

ALJ/JF2/jnf

Date of Issuance 2/26/2025

Decision 25-02-026 February 20, 2025

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to
Continue Electric Integrated Resource
Planning and Related Procurement
Processes.

Rulemaking 20-05-003

**DECISION TRANSMITTING ELECTRICITY RESOURCE PORTFOLIOS
TO THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR
FOR 2025-2026 TRANSMISSION PLANNING PROCESS**

TABLE OF CONTENTS

Title	Page
DECISION TRANSMITTING ELECTRICITY RESOURCE PORTFOLIOS TO THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2025-2026 TRANSMISSION PLANNING PROCESS	1
Summary	2
1. Background	3
1.1. Factual Background.....	3
1.2. Procedural Background.....	5
1.3. Submission Date	6
2. Modeling Inputs and Assumptions.....	7
2.1. Comments of Parties	7
2.2. Discussion.....	15
3. Recommended Base Case Portfolio	18
3.1. Comments of Parties	20
3.2. Discussion.....	26
4. Recommended Sensitivity Portfolio.....	27
4.1. Comments of Parties	32
4.2. Discussion.....	34
5. Busbar Mapping	35
5.1. Comments of Parties on Methodology.....	37
5.2. Comments of Parties on Preliminary Results.....	43
5.3. Discussion.....	55
6. Production Cost Modeling of Recommended Base Case Portfolio	68
7. Summary of Public Comment	76
8. Comments on Proposed Decision.....	76
9. Assignment of Proceeding	84
Findings of Fact.....	84
Conclusions of Law	87
ORDER	90

**DECISION TRANSMITTING ELECTRICITY RESOURCE PORTFOLIOS
TO THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR
FOR 2025-2026 TRANSMISSION PLANNING PROCESS**

Summary

This decision recommends to the California Independent System Operator (CAISO) for its 2025-2026 Transmission Planning Process the analysis of two electricity portfolios: a reliability and policy-driven base case portfolio and a sensitivity portfolio.

The base case portfolio recommended is based on the greenhouse gas (GHG) emissions target for the electricity sector of 25 million metric tons (MMT) by 2035, includes the resources contained in the individual integrated resource plans submitted to the Commission by the load serving entities (LSEs) in November 2022, and relies on the same modeling assumptions as the adopted preferred system plan portfolio, with some relevant updates described in this decision. Commission staff have analyzed this recommended base case portfolio for its reliability and emissions characteristics and the portfolio is found for both metrics to be within reasonable bounds to recommend to the CAISO for further transmission analysis. The portfolio achieves 99 percent clean energy serving retail load by 2035, with a portfolio of approximately 63 gigawatts of new storage and clean energy to come online between now and 2035.

This decision also asks the CAISO to reserve deliverability on the transmission system for certain diverse resources that are geographically-limited and take longer to develop, including geothermal, biomass, offshore wind, non-battery long duration energy storage, and a specified portion of the total amount of in-state/on-shore and out-of-state wind. We also request that the CAISO study,

but not yet trigger the investment in, new transmission to support some out-of-state wind and Northern California wind (not within the CAISO Balancing Authority Area), since these resources would require extensive new transmission development not previously identified or assessed that will be complex to accomplish and will require regional cooperation.

The sensitivity electricity portfolio recommended herein is intended to help study the transmission implications of a portfolio with a greater volume of long lead-time (LLT) resources than in the base case portfolio, that relies on the resources online and under contract included in the LSE plans, with amounts and types similar to the those included in Decision (D.) 24-08-064, while also including the LSE planned resources as submitted in November 2022 only through 2030, with the capacity expansion model allowed to optimize thereafter. This sensitivity analysis will help the state better analyze the appropriate transmission development to support the LLT resources called for in D.24-08-064.

This proceeding remains open for, among other purposes, consideration of the Reliable and Clean Power Procurement Program that is expected to be addressed in early 2025.

1. Background

This section presents both the factual and procedural background for this portion of the proceeding.

1.1. Factual Background

As part of the longstanding agreement between the California Energy Commission (CEC), California Independent System Operator (CAISO), and the California Public Utilities Commission (Commission) to collaborate on electricity

resource and transmission planning, every year Commission staff develop a recommended set of portfolios for the CAISO to analyze in its annual Transmission Planning Process (TPP).

