP Reference System Plan and Preferred System Plan portfolios	IRP Reference System Plan portfolio (currently 7,926 MW wind and 16,445 MW solar PV)	IRP Preferred System Plan portfolios

4.1. Standardized ELCC Method for RPS Program

Before we discuss the staff proposal, as a threshold question, the Commission must address whether we should adopt a standardized ELCC method for the IOUs under the RPS program.

[6] Section III: Modeling Scope and Conventions, to Attachment A of *Administrative Law Judge's Ruling Finalizing Production Cost Modeling Approach and Schedule for Preferred System Plan Development* in the IRP proceeding (R.16-02-007), November 15, 2018. https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/DemandModeling/R1602007_PCM%20ruling%2011-14-18%20Attachment%20A%20PDF.pdf

No party other than PG&E and SDG&E objects to adopting a standardized ELCC method. Even though PG&E agrees with the proposed ELCC modeling requirements and the idea of working towards a common method for planning purposes, PG&E prefers to maintain discretion in assigning capacity values for RPS procurement. Both PG&E and SDG&E are concerned that they are going to be restricted to using an inflexible standardized model that will not be able to keep up with the market in real-time.

Unlike PG&E and SDG&E, SCE supports the use of a uniform ELCC method to ensure consistent performance of planning, procurement, and valuation of resources. SCE argues that if all load-serving entities (LSEs) use different ELCC methods for similar resources in their RPS procurement process, the outcomes may produce misalignment with resource needs, system reliability, and the IRP proceeding in general.

As noted by PG&E, there are no statutory requirements to implement a standardized approach for calculating capacity values in the RPS program. PG&E is also correct that there is historical precedent granting IOUs discretion to develop and propose their own method for evaluating LCBF procurement. For example, D.14-11-042 directed the IOUs to report two bid rankings based on different methodologies: One ranking of all bids received based on resource adequacy valuations calculated with net qualifying capacity values based on the existing exceedance methodology and the other ranking to use net qualifying capacity values based on an ELCC method developed by E3 or the utility.[7]

Nevertheless, we find that it is reasonable to adopt a standardized ELCC method to be used for RPS program bid ranking and selection for the following reasons: (1) Staff has made reasonable progress to date in determining necessary

[7] D.14-11-042 at 51 and OP 23.

modeling requirements and clearly identified the benefits of switching to an ELCC method; (2) Adopting a standardized approach will help the Commission maintain consistency between the modeling conventions used in this proceeding and the IRP proceeding, to the extent it is reasonable to do so; (3) Because the ELCC method considers the impact of an additional resource in relation to the whole electric system, it conforms with statutory requirements to consider grid reliability in RPS bid selection. Finally, adopting a standardized ELCC methodology for all IOUs should facilitate planning and analysis by the IOUs, industry, and the Commission. Because the IOUs will be compiling the study, the Commission expects that the IOUs will run the model annually to capture dynamic nature of the market and power grid and keep up with the market conditions. Changes necessary to revise the ELCC method may be brought before the Commission for review and approval in RPS draft plans.

Despite the IOUs' preference for the Commission staff to conduct the ELCC study, we direct the IOUs to conduct a joint study to compute the ELCC values based on the modeling requirements adopted in this decision. Currently, the Commission staff has limited resources to conduct additional modeling studies. Moreover, the timing of modeling efforts in the IRP proceeding may not match the timing of the RPS procurement. In addition, the ELCC modeling requirements for the RPS proceeding are slightly different than those adopted in the IRP proceeding. Therefore, we conclude that a joint ELCC study to be conducted by the IOUs as opposed to a staff-led study will produce more timely results.

4.2. Marginal or Average ELCC Values

Staff proposes using marginal ELCC values for RPS procurement instead of average ELCC values. Marginal ELCC is defined as the effective capacity

value of a marginal resource addition from a given resource class, *e.g.* a new solar or wind resource, to the overall electric system; average ELCC is defined as the effective capacity of all generators in a resource class. Accordingly, average ELCC studies are used to characterize the capacity value of a whole class or group of resources, whereas marginal ELCC studies are used to characterize the capacity value of adding an increment of a given resource type. Average portfolio ELCC values are currently used for production cost modeling in the IRP proceeding and RA proceeding.[8]

Several parties, including AWEA, Calpine, CLECA, SCE, and Public Advocates Office, support using marginal ELCC values in resource valuation and aligning ELCC methodologies among different proceedings to ensure consistent treatment of RPS capacity in planning and procurement,[9] and to increase administrative efficiencies and reduce cost to ratepayers.[10]

