BEFORE THE ENERGY COMMISSION
OF THE STATE OF CALIFORNIA

SB 100 Joint Agency Report: Charting a path to a 100% Clean Energy Future	19-SB-100 (August 16, 2019)

I. Introduction

The California Independent System Operator Corporation (CAISO) submits reply comments on the on the Senate Bill 100 (SB 100) Modeling Inputs and Assumptions Workshop (Workshop) held on February 24, 2020 by the California Energy Commission, California Public Utilities Commission, and the California Air Resources Board (collectively the Joint Agencies). At the Workshop, the CAISO served on a panel discussing reliability and resource adequacy considerations from the perspective of a Balancing Authority (BA). As the largest BA in California, representing 80 percent of the load, the CAISO appreciates the opportunity to engage in, and consult on, these important issues.

As an overarching approach to meet SB 100 goals, the CAISO encourages the Joint Agencies to put more emphasis on setting policy direction to maintain reliability and resource adequacy and less emphasis on relying on modeling exercises to determine what that direction should be. Models can only consider a limited set of parameters and are best used to inform, vet, and refine expressed policy decisions. Experience with RESOLVE, in particular, shows that many important policy considerations are not readily quantifiable and therefore are either ignored or require manual workarounds to capture.

The Joint Agencies should consider and develop policy direction to:

- Diversify the resource fleet;
- Intentionally test a limited and manageable quantity of new(er) technologies to prove these resources at scale before transitioning away from current technology;

- Set clear direction on how and when to reduce reliance on the existing gas-fired generation fleet so that stakeholders can consider and implement concrete plans to ensure system and local area reliability;
- Proactively consider the potential and costs of transmission-related projects such as in-state large-scale renewable development; accessing offshore wind; enabling out-of-state resource development and other policy-driven considerations due to the long lead-times for transmission development; and
- Strategically maintain the natural gas-fired fleet to provide both energy and other grid services during the transition to a cleaner future, which includes maintaining the gas delivery infrastructure.

In the past, the CAISO has worked closely with each of the Joint Agencies and their staff to consistently provide independent reliability-based analyses, borne out of operational and market experience, to develop this policy direction. The CAISO looks forward to continuing this collaborative effort to help the state meet its SB 100 goals.

II. Discussion

The CAISO provides the following comments urging the Joint Agencies to use model outputs judiciously, reduce the number of proposed study scenarios, and set a policy direction that considers a variety of concerns.

A. The Joint Agencies Should Use Model Outputs Judiciously.

The Joint Agencies plan to use the RESOLVE modeling program to support their SB 100 analyses. The CAISO has been engaged in the California Public Utilities Commission's (CPUC's) integrated resource planning (IRP) process, which also uses RESOLVE, since its inception in 2016. The CAISO participates in the IRP Modeling Advisory Group and provides its own production cost modeling of portfolios developed in the IRP proceeding.[1] In the CAISO's observation of RESOLVE outputs, the model tends to favor large scale solar resource additions, supplemented with short-duration battery storage. This selection is based predominantly on capital and operating cost comparisons. The Joint Agencies should

[1] *See* CAISO comments in California Public Utilities Commission, Order Instituting Rulemaking to Develop an Electricity Integrated Resource Planning Framework and to Coordinate and Refine Long-Term Procurement Planning Requirements, Rulemaking (R.) 16-02-007. (CPUC IRP)

not consider these results the "optimal" portfolio that the state should pursue—rather, it is simply an optimal solution based on the inputs and the modeling algorithm to achieve very specific and overarching policy objectives (*i.e.*, greenhouse gas constraints at least capital and operating cost). The model itself does not consider other relevant limitations and factors that warrant objective qualitative consideration.