Generally, in each TPP cycle, the CAISO evaluates a reliability and/or policy-driven base case portfolio. Under the CAISO tariff adopted by the Federal Energy Regulatory Commission (FERC), if the results of the base case analysis show the need for additional transmission development, the transmission projects are brought to the CAISO Board for approval in the spring of the second year of the TPP cycle (in this case Spring 2026). If approved by the CAISO Board, under the FERC tariff, the projects would receive cost recovery through the transmission access charge.

Along with the base case analysis that generally leads directly to transmission project approval, in each TPP cycle the CAISO typically analyzes one or more sensitivity portfolios. The purpose of the sensitivity portfolio analysis is to assist in future planning by identifying relevant transmission needs and potential costs.

Decision (D.) 24-02-047 included both a base case and a sensitivity portfolio that the CAISO is in the process of analyzing for the current 2024-2025 TPP cycle. The base case portfolio was based on the electricity sector scenario that achieves a 25 million metric ton (MMT) greenhouse gas (GHG) emissions target in 2035, including 4.5 gigawatts (GW) of offshore wind. The 2024-2025 TPP sensitivity portfolio currently being studied by the CAISO is a High Natural Gas Retirement scenario, designed to assist in planning for the potential future retirement of fossil-fueled resources.

1.2. Procedural Background

An Administrative Law Judge's Ruling (ALJ Ruling) was issued on September 12, 2024 seeking comments on the proposed base case and sensitivity portfolios for the 2025-2026 TPP cycle.

The following parties filed timely comments by September 30, 2024 in response to the ALJ Ruling: American Clean Power – California (ACP-CA); Alliance for Retail Energy Markets (AReM); CAISO; California Community Choice Association (CalCCA); California Wind Energy Association (CalWEA); California Environmental Justice Alliance (CEJA) and Sierra Club, jointly; California Energy Storage Alliance (CESA); California Western Grid Development LLC (CWG); Defenders of Wildlife (DOW); Environmental Defense Fund (EDF); ENGIE North America, Inc. (ENGIE); Fervo Energy Company (Fervo); Form Energy, Inc. (Form); GridLiance West, LLC (GridLiance); GreenGen Storage, LLC (GreenGen); Golden State Clean Energy, LLC (GSCE); Green Power Institute (GPI); Horizon West Transmission, LLC (Horizon); Hydrostor, Inc. (Hydrostor); Invenergy California Offshore, LLC (InvenergyCA); Mussey Grade Road Alliance (MGRA); Offshore Wind California (OWC); Pattern Energy Group, LP (Pattern); Protect Our Communities Foundation (PCF); Pacific Gas and Electric Company (PG&E); Public Advocates Offices of the California Public Utilities Commission (Cal Advocates); RWE Offshore Wind Holdings, LLC (RWE); Sonoma Clean Power Authority (SCPA); San Diego Gas & Electric Company (SDG&E); Solar Energy Industries Association (SEIA) and Large-Scale Solar Association (LSA), jointly; and Vineyard Offshore Wind, LLC (Vineyard).

The following parties filed reply comments by October 7, 2024 in response to the ALJ Ruling: ACP-CA; Bay Area Municipal Transmission Group (BAMx); BHE Renewables, LLC (BHE); CAISO; CalCCA; Calpine Corporation (Calpine); CalWEA; CEJA and Sierra Club, jointly; DOW; EDF; Fervo; GPI; GridLiance; GreenGen; Hydrostor; Invenergy California; MGRA; NextEra Energy Resources, LLC (NextEra); OWC; Pioneer Community Energy (Pioneer); RWE; SEIA and LSA, jointly; Southern California Edison Company (SCE); Terra-Gen LLC (Terra-Gen); and Vineyard.

On November 5, 2024, Commission staff held a workshop to present and discuss the preliminary mapping of electricity resources in the portfolios to busbars on the transmission system. On October 30, 2024, an ALJ Ruling was issued inviting parties to comment on the busbar mapping results. No reply comments were invited.

The following parties timely filed comments by November 19, 2024, on the preliminary busbar mapping: ACP-CA; CalCCA; Cal Advocates; CalWEA; CEJA and Sierra Club, jointly; CESA; Coalition for the Optimization of Renewable Development (CORD); DOW; EDF; ENGIE; Equinor; GridLiance; GPI; GreenGen; GSCE; MGRA; NextEra; PCF; PG&E; SEIA and LSA, jointly; and Terra-Gen.