SCE explains the importance and relevance of using marginal ELCC values by stating that "ELCC values provide an important signal to the market about the ability of new resources to contribute to system reliability given the portfolio of resources assumed to be online. The goal of marginal ELCC analysis is to estimate the ability of incremental resources to contribute to system reliability measured by a 1-in-10 LOLE metric given the forecast of system resources and demand. Therefore, the marginal ELCC value provides the most relevant signal to the market and system planners about the ability of new resources -- RPS or

[8] *See* Administrative Law Judge's Ruling Finalizing Production Cost Modeling Approach and Schedule for Preferred System Plan Development, Attachment A: Guide to Production Cost Modeling in the IRP Proceeding, November 15, 2018, R.16-02-007; and D.19-06-026.

[9] SCE Comments, October 5, 2018, at 4.

[10] Public Advocates Office, October 5, 2018, at 3.

otherwise -- to provide system RA benefits."[11] On the other hand, SCE argues, using an average ELCC for new resources does not reflect the capabilities of those new or incremental resources to meet system reliability needs and sends the wrong signals to the market and to system planners about the system capacity value of new resources. SCE asserts that if an incremental resource contributes a small amount to reliability, it should receive a small amount of RA value. SCE also provides a numerical example to demonstrate the differences between a marginal ELCC value and an average ELCC value: "…consider a 10 MW solar facility. Using a marginal ELCC of ~15% would assign a 1.5 MW benefit to the facility. In contrast, using an average ELCC of ~45% would assign a 4.5 MW benefit, inflating the contribution by 300%."[12]

WPTF also provides numerical examples to demonstrate how average ELCC can overstate the capacity value of a resource.[13] WPTF adds that "overstating the capacity value of incremental resources, while failing to account for the corresponding reduction in capacity value of preexisting renewables of the same type can result in an IOU ascribing an inflated capacity value to renewables, ratepayers may have to bear costs that are not reflective of value.[14]" WPTF supports using marginal ELCC values for reliability as well as ratemaking purposes.

Several parties, including LSA and SBUA, oppose the staff proposal. LSA believes that marginal ELCC is an inappropriate way to value resource capacity. Supporting the use of an average ELCC for RPS procurement, LSA argues that

[11] SCE Comments, October 5, 2018, at 2.

[12] SCE Reply Comments, October 15, 2018, at 2 and 3.

[13] WPTF Comments, October 5, 2018, at 2.

[14] WPTF Comments, October 5, 2018, at 2 and 3.

because all LSEs other than IOUs are likely to continue to use average values, directing IOUs to use marginal values is discriminatory.[15]

First, the Commission does not agree with LSA and views the use of different methods among LSEs to rank resource bids as a disconnect rather than a discriminatory practice. LSA thinks that using marginal ELCC values in the RPS proceeding discriminates against solar resources because solar ELCCs will be lower due to high solar penetration on the grid. One incremental capacity addition, *e.g.* a new solar resource, may not have a big impact for system reliability given all the solar resources that the electric system currently has. However, this is important to know, because the IOUs need to consider the capacity value for each incremental resource procured to determine how to rank the bids in their LCBF valuation.

We note that the ELCC capacity values express how well a facility is able to meet reliability conditions and reduce expected reliability problems or outage events caused by capacity shortfalls.[16] Therefore, it is very important that this valuation is made with utmost accuracy for resource additions to ensure grid reliability and prudent use of ratepayer funds. Currently, calculating a marginal ELCC value as proposed by staff appears to be the most accurate way to make that assessment. As noted by SCE and WPTF, using average values would inaccurately inflate capacity contribution from incremental resources. Therefore, we adopt the staff proposal to use marginal ELCC values in RPS bid ranking and selection.

As we have stated before, average portfolio ELCC values are currently used for production cost modeling in the IRP proceeding. Because ELCC values

[15] LSA Comments, October 5, 2018, at 2.

[16] Staff Proposal at 2.

are used for different purposes in each proceeding, we deviate from the IRP modeling requirements herein. In the IRP proceeding, average ELCC values are calculated to validate the Preferred System Plan to determine if sufficient capacity exists to ensure system reliability, whereas, in the RPS proceeding, marginal ELCC values are needed to determine incremental value of a resource to the system and to the ratepayer.