For example, the RESOLVE model will maximize solar resource build out even if it is only marginally less expensive than other resources. In a recent CPUC IRP portfolio, RESOLVE produced an optimal portfolio with over 10,000 MW of new large-scale solar resources in a single modeled year (2023).[2] This model-based output does not properly consider the value of a diversified generation fleet, nor does it take into account practical limitations and changing externalities. As a result, CPUC Energy Division staff manually limited annual solar buildout to 2,000 MW per year because "[m]any 'real-world' factors make it challenging to ramp up resource deployment quickly [such as the logistics] of training and re-locating staff, upstream supply chain limitations, siting and permitting lead times, etc."[3]

Similarly, recent CPUC IRP portfolios show optimized buildouts of between 8,000 MW to 11,000 MW of short-duration storage by 2030.[4] The CAISO has less than 200 MW of short-duration battery storage operating in the wholesale market today. CAISO operational experience with energy storage resources does not match recent modeling of "optimized" storage behavior.[5] Even as the CAISO prepares for more storage, including hybrid resources, use cases are constantly evolving. RESOLE modeling cannot accurately predict future storage resource behavior, especially when "hybridized" with renewable resources. Similarly, modeling cannot determine the impact, if any, that the investment tax credit will have on charge and discharge behavior. Although both solar and short-duration storage resources are important elements of California's transition to meet SB 100, the CAISO is still learning about how these resources will operate in its energy markets. The

[2] CPUC IRP, November 6, 2019 Ruling, 46 MMT Case from Section 3.1 Selected Resources in Core Policy Cases, Attachment A, p. 62.
[3] CPUC IRP, November 6, 2019 Ruling, 46 MMT Limited Near-term Solar Build from Section 3.9 Near-term Resource Availability Sensitivities, Attachment A, p. 122.
[4] *See* CPUC IRP November 6, 2019 Ruling and February 21, 2020 Proposed Decision.
[5] *See* CAISO comments on recent storage performance compared to modeled behavior on pages 12-14 from: http://www.caiso.com/Documents/Jul22-2019-Comments-PotentialReliabilityIssues-R16-02-007.pdf

CAISO is actively tracking future operational challenges, such as increasing evening ramping needs and multiple-day cloud-coverage events, which would reduce solar generation and limit charging capability.

The Joint Agencies should articulate an intentional plan for the existing natural gas-fired fleet rather than only relying on modeling results. Thus far, the CPUC's modeling produces many scenarios that alternatively economically retain the existing gas-fired fleet—beyond "real world" considerations—or abruptly retire them. In the first scenario, the model largely retains natural gas-fired resources through 2030 because it is economic to do so in the modeling framework.[6] However, this ignores that some of these resources will be over 40 years old by 2030. At that stage, some resources may not physically be capable of operating under the same conditions. This outcome also does not reflect an orderly and planned transition away from the gas fleet, which is a fundamental issue, especially in disadvantaged communities. On the other hand, the same RESOLVE scenario retires (only) 5,000 MW of gas-fired generation by 2045 but on a system that has a cumulative modeled increase of over 77,000 MW of large-scale solar and over 54,000 MW of short-duration battery storage.[7] The modeling is at a system level so it cannot consider whether large-scale solar and short-duration battery storage are workable solutions in the local capacity areas. The CAISO is conducting more detailed analyses to determine whether there are sufficient resources within local capacity areas in the CAISO footprint to charge a significant penetration of battery storage resources given the limited import capabilities into these load pockets.[8] Lastly, the CAISO has observed that the RESOLVE outcomes in the same modeled year (*e.g.*, 2030) are different if the last modeled year (*e.g.*, 2030 versus 2045) is also different.[9]

The CAISO generally supports modeling as a useful tool to explore the consequences of certain high-level scenarios and to learn as policies are implemented, but the application of a strict "least-cost" modeling paradigm risks ignoring more nuanced considerations that cannot be readily monetized or quantified. The CAISO instead urges the Joint Agencies to be judicious in its use and interpretation of modeled outputs.

---

[6] *See* CPUC IRP February 21, 2020 Proposed Decision, proposed Reference System Plan.
[7] *See* CPUC IRP February 21, 2020 Proposed Decision, proposed Reference System Plan.
[8] *See* http://www.caiso.com/Documents/2021LocalCapacityRequirementsFinalStudyManual.pdf, p. 7.
[9] CPUC IRP, November 6, 2019 Ruling.