1.3. Submission Date

This portion of the proceeding was submitted on November 19, 2024 upon receipt of parties' comments on the preliminary mapping of resources in the portfolios to busbars on the transmission system.

2. Modeling Inputs and Assumptions

The ALJ Ruling summarized the updates to the RESOLVE capacity expansion model since the development of the 2024-2025 TPP scenarios. The most significant updates were:

- New Transmission Cluster Constraints: New resource interconnection limits were added in RESOLVE on each transmission constraint cluster, based on the number and voltage of identified buses in the cluster.
- Load Inputs: Load forecast assumptions were updated from the 2022 version of the CEC's Integrated Energy Policy Report (IEPR) to the 2023 IEPR version.¹
- Geothermal Resource Cost: A binary version of the geothermal technology is now represented instead of the flash version, which results in approximately a 30 percent cost increase.²
- Arizona Solar Profiles: Corrected Arizona Solar candidate resource profile to reflect a daylight savings time adjustment.

2.1. Comments of Parties

Numerous parties commented on or responded to the ALJ Ruling's questions on inputs and assumptions (I&A) updates used in the modeling that led to the recommended portfolios in the ALJ Ruling.

First, we summarize comments related to the I&A and the updates described above. AReM recommends that we replace the 4,000 MW cap on

¹ See details on the CEC's web site at the following link: <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2023-integrated-energy-policy-report>.

² All costs are derived from the National Renewable Energy Laboratory's 2023 Annual Technology Baseline.

imports. Pattern recommends that the Commission confirm that the RESOLVE modeling does not simply fill unutilized transmission capacity with unspecified imports, recommending instead that we should proactively plan for specified renewable imports that can utilize available transmission capacity at the lowest cost to ratepayers in the long term.

Pattern, as well as ACP-CA in reply comments, encourage the Commission to consider a new class of out-of-state renewable resources that do not require any incremental transmission, which would involve creating new candidate resources to be chosen by the RESOLVE model. Pattern is also interested in whether the Commission considers New Mexico solar and storage as candidate resources.

CalCCA suggests that the Commission determine which resources cannot meet the resource portfolio levels with capacity already progressing through the interconnection queue to identify resources that should be classified as long lead-time (LLT) for purposes of the CAISO's System Need score. SEIA and LSA agree in their reply comments.

SEIA and LSA, also in reply comments, suggest that IRP modeling may need to revisit the annual solar build limits and increase the near-term solar volumes to ensure that transmission is available to support solar needs.

PG&E and SCPA are concerned that the electric system may move toward a winter peak and suggest that RESOLVE assumptions be updated accordingly. In reply comments, ACP-CA and CalWEA agree.

Form asks that we include 100-hour multi-day storage as a candidate resource. CESA recommends that the scenarios be updated with new resource

categories to ensure accurate transmission. CESA takes specific issue with the characterization of 12-hour storage resources, arguing that pumped storage hydroelectric resources (PSH) are not equivalent to 12-hour lithium ion batteries, in terms of either cost or performance. CalWEA and ENGIE request that the winter capacity values being used for in-state wind resources be reevaluated.

PCF encourages the Commission to make assumptions on a shorter-term basis in general, to maximize the availability of technological innovations and to take advantage of cost reductions.

In reply comments, ACP-CA generally request that the Commission update the costs of out-of-CAISO resources. Cal Advocates suggests that inputs related to combined heat and power (CHP) should be updated to align with the IEPR assumption that CHP resources will remain in service and/or repower rather than retire.

Several parties also comment on the geothermal cost assumptions. Fervo is concerned with using the 2023 National Renewable Energy Laboratory (NREL) Annual Technology Baseline (ATB) data vs. the newly-available 2024 cost estimates. ACP-CA agrees in reply comments. Fervo, PCF, EDF, and SCPA recommend that the Commission use ATB EGS binary cost for geothermal and notes that hydrothermal binary cycle NRL ATB does not capture advancing geothermal technologies. They also argue that the change in assumptions should be better justified by staff. Finally, they argue that costs should better represent near-term opportunities for geothermal. In replies, Fervo reiterates support for using new resource costs for geothermal and BHE and ACP-CA agree, arguing that the cost assumption change will have the unintended consequence of forcing

LLT resources out of the modeling results. SCPA suggests exploring the use of the NREL 2023 Renewable Energy Potential model and prioritizing modeling next generation geothermal technologies with their own separate costs and resource availability profiles.