4.3. Behind-the-Meter PV

The staff proposal treats behind-the-meter solar as a supply resource as opposed to a load modifier.

Most parties did not comment on or did not object to treating BTM PV as a supply resource. Supporting the staff proposal to treat behind-the-meter solar as a supply resource, WPTF states that, because BTM PV constitutes a significant fraction of PV, this resource type increases the saturation of solar, pushes reliability problems to hours in which solar resources do not produce, and depresses solar ELCC in general.[17] PG&E argues that considering BTM PV as a load modifier skews ELCC values for other resources and is equivalent to assuming that all the projected BTM PV resources are added to the system before any resource types, which PG&E claims as incorrect.[18]

In contrast, LSA asserts that BTM PV, by definition, is a load modifier as these resources are neither seen nor optimized by CAISO. Also, LSA adds, these resources cannot be used to balance load, manage congestion, be optimized or dispatched.[19]

[17] WPTF Comments, October 5, 2018, at 3.

[18] PG&E Reply Comments, October 15, 2018, at 6.

[19] LSA Comments, October 5, 2018, at 3.

As noted by SCE, developing ELCC values for BTM PV is necessary to compare the ability of these resources to improve system reliability with other supply-side resources.[20] Therefore, we direct the IOUs to model BTM PV as a supply-side resource, as proposed by staff, and not a load-modifier.

4.4. RPS Resources Paired with Storage

Staff recognizes reliability contribution of storage paired resources and proposes analyzing 4-hour duration batteries in ELCC studies.

CESA, PG&E, SCE, and SDG&E support consideration of RPS-paired storage resources in an ELCC study and suggest modifications or studying variations of staff proposal, *e.g.* considering shorter and longer durations. For example, CESA suggests taking an additive approach to the RPS resource combined with the dispatchable four-hour energy storage resource and studying several different sub-classes of RPS-paired storage systems with shorter durations.[21] SCE also supports including paired resources in the study with shorter and longer durations and proposes that the study also assess the degree to which paired resources can be flexible capacity resources to meet ramping needs. Similarly, SDG&E supports the staff proposal and suggests evaluating more than just 4-hour duration batteries. According to SDG&E, additional analysis about what duration of storage provides the optimal value for various resources and in different seasons and time of the day would allow for more cost-effective resource procurement.[22]

Public Advocates Office supports analyzing 4-hour duration only because this duration constitutes most of the storage resources that have been contracted

[20] SCE Reply Comments, October 15, 2018, at 3.

[21] CESA Comments, October 5, 2018, at 5 and 6.

[22] SDG&E Comments, October 5, 2018, at 3.

to date. Therefore, Public Advocates Office does not recommend analyzing multiple battery durations until the IOUs procure more diverse storage resources.[23]

In contrast, Calpine, SBUA, and GPI oppose considering resource-paired storage resources in an ELCC study. Calpine asserts that paired resources should only be modeled if the pairing "impacts the operation of either component," otherwise, Calpine argues, ELCC value for paired resource should be the sum of the ELCCs of its components. Similarly, SBUA asserts that modeling paired resources may yield unreliable ELCC values that do not reflect the actual range of storage. SBUA adds that paired resources may skew ELCC values because of the variables associated with its dispatch algorithm. SBUA suggests that ELCC for paired resource should be the sum of the ELCCs of its components.[24] GPI objects to imposing artificial limits on the configurations for renewable resources paired with storage.[25]

CalWEA also questions whether storage paired with wind and solar warrants generic ELCC values. CalWEA asserts that paired storage resources are inherently less valuable than stand-alone storage because of operational constraints and because paired storage resources are not likely to offer locational benefits that stand-alone storage can provide.[26]

We agree with the staff proposal and direct the IOUs to analyze 4-hour duration batteries in ELCC studies. Differences in party positions indicate that there is need for further research and refinement to determine the reliability

[23] Public Advocates Office Comments, October 5, 2018, at 3.

[24] SBUA Comments, October 5, 2018, at 5 and 6.

[25] GPI Comments, October 5, 2018, at 4.

[26] CalWEA Comments, October 5, 208, at 3.

value of paired resources. However, these differences should not deter us from going forward with modeling paired storage facilities with 4-hour durations.

Modeling paired storage facilities with 4-hour durations is necessary due to the amount of 4-hour storage that has been procured to date pursuant to Assembly Bill (AB) 2514 (Skinner), Stats. 2010, Ch. 469. [27] In the Joint IOUs Updated ELCC study, the modeling showed that resources paired with storage boost the ELCC values.[28] We agree with parties such as CESA and SCE that modeling shorter duration storage may result in higher ELCC values for solar and wind, thus sending a signal of economic viability of co-located storage to market. Given the relatively small amount of storage installed to date, as Public Advocates Office pointed out, the additional work to model shorter, *e.g.* 1-hour, storage is likely to outweigh the potential benefits that short-duration storage could have on ELCC values. Given how resource- and time- intensive ELCC modeling efforts are, we will prioritize the ELCC modeling needs. First, the IOUs are required to model 4-hour duration storage at this time. In order to maintain consistency with the IRP modeling requirements and to be prepared to evaluate shorter-duration storage resources if need be, the IOUs should next jointly model 1-hour and 2-hour duration storage paired resources and file their result in a subsequent filing, as explained in Section 5. The Commission welcomes the IOUs' as well as other parties' further efforts to explore impacts of shorter and longer duration storage on ELCC values, but we will not require modeling

[27] AB 2514 established the Energy Storage Procurement Framework and Program which mandates energy storage procurement for investor-owned utilities.

[28] Joint Update of Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company to Administrative Law Judge's Ruling Accepting Into the Record Revised Energy Division Staff Paper on the Use of Effective Load Carrying Capability for Renewables Portfolio Standard Procurement and Setting Schedule, Attachment 2, at 21, May 31, 2017, R.15-02-020.

beyond what is stated above; however, the IOUs may choose to model additional storage durations.

4.5. Locational and Resource Granularity

When conducting a marginal ELCC study, technology types and locations are differentiated, and they are relatively compared at the generator level. The staff proposal separates technology into three resource classes (wind, solar PV, storage) and five resource class subtypes (tracking PV, tracking PV with storage, distributed PV, wind, and wind with storage).

In their comments, parties have expressed a need for granular location and resource type modeling due to wide variation in production profiles for the same technology type in different locations.[29] For example, SCE recommended including non-tracking solar PV and solar thermal.[30] SCE also suggested more granular subareas to account for different wind profiles.[31] SBUA pointed out that the use of a few supply zones may be adequate for the IRP as an aggregated planning proceeding, but the proposed ELCC values are unlikely to be sufficiently granular to accurately value renewable resources.[32]

We agree that there is need for granular location and resource type modeling due to wide variation in production profiles for the same technology type in different locations. We also recognize how resource- and time-intensive ELCC modeling can be. Therefore, it is necessary to study not only the four primary regions as proposed by staff, but specifically the four regions located in the CAISO and three regions located outside CAISO, a subset of the regions used

[29] *See* AWEA Comments, October 5, 2018, at 2.

[30] SCE Comments, October 5, 2018, at 3.

[31] SCE Comments, October 5, 2018, at 3.

[32] SBUA Comments, October 5, 2018, at 4.

in the IRP production cost modeling, to capture the differences in generation profiles for the same technology types. This way, we will maintain consistency with IRP modeling requirements without overburdening modeling entities. The Commission may consider expanding the study regions in the future, if warranted. At a minimum, the resulting ELCC studies should be the ones listed below:

Table II: Regions in ELCC Studies[33]

Locations	SERVM Region
Northern CA (CA-N)	PGE_BAY
	PGE_Valley
Southern CA (CA-S)	SCE
	SDGE
Northwest US (OOS-NW)	BPAT
Southwest US (OOS-SW)	AZPS
	PNM_EPE

[33] Based on Table 1: Assignment of WECC regions to model SERVM zones, Unified Resource Adequacy and Integrated Resource Plan Inputs and Assumptions – Guidance for Production Cost Modeling and Network Reliability Studies at 16, March 29, 2019, in R. 16-02-007.

Table III: ELCC Studies with Location and Technology Pairings

Study #	ELCC Value - Location	Technology
1	Marginal - CA -N	Wind
2	Marginal - CA -N	Fixed PV
3	Marginal - CA -N	Tracking PV
4	Marginal - CA -N	Distributed PV
5	Marginal - CA -N	Tracking PV w/Storage (4 hour)
6	Marginal – CA -N	Wind w/Storage (4 hour)
7	Marginal – CA -S	Wind
8	Marginal – CA -S	Fixed PV
9	Marginal – CA -S	Tracking PV
10	Marginal – CA -S	Distributed PV
11	Marginal – CA -S	Tracking PV w/Storage (4 hour)
12	Marginal – CA -S	Wind w/Storage (4 hour)
13	Marginal – OOS- NW	Wind
14	Marginal - OOS- NW	Wind w/Storage (4 hour)
15	Marginal - OOS - SW	Wind
16	Marginal - OOS - SW	Fixed PV
17	Marginal - OOS - SW	Tracking PV
18	Marginal - OOS - SW	Tracking PV w/Storage (4 hour)
19	Marginal - OOS - SW	Wind w/Storage (4 hour)

4.6. Base Portfolio

Staff proposes using the IRP Reference System Plan as the base portfolio for ELCC modeling for the RPS program. We determine that the most recently updated base portfolio should be used for ELCC modeling.

Most parties support or do not object to using the Reference System Plan (RSP) as the base portfolio for ELCC modeling for RPS and offer suggestions for updates or modifications. Parties support using the IRP RSP as a base portfolio,

because it has a comprehensive set of existing resources,[34] and it provides a reasonable assumption of installed capacity in the system.[35] In addition, ensuring coordination between IRP and RPS proceedings may streamline procurement.[36] AWEA suggests the base portfolio should be updated with more assumptions of retiring resources and future transmission projects.[37]

In contrast, CalWEA, PG&E and SDG&E support using the PSP, because the PSP is considered to be a more refined portfolio and incorporates updates to the RSP and other modeling requirements. For example, the Proposed Preferred System Plan for the 2017-2018 IRP cycle is a modified version of the Reference System Plan (from D.18-02-018) that uses the CEC's 2017 Integrated Energy Policy Report assumptions and meets the electric sector greenhouse gas planning target of 42 MMT by 2030.

Because the PSP is currently more refined than the RSP, we determine that the PSP should be used for ELCC modeling in the RPS proceeding for 2020 procurement planning. For future RPS procurement cycles, the IOUs should update the base portfolio for consistency with the most recent baseline resource list from the IRP proceeding (Reference System Plan or Preferred System Plan).

4.7. Loss of Load Expectation Metric

Loss of load expectation (LOLE) represents the expected number of days per year for which the available generation capacity is insufficient to serve the demand at least once per day. Staff proposes to use a LOLE metric of 0.3, which means that the power system would be expected to have 3 days of loss of load in

[34] LSA Comments, October 5, 2018, at 7.

[35] SCE Comments, October 5, 2018, at 5.

[36] Public Advocates Office Comments, October 5, 2018, at 3.

[37] AWEA Comments, October 5, 2018, at 5.

10 years. We determine that the RPS proceeding should use the LOLE metric of 0.1, which is a widely adopted reliability standard used in planning studies.

CAISO opposes changing the 1 day-in-10 years industry LOLE target to 3 days-in-10 years LOLE.[38] CAISO notes that "the industry developed the 1-day-in 10 years target based on legacy power systems that were dominated by conventional resources with high availability factors." CAISO adds that any change in LOLE target must consider factors such as variable energy resource integration needs and energy limited resources.[39]

Currently, a LOLE metric of 0.1 is used in the IRP-related production cost modeling efforts. To ensure coordination among planning and procurement proceedings, LOLE metric should be consistently used across proceedings. Therefore, we determine that the RPS proceeding should use the 0.1 annual LOLE metric consistent with CAISO practice and its use in IRP-related production cost modeling efforts.

4.8. Study Year

Staff recommends using 2022 as a study year to examine near term effects of RPS procurement. We find that 2022, 2026, and 2030 should be modeled for the 2020 procurement cycle. For future procurement cycles, the most recently updated base portfolio from the IRP proceeding must be used with study years of subsequent four-year increments.

AWEA, Public Advocates Office, SDG&E, and WPTF support using 2022 as a study year. SCE agrees that 2022 is a reasonable study year for the marginal ELCC study, stating that this year would be close to the online dates of any marginal resources. SCE proposes to study at least one more year 2026 or 2030,

[38] CAISO Reply Comments, October 5, 2018, at 3.

[39] CAISO, Reply Comments, October 5, 2018, at 4.

to assess how the marginal ELCC changes as growth of distributed energy resources and electrification may impact electric system over the coming years.[40]

Other parties recommend using a different year and/or multiple study years, *e.g.* 2022, 2026, and 2030, for the reasons summarized below:

- A 2026 study year would be more appropriate because 2026 is far enough out to serve as a proxy for long-term value and better aligns with longer term planning.
- There may be many projects coming online in 2022 and using a study year of 2022 may distort the long-term value of resources.
- All future study years within the IRP provide useful benchmarks to inform and illustrate how marginal ELCC values of renewables change under different system conditions.
- The study year should be the midpoint of a resource's expected contract life.
- One single point in time would not be an accurate representation, because estimates of a capacity value of a new renewable resource should reflect the resource's ELCC over its entire contract term or physical life.

The Commission finds that using 2022 as a study year is reasonable because it is close to the online dates of marginal resources that have already been procured or are being procured now. Based on party comments, we find that including two additional study years is also reasonable. Accordingly, we direct the IOUs to conduct ELCC modeling with study years of every four years through the end of the study period for each IRP cycle. For the 2017-2018 IRP cycle, these years would be 2022, 2026, and 2030, consistent with updated IRP production cost modeling scope and conventions. The additional study years of 2026 and 2030 should be useful in analyzing potential impacts of distributed

[40] SCE Comments, October 5, 2018, at 5.

energy resources and electrification and would serve as a longer-term assessment of system characteristics based on the inputs and assumptions in IRP modeling.

4.9. Using Monthly or Annual ELCC Values

A bid ranking system may use monthly ELCC or annual ELCC to assess capacity value of RPS bids. Monthly ELCC considers monthly distribution of the annual loss of load. Annual ELCC considers one loss of load metric for the entire year. Currently, the IRP proceeding conducts an annual loss of load expectation study to produce annual ELCC values. Staff proposes to use monthly ELCC values using levelized loss of load targets in each month to account for fluctuations in monthly peak demand. We determine that annual ELCC values are sufficient to assess capacity value of RPS bids.

The staff proposal on ELCC in the ALJ Ruling (dated September 12, 2018) requested the IOUs to conduct modeling efforts using bid data obtained through prior solicitations to investigate the sensitivity of RPS bids' net market values to changes in the ELCC study through utilizing two ranking systems: one using only annual marginal ELCC values and one using monthly marginal ELCC values, and provide the results in comments. Parties other than the IOUs generally support additional modeling efforts by the IOUs to examine the effects of monthly versus annual ELCC values. The IOUs jointly opposed the request.

SDG&E and SCE see benefit in examining monthly ELCC values. SDG&E argues that the best data for monthly ELCCs will come from IRP once SERVM process is complete.[41] SCE also supports investigating the potential impact of marginal monthly ELCC versus marginal annual ELCC when assessing capacity value of RPS bids and advocates for alignment within RPS, IRP, and RA proceedings to ensure that RPS resources are properly valued and procured.

[41] SDG&E Comments, October 5, 2018, at 5.

PG&E believes having the IOUs conduct the study would duplicate efforts of the IRP proceeding. PG&E asserts that using a monthly ELCC value provides no additional value because the RPS is focused on procuring annual volumes. PG&E argues that a monthly and an annual study should not have different results unless there are distinctly different capacity price forecasts.[42] CALWEA considers using annual values as inappropriate due to monthly fluctuations in peak demand.[43]

Given that the IRP proceeding will be using an annual ELCC study, we agree that requiring a monthly study for RPS is unnecessary at this time. We direct the IOUs to use annual values in order to better coordinate alignment between the ELCC studies used in the IRP and RPS proceedings and to prevent duplicative efforts that require detailed modeling work.

5. Next Steps

PG&E, SCE, and SDG&E are the IOUs that submit their respective RPS procurement plans and bidding protocol to the Commission for approval. Filed with each plan and bidding protocol is a detailed description of the IOU's LCBF methodology, which is the methodology the IOU uses for ranking and selecting bids from its RPS procurement solicitations. The IOUs must modify their ELCC method to implement the changes adopted in this decision. The IOUs must conduct a joint ELCC study for use in LCBF for RPS procurement in 2020 and utilize the standardized method described in the staff proposal, as modified by this decision.

PG&E, SCE and SDG&E must jointly file their ELCC study results in a Tier 2 Advice Letter by June 1, 2020. PG&E, SCE and SDG&E must jointly file their

[42] PG&E Comments, October 5, 2018, at 6.

[43] CalWEA, Opening Comments, October 5, 2018, at 2.

ELCC study results for 1-hour and 2-hour duration storage paired resources by December 31, 2020. The IOUs must update the modeling annually and file a Tier 2 Advice Letter by June 1 of each year with updated ELCC values, until directed otherwise.

6. Comments on Proposed Decision

The proposed decision of ALJ Atamturk in this matter was mailed to the parties in accordance with Section 311 of the Public Utilities Code and comments were allowed under Rule 14.3 of the Commission's Rules of Practice and Procedure. Comments were filed on September 12, 2019 by the following parties: AWEA and LSA; CalWEA; CESA; GPI; PG&E; SCE; SDG&E; SBUA; and WPTF. Reply comments were filed on September 17, 2019 by the following parties: AWEA and LSA; CalWEA; PG&E; Public Advocates Office; and SBUA. In response, corrections and clarifications are made. We address certain comments below.

PG&E, SCE, and SDG&E request more time to complete the joint ELCC study and propose to submit the first standardized ELCC values in their 2020 RPS Plans. We grant their request, in part, and direct the IOUs to submit the updated ELCC numbers in a Tier 2 AL by June 1, 2020.

CESA recommends using an additive qualifying capacity calculation for paired storage resources without any charging constraints. Because this issue is still being considered in other proceedings and at the staff level, we will not make a determination at this time.

CESA recommends that either thirty-minute or one-hour duration storage pairings be prioritized in the marginal ELCC studies along with the four-hour duration storage pairings. Because ELCC modeling is resource- and time-intensive, we have allowed but not required the IOUs to model shorter duration

storage in initial studies. In order to maintain consistency with the IRP modeling requirements, though, and to be prepared to evaluate shorter-duration storage resources, if need be, we require PG&E, SCE and SDG&E to jointly model 1-hour and 2-hour duration paired storage and file their ELCC study results in a Tier 2 Advice Letter by December 31, 2020.

7. Assignment of Proceeding

Clifford Rechtschaffen is the assigned Commissioner and Nilgun Atamturk and Sarah Thomas are the assigned ALJs in this proceeding.

Findings of Fact

1. The staff proposal defines ELCC as an indicator that shows how well a facility can meet reliability conditions and reduce expected reliability problems or outage events caused by capacity shortfalls.
2. ELCC establishes capacity value of new renewable resources in relation to the whole electric system.
3. Due to increasing penetration of renewable resources, it is prudent and essential to align procurement under the RPS program with future system reliability conditions for effective planning and procurement of renewables.
4. Staff has made reasonable progress to date in determining necessary modeling requirements and clearly identified the benefits of switching to an ELCC method.
5. Adopting a standardized approach will help the Commission maintain consistency between the modeling conventions used in this proceeding and the IRP proceeding.
6. Adopting a standardized ELCC methodology for all IOUs will facilitate planning and analysis by the IOUs, industry, and the Commission.

7. The proposed ELCC method considers the impact of an additional RPS-eligible resource in relation to the whole electric system.

8. The proposed ELCC method conforms with statutory requirements to consider grid reliability in RPS bid selection.

9. Running models periodically, *e.g.,* annually, will capture the dynamic nature of the market and power grid and keep up with market conditions.

10. Average ELCC studies are used to characterize the capacity value of a whole class or group of resources whereas marginal ELCC studies are used to characterize the capacity value of adding an increment of a given resource type.

11. Calculating a marginal ELCC value is the most accurate way to assess incremental capacity value for new RPS resources with respect to the entire electric system.

12. Using average ELCC values would inaccurately inflate capacity contribution from incremental resources.

13. Developing ELCC values for behind-the-meter solar is necessary to compare the ability of these resources to improve system reliability with other supply-side resources.

14. Modeling shorter duration storage may result in higher ELCC values for solar and wind, thus sending a signal of economic viability of co-located storage to market.

15. Given the relatively small amount of storage installed to date, the additional work to model shorter, *e.g.* 1-hour, storage is likely to outweigh the potential benefits that short-duration storage could have on ELCC values. However, the Commission needs to maintain consistency with the IRP modeling requirements.

16. Modeling paired storage facilities with 4-hour durations is necessary due to the amount of 4-hour storage that has been procured to date pursuant to AB 2514 (Skinner), Stats. 2010, Ch. 469.

17. The ELCC modeling efforts are resource- and time- intensive.

18. When conducting a marginal ELCC study, technology types and locations must be differentiated and relatively compared at the generator level.

19. There is need for granular location and resource type modeling due to wide variation in production profiles for the same technology type in different locations.

20. The PSP used in Integrated Resource Planning modeling efforts is currently more refined than the RSP.

21. The Loss of Load Expectation metric of 0.1 is a widely adopted reliability standard used in planning studies.

22. The IRP modeling efforts require a Loss of Load Expectation metric of 0.1.

23. A study year of 2022 is close to the online dates of marginal resources that have already been procured or are being procured now by the IOUs.

24. Additional study years of 2026 and 2030 will be useful in analyzing potential impacts of distributed energy resources and electrification and will serve as a longer-term assessment of system characteristics based on the inputs and assumptions used in Integrated Resource Planning modeling.

Conclusions of Law

1. The staff proposal on ELCC method is supported by the record and should be adopted as modified.

2. We should adopt the staff proposal to use marginal ELCC values in RPS bid ranking and selection.

3. The IOUs should conduct the ELCC study annually to capture dynamic nature of the market and power grid and keep up with the market conditions. Changes necessary to revise the ELCC method should be brought before the Commission for review and approval in draft RPS plans.

4. We should adopt the staff proposal to treat behind-the-meter solar as a supply-side resource and develop ELCC values for behind-the-meter solar.

5. Given how resource- and time- intensive ELCC modeling efforts are, the ELCC modeling needs should be prioritized.

6. Given the relatively small amount of storage procurement that has occurred to date, the additional work to model 1-hour storage is likely to outweigh the potential benefits that short-duration storage could have on ELCC values. Therefore, the IOUs should prioritize modeling only 4-hour duration storage.

7. In order to maintain consistency with the IRP modeling requirements and be prepared to evaluate shorter-duration storage resources if need be, the IOUs should next jointly model 1-hour and 2-hour duration storage paired resources.

8. The four regions located in the CAISO and three regions located outside CAISO should be studied to capture the differences in generation profiles for the same technology types.

9. In order to ensure consistency with IRP without overburdening the modeling entities, IOUs should use a subset of the planning regions used in the IRP production cost modeling.

10. The Preferred System Plan should be used for ELCC modeling in the RPS proceeding for 2020 procurement planning.

11. The IOUs should use the 0.1 annual LOLE metric in their joint ELCC study.

12. Study years of 2022, 2026 and 2030 should be used for the joint ELCC study.

13. Using annual ELCC values rather than monthly ELCC values will ensure alignment between the ELCC studies used in the IRP and RPS proceedings.

O R D E R

IT IS ORDERED that:

1. Modeling requirements are adopted for Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E) to determine one element of their respective least-cost best-fit methodologies, the Effective Load Carrying Capability (ELCC) values, to be used for the Renewables Portfolio Standard (RPS) program bid ranking and selection. These modeling requirements are: (1) The Strategic Energy Risk Valuation Model must be used to determine marginal ELCC values; (2) Behind-the-meter Photovoltaic (PV) must be treated as a supply-side resource; (3) An annual loss of load expectation study must be conducted; (4) Three resource classes (wind, solar PV, and storage) and six resource class subtypes (fixed axis PV, tracking PV, tracking PV paired with storage, distributed PV, wind, and wind paired with storage) must be modeled; four geographic locations located in the California Independent System Operator (CAISO) area and three regions located outside of the CAISO area must be modeled; and installed capacities from the Integrated Resource Planning proceeding's most recently updated base portfolio (Reference System Plan or Preferred System Plan) must be used; (5) The resource portfolio from the 2017-2018 IRP's Preferred System Plan with a study year of 2022, 2026, and 2030 must be modeled for the 2020 procurement cycle. For future procurement cycles,

the most recently updated base portfolio from the IRP proceeding must be used with study years of subsequent four-year increments.

2. Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E) must conduct a joint study to determine Effective Load Carrying Capability (ELCC) values for incremental resources eligible for the Renewables Portfolio Standard (RPS) procurement, as described in this decision, in 2020. PG&E, SCE and SDG&E must jointly file their ELCC study results in a Tier 2 Advice Letter by June 1, 2020. PG&E, SCE and SDG&E must jointly file their ELCC study results for 1-hour and 2-hour duration storage paired resources in a Tier 2 Advice Letter by December 31, 2020. PG&E, SCE, and SDG&E must jointly update the modeling annually and file a Tier 2 Advice Letter by June 1 of each year with updated ELCC values, until directed otherwise.

3. Rulemaking 18-07-003 remains open.

This order is effective today.

Dated September 26, 2019, at San Francisco, California.

MARYBEL BATJER
President
LIANE M. RANDOLPH
MARTHA GUZMAN ACEVES
CLIFFORD RECHTSCHAFFEN
GENEVIEVE SHIROMA
Commissioners