B. The Joint Agencies Should Reduce the Number of Proposed Study Scenarios.

At the Workshop the Joint Agencies presented eight scenarios for analysis in RESOLVE: (1) High Electrification (offshore wind and out-of-state transmission not available); (2) High Electrification (offshore wind not available); (3) High Electrification (out-of-state transmission not available); (4) High Biofuels (offshore wind and out-of-state transmission not available); (5) High Hydrogen (offshore wind and out-of-state transmission not available); (6) 2019 Reference (RPS+); (7) 2019 Reference (no combustion of fossil fuel); and (8) 2019 Reference (60 percent RPS only for reference).[10] The Joint Agencies should collapse the first five scenarios into a single scenario with different "availability" dates for resources that would require significant lead-time to come online. Each of the demand values listed (high electrification, high biofuels, and high hydrogen) can be pursued simultaneously, at least in the near- to medium-term. Within high electrification scenario, there is no reason why offshore wind and out-of-state resource development would be incompatible strategies. In fact, today there is keen interest in both offshore wind development[11] and out-of-state resource development.[12] The Joint Agencies should work with stakeholders to develop availability dates for modeling purposes that reflect reasonable online dates given the realities of permitting, siting, and construction. Modeled scenarios should also be reviewed to ensure they reflect a wide range of system conditions including multiple days in which there is low solar and wind production.

The Joint Agencies should balance modeling outputs with known policy desires. For example, offshore wind and other as-yet undeveloped technologies are likely to be uneconomic in the near term. However, most modeling exercises would have found large-scale solar and short-duration battery resources uneconomic only a decade ago, yet there was policy direction to pursue those resources due to their perceived policy value.

[10] Kootstra, Mark, SB 100 Analytical Approach, p. 32.
[11] *See* https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/offshore-renewable-energy
[12] *See* http://www.caiso.com/planning/Pages/InterregionalTransmissionCoordination/default.aspx

C. The Joint Agencies Should Set Policy Direction that Considers a Variety of Concerns.

Stakeholders require policy direction as soon as possible and this direction should not be limited to meeting the renewable portfolio standard (RPS) percentage and greenhouse gas constraints at least-cost. At a minimum, the Joint Agencies should consider the needs of the state by balancing reliability, diversity, resilience, affordability, and the needs of disadvantaged or environmental justice communities. Considering these broader policies may set the state on a different course.

The Joint Agencies should provide policy direction to:

- **Diversify the resource fleet** – Solar resources—both behind-the-meter and large-scale—have significantly helped California reduce its carbon footprint and meet RPS targets. However, as solar resources begin to replace existing resources, the state must ensure either that (1) solar resources can provide the same level of reliable service or (2) the fleet is diversified enough to collectively meet energy needs across all 8760 hours in the year. In fact, the CAISO is at the forefront of testing these capabilities.[13] Physically diversifying the fleet also provides mitigation against permitting, siting, supply chain and other logistical limitations related to one dominant resource. Geographic diversity, especially for intermittent resources, allows for more efficient risk-mitigated use of a larger pool of resources across space and time. The CAISO's energy imbalance market has a mechanism to unlock some of this potential, but resource procurement should also include resource diversity as a guiding principle.
- **Intentionally test a limited and manageable quantity of new(er) technologies to prove these resources at scale before transitioning away from current technology** – The CAISO successfully integrated over 12,000 MW of large-scale solar and manages the system with over 8,000 MW of behind-the-meter solar that impacts the grid. During this evolution, the CAISO has learned many operational lessons, made major market changes, and worked closely with market participants to change and influence resource behavior and participation. Even with these changes, the CAISO still relies heavily on current hydro, gas-fired, and import

[13] *See* https://www.caiso.com/Documents/UsingRenewablesToOperateLowCarbonGrid-FAQ.pdf

resources to manage daily ramping and flexibility needs. Hydro, gas, and import resources also provide the bulk of the essential grid services necessary to maintain grid reliability. This is even more pronounced under stressed conditions. As the grid transitions to new resources, such as short-duration battery storage or "hybridized" storage and intermittent renewable resources, the CAISO will need a period of testing to ensure they (1) can provide the necessary capabilities to maintain reliability and (2) have the appropriate incentives to make those capabilities available at scale. The CAISO has and will continue to provide engineering-based and operational feedback to help the Joint Agencies refine policy direction. For example, the CAISO can provide feedback on the types of resource characteristics needed, new resource testing results, and reliability issues that arise with certain new technologies.