MGRA in opening comments, and GreenGen in replies, argue that NREL data should be used to evaluate California's PSH projects.

With respect to assumptions about demand, CEJA and Sierra Club request that the Commission ensure that the current 2023 IEPR forecast with a lower managed system peak demand (compared to the 2022 IEPR forecast) is being used.

AReM recommends that adequate resources be included in the portfolio to ensure that publicly-owned utilities (POUs) meet applicable state clean energy standards and add separate emissions accounting for POU and CPUC-purview load so that the latter is not unfairly held responsible for meeting POU emissions mandates.

Also in the general category of assumptions, numerous parties commented with concerns about transmission and interconnection constraints.

SCPA expresses overall concerns about the new application of interconnection cluster constraints in RESOLVE. SCPA argues that assuming that all incremental capacity will be spread uniformly across the existing infrastructure without triggering additional transmission needs sends an inaccurate signal to the CAISO about the true nature of future transmission needs.

Horizon West is concerned that interconnection constraints do not change over the study horizon, which they take to mean that CAISO-approved upgrades are not included in the RESOLVE inputs.

GridLiance comments that data inputs to the RESOLVE model should reflect transmission system upgrades already approved in the CAISO TPP in years in which the upgrades are scheduled to be placed in service. In addition, GridLiance argues that the transmission data should change to reflect the upgrades selected by RESOLVE as those upgrades are selected.

With specific respect to the transmission needed for offshore wind, Invenergy California argues that the transmission constraints should be adjusted to reflect at least 5.3 GW of offshore wind for the Morro Bay Offshore upgrade. In reply comments, CalWEA agrees, because the transmission system upgrades needed are relatively limited and, if not used by offshore wind (OSW), likely will be used and useful for other resources; thus, CalWEA argues that these would be least-regrets upgrades. Invenergy California also argues that we should consider sizing the Central Coast interconnection larger than the new OSW capacity to allow for other renewable projects to interconnect.

In reply comments, GPI recommends assessing whether any new transmission buildout for OSW in either the base case or the sensitivity case could reasonably interconnect with alternative resources if OSW procurement turns out to be less than the amount included in the portfolios.

Another category of comments reflected general concerns with the RESOLVE capacity expansion model.

SCPA expresses some general skepticism about the efficacy of transmission constraint modeling in RESOLVE. TerraGen agrees in reply comments and states that the resulting transmission plans are failing to trigger particular much-needed transmission upgrades.

Invenergy California argues that RESOLVE does not accurately quantify the net benefits of OSW and does not reflect OSW technology capabilities and cost projections. In reply comments, GPI generally disagrees with the Invenergy California analysis, but also argues that the model, method, inputs and assumptions are not transparent. Still, GPI points out that OSW developers present a one-sided view of costs relative to OSW benefits and notes that no OSW developers present any alternative cost estimate data that would justify lowering the OSW cost below the assumptions in RESOLVE. CEJA and Sierra Club agree with Invenergy California and are generally concerned that RESOLVE does not account for diversity benefits. GPI also offers criticism that the model is unable to value diverse portfolios and is myopically focused on solving for least cost.

Vineyard, ENGIE, OWC, and ACP-CA also express concerns about the lack of accounting for federal and state financial incentives. ENGIE is also concerned about the model not fully addressing development potential in Nevada.

GSCE raises concerns about solar and storage development opportunities in Northern California in RESOLVE. CalWEA and TerraGen agree in reply comments and encourage the Commission to address the limitations that have resulted in under-planning for the Northern California region. CalWEA

specifically asks the Commission to revert to the 800 MW (instead of the 1,700 MW proposed) of Tehachapi wind resources identified in previous PSP portfolio, because there are military conflicts, as well as a California condor presence making further development in the area difficult.

GSCE also expresses concern that RESOLVE has insufficient ability to model transmission interactions that create local capacity areas.

PCF, DOW, and CEJA and Sierra Club also feel that the model insufficiently incorporates the benefits of behind-the-meter resources.

Several comments also focused on alignment (or the lack thereof) between IRP and the CAISO processes. SEIA and LSA request better alignment in order to enable timely inclusion of the results of previous TPP analyses into the IRP scenario development for the next TPP. For example, they state that new transmission projects approved in the 2023-2024 TPP are not included in the proposed 2025-2026 portfolio.

SCPA requests that the model be updated with new CAISO deliverability methodology from its annual White Paper prior to selecting the recommended final portfolio from IRP for the next TPP.

Several parties are also concerned about the maximum import capability (MIC) allocation process alignment. CalCCA recommends that MIC expansion be incorporated into the busbar mapping process. ACP-CA requests further clarification that MIC needs will account for reasonably conservative assumptions for import flows. ACP-CA also recommends that the Commission request that the CAISO plan for an appropriate amount of in-CAISO transmission to resolve future MIC constraints that are driven by more

conservative assumptions regarding long-term MIC needs. SCPA requests that the busbar mapping process be revised to align expectations of MIC expansion with LSE planning for policy-driven out-of-state LLT resource procurement. Fervo agrees in reply comments. GSCE also wants the Commission to provide direction to the CAISO to plan for resource development in the San Joaquin Valley.

Referencing Senate Bill (SB) 887 (Stats. 2022, Ch. 358), CWG requests that if the CAISO's 2025-2026 TPP analysis finds that the use of gas generation is not significantly reduced in local areas, the Commission should ask CAISO to approve transmission additions necessary to allow the use of local area gas generation to be significantly reduced by 2035.

On the subject of SB 887 requirements, CEJA and Sierra Club allege that the lack of a gas retirement scenario as the base case portfolio is inconsistent with California policy and law, including Section 454.57(e)(4) of the Public Utilities Code. CEJA and Sierra Club, as well as CWG, also argue that the RESOLVE model incorrectly assumes that gas plants are needed for reliability. SCE disagrees with this in reply comments, noting that natural gas should be retained in the portfolios for its capacity value and that it will take a seven-to-eleven-fold multiple of the clean firm resource capacity, as well as additional retention of natural gas, to maintain reliability, according to SCE's analysis.

CalCCA comments that the Commission should have a plan to evaluate new resource development in local areas and new transmission alternatives to relieve local area constraints. In reply comments, EDF agrees that it is prudent to procure sufficient clean energy and transmission resources in local areas that

currently rely on natural gas for reliability so that the capacity factors of the fossil fueled plants will decrease and then these resources will no longer be selected by RESOLVE in as large amounts.

CEJA and Sierra Club argue that the Commission committed to local reliability analysis and to prioritizing natural gas retirement analysis in disadvantaged communities. In reply comments, they reiterate that local procurement should be done through the resource adequacy central procurement entity (CPE) to target areas where CAISO has found that storage can serve as a complete replacement of natural gas resources.

2.2. Discussion

In this section we respond generally to parties' comments on the modeling inputs and assumptions. Many of the comments fall into the category of assumptions that we typically update within each IRP cycle. While for purposes of this year's TPP recommendations we are relying on assumptions from the PSP adopted in D.24-02-047, updated where possible, there will be a further opportunity for parties to have input into the next round of assumptions to be used to develop the next PSP starting in early 2025. During that process, there will be updates to a host of inputs and assumptions, including, but not limited to: resource cost estimates, import assumptions, and transmission constraints. In the meantime, we are seeking to be broadly consistent with previous portfolios, while moving the TPP process forward incrementally.

With respect to parties' comments about alignment with CAISO processes, we note that our staff coordinate with the CAISO frequently and we are well aligned wherever possible. In some cases, the different timing of the CAISO tariff

requirements for their TPP and other processes necessitate that we use the best-available information that we are able to incorporate at the time the recommendations are being developed. There are inherent challenges in aligning timing perfectly because, at least in some cases, the modeling analysis takes time and therefore assumptions cannot always be revised in real time. In some other cases, parties are recommending that we align processes that are not a joint role for the Commission and the CAISO, but rather within the CAISO's exclusive purview, such as MIC allocation. For these processes, while the Commission may make recommendations, the CAISO Board is the ultimate decisionmaking authority.

With respect to some parties' criticisms of the RESOLVE model, many of these have been considered in the past. Some of the comments also relate more to the model's assumptions than its design or function. While we always remain open to improvements, we note that RESOLVE provides one of the best-available tools to model future resource buildout necessary to reliably achieve state policy goals. Further improvements to the model are continuously being made, and all of the parties' suggestions in this context will be taken into consideration when we consider changes to inputs and assumptions for the next cycle of IRP. Commission staff plan to seek stakeholder feedback in the first quarter of 2025.

In response to parties encouraging further work on natural gas retirements, especially in disadvantaged communities, we note that the current base case is modeled to achieve a GHG emissions level of 25 MMT, which includes modeled reductions in natural gas usage. We further note that the 2024-2025 TPP process is still underway at the CAISO and includes analysis of a

sensitivity portfolio with a high amount of natural gas plant retirement. The results from that study may help us plan transmission solutions for additional natural gas retirement in the future, including in local areas, but it is premature to consider in this year's base case portfolio because the analysis is not yet complete.

We also note that in the 2022-2023 TPP, a total of 12 transmission projects (collectively referred to by the CAISO as the Southern Area Reinforcement Projects), including a new 500 kilovolt (kV) line, were approved to reinforce the grid in the San Diego and Los Angeles load centers. These projects were identified in response to the SB 887 requirements, where the Commission requested that the CAISO identify the higher-priority transmission facilities to allow for increased capacity into local areas. The CAISO's 20-year Transmission Outlook, as well as the 2024-2025 TPP preliminary reliability results, show that these projects are an effective solution to enable additional renewable generation to enter the local areas and replace natural gas generation. Local area studies being completed in early 2025 will further analyze the ability of these projects to scale back natural gas usage.

In response to the comments of CWG, where they claim that CAISO TPP studies found that gas plants are expected to run more, not less, we find this assertion to be based on a misrepresentation of the assumptions in the CAISO analysis, which shows a comparison between the forecast hourly load profiles compared with the transmission load serving capability. CWG makes an assumption that all of the load above the transmission carrying capability would be served by natural gas plants, but that is not necessarily the case, as more

renewables and storage are on the system and able to deliver during the peak hours. Since the study referenced by CWG was completed, CAISO has approved multiple new transmission projects into the Los Angeles Basin, which we expect to change the conclusions of similar studies to be conducted in the future.

In addition, as was true with the 2024-2025 TPP base case portfolio, this year's base case portfolio, as modeled by RESOLVE, already includes reductions in utilization of natural gas plants (based on GWh of energy produced) within the CAISO area of 71 percent by 2035 and 80 percent by 2040, compared to the first modeled year, 2026. This is consistent with SB 887's requirements that we "substantially reduce" reliance on non-preferred resources by 2035 in local areas. The base case portfolio included in this decision achieves clean energy production well beyond the SB 100 (Stats. 2018, Ch. 312) interim targets used for modeling, achieving 99 percent (compared to the SB 100 90 percent target), 106 percent (compared to the 95 percent target), and 114 percent (compared to the 100 percent target) clean generation in 2035, 2040, and 2045, respectively. Generation percentages above 100 percent are achievable because SB 100 targets are based on retail sales and because exported energy counts towards these targets.

3. Recommended Base Case Portfolio

The ALJ Ruling included a recommendation for a reliability and policy-driven base case portfolio that was designed to be similar to the 2024-2025 TPP base case, with the same policy assumptions. The portfolio incorporates the 25 MMT by 2035 GHG emissions target, includes the resources contained in the individual LSE IRPs submitted in November 2022, and uses the same modeling

inputs and assumptions, with the updates noted in Section 2 of this decision, including updating the load forecast assumptions. The key model years for this year's TPP base case are 2035 (10-year projection) and 2040 (15-year projection).

The proposed base case in the ALJ Ruling included the new resource amounts shown below in Table 1. Table 1 includes values for model years 2030 and 2045, even though those results are not required for CAISO TPP analysis.

**Table 1:
New Resources Included in 2025-2026 TPP Proposed Base Case (in GW)**

RESOLVE Resource Type	2030	2035	2040	2045
Natural Gas	-	-	-	-
Geothermal	1.5	1.6	1.6	1.6
Biomass	0.2	0.2	0.2	0.2
In-State Wind	5.2	7.9	7.9	9.0
Out-of-State Wind	4.7	9.0	10.7	15.7
Offshore Wind	-	4.5	4.5	4.5
Solar	14.8	19.8	44.9	61.8
Li-ion Battery (4 hr)	11.6	15.7	15.7	15.7
Li-ion Battery (8 hr)	1.2	2.8	12.0	21.1
Pumped Hydro Storage (12 hr)	0.5	0.8	0.8	0.8
Other LDES (8-24 hr)*	0.3	0.5	0.5	0.5
Shed Demand Response	-	-	-	-
Gas Capacity Not Retained	-	-	-	(3.5)
Total	40.0	62.9	98.8	127.4

* Long-duration energy storage (LDES) technologies include Flow Batteries (8hr) and Adiabatic Compressed Air Energy Storage (24 hr).

3.1. Comments of Parties

Approximately 30 parties commented on the base case portfolio recommendation. Some parties, including CAISO, PG&E, Horizon West, SDG&E, and Pattern, were generally supportive and/or provided some suggested clarifications to the base case.

CAISO supports the base case portfolio because it is informed by the LSE plans, meets a 25 MMT GHG target, and is consistent with the 2024-2025 TPP base case, while adding reasonable changes mostly due to modifications to the load forecast. BAMx supports this rationale in reply comments.

CAISO also supports including LLT resources in the sensitivity portfolio, but cautions that without LLT resources in the base case, the CAISO will likely not approve enough transmission to support the ultimate LLT resource volumes. CAISO recommends that the CAISO and Commission staff continue to work together on options to align LLT procurement direction with CAISO transmission processes. Invenergy and Hydrostor support this suggestion in reply comments and share the overall concern.

CalCCA, GPI, PG&E, and SCPA suggest that we reconsider reliance on the 2022 IRPs in the base case. SCPA suggests that LSE planned resources be supplemented with CAISO interconnection queue data. PG&E suggests using data from the more-recently-filed procurement data filings (from June 1, 2024). GPI supports this in reply comments. GPI also recommends that the Commission provide a comparison of planned-to-actual LSE procurement to validate alignment with planning portfolios. SEIA/LSA, CalWEA, and GreenGen agree with this recommendation in reply comments, noting that the LSE plans relied

on 2021 cost data. CalWEA suggests that the LLT resources procured by the LLT CPE will displace solar and storage resources that were contained in LSE plans.

In reply comments, GPI also recommends that the influence of the 2022 LSE plans be reduced in the base case portfolio, by only forcing in the planned resources through 2030, and LLT resources through 2035.

In reply comments, SCE disagrees with parties that want to eliminate reliance on the 2022 LSE plans, noting that only resources included in the approved plans and/or selected by RESOLVE modeling should be included in the base case. SCE generally supports the proposed base case, including its level of natural gas generation retention. SCPA and CEJA/Sierra Club, on the other hand, express concern that the base case portfolio requires retention of an additional 2.7 GW of natural gas generation, compared to the 2024-2025 TPP base case. In reply comments, Calpine supports maintaining consistency with the most-recently-adopted PSP portfolio.

Pattern does not support including the LLT volumes adopted in D.24-08-064 in the base case. SEIA/LSA agree in reply comments. Also in reply comments, BAMx urges the Commission only to include 4.5 GW of OSW in the base case, given uncertainty with OSW development and its high transmission costs. GPI makes similar arguments about OSW uncertainty in its reply comments.

Most of the parties representing OSW interests expressed concerns with the proposed base case. Hydrostor, ACP-CA, and RWE argue that the base case proposed does not align with the state's procurement and policy goals. Vineyard, RWE, Invenergy, ACP-CA, OWC, Fervo, and CalWEA all comment that the base

case should include the maximum quantities of LLT resources reflected in the need determination in D.24-08-064. RWE wants the base case to reflect the intention stated in D.24-08-064 to leave room for LSEs to conduct individual procurement separate from the initial tranche of CPE procurement. RWE also argues that the Commission needs to ensure that the necessary transmission infrastructure will be in place to accommodate up to the 7.6 GW of OSW resources, including right-sizing of transmission investments at the outset. In reply comments, CalWEA and Vineyard reiterate that 7.6 GW of OSW should be included in the base case, arguing that limiting transmission planning now could lead to a less competitive solicitation for the wind resources. They argue that delays in transmission planning will threaten California's ability to achieve the long-term GHG goals and the CPE's planned 2037 delivery date. RWE points out that initial delivery dates for D.24-08-064 would imply a five-year development time for transmission to support delivery of the LLT resources, which RWE argues is not enough time.

In reply comments, CEJA and Sierra Club agree with including 7.6 GW of OSW as an opportunity to signal unambiguously that California is strongly committed to OSW development. RWE and OWC suggest that the Commission should include up to 10 GW by 2040 or 2045.

In reply comments, SEIA and LSA disagree about including D.24-08-064 quantities in the base case, noting that many factors impact transmission and resource development timelines and there will be opportunities to shorten the timelines while mitigating ratepayer risks. NextEra argues that higher amounts of LLT resources in the base case could increase risk to customers,

recommending that