- **Set clear direction on how and when to reduce reliance on the existing gas-fired generation fleet so that stakeholders can consider and implement concrete plans to ensure system and local area reliability –** Currently, the modeling framework is based on a system-wide analysis even though the vast majority of the gas-fired fleet on the CAISO grid is located in the local capacity areas. Based on the current trending of resource adequacy procurement, local capacity area generation closely matches the local need requirement. In other words, it is difficult to retire existing resources without falling below the local capacity need requirement. On the other hand, transmission solutions can increase the transfer capability into local areas. Although the CAISO remains supportive of considering transmission solutions, such upgrades face numerous permitting, siting, and construction challenges. In the meantime, gas-fired resources within the local capacity areas may retire for other reasons such as when they reach their physical end of life, or mature out of long-term commercial contracts. The Joint Agencies should set the policy direction for an orderly reduction in the existing gas-fired generation fleet considering CAISO reliability analyses for local capacity areas in the CAISO's footprint. The CAISO is already taking steps to analyze battery charging capability in local capacity areas.

- **Due to the long lead times for transmission projects, proactively consider the potential benefits and costs of transmission-related projects** – New transmission projects may be necessary to interconnect large-scale in-state renewables, access offshore wind, or enable out-of-state resource development or other policy-driven considerations. However, the transmission permitting, siting and construction processes can take 10 years or more. Therefore, planning for transmission-dependent projects should start as soon as possible. If the Joint Agencies set the policy direction and intent, the CAISO can provide feedback on the technical feasibility of transmission-dependent policies.
- **In the meantime, strategically maintain the natural gas-fired fleet and delivery infrastructure** – During the transition to a cleaner grid, the state may need to retain portions of the current gas-fired fleet to provide both energy and reliability services. Specifically, reliability services include, but are not limited to: regulation; frequency response; spinning and non-spinning reserves; inertia; fault current; and grid forming capability. Although other resources, including renewable resources, can provide a sub-set of these services, they cannot yet provide these services on a large scale. In addition, renewable resources often have policy and commercial incentives that run counter to providing grid services. The Joint Agencies should also consider how to appropriately maintain necessary gas delivery infrastructure, which may be used less overall but will be more heavily relied upon during shorter periods, such as during steep ramping events.[14]

III. Conclusion

In many respects, California leads the country in transitioning to a cleaner grid. However, that means much of the "easy" decarbonization has already occurred. The next steps will be more challenging and will require intentional steps to unlock the value of resource procurement decisions and ensure greater vigilance over reliability. The CAISO looks forward to working with the Joint Agencies in this SB 100 process to provide engineering-based modeling to assess reliability impacts and provide feedback on market

[14] *See* CAISO comments at: http://www.caiso.com/Documents/Feb26-2020-Comments-ScopeProceeding-SafeandReliableGasSystems-R20-01-007.pdf

and operational experiences. In addition, the CAISO will continue to explore transmission opportunities and ramifications, both to inform resource-planning discussions and to be better positioned to act when policy direction is established. Lastly, although the SB 100 process focuses on the long-term needs, near- and mid-term procurement (*i.e.*, in the next three to 10 years) will be critical to maintaining reliability and meeting state goals. Ultimately these near- and mid-term decisions should align with long-term the policy direction.

Respectfully submitted

By: *<u>/s/ Jordan Pinjuv</u>*
Roger E. Collanton
General Counsel
Anthony Ivancovich
Deputy General Counsel
Anna A. McKenna
Assistant General Counsel
Jordan Pinjuv
Senior Counsel
California Independent System Operator Corporation
250 Outcropping Way
Folsom California 95630
Tel.: (916) 351-4429
jpinjuv@caiso.com

Date: March 9, 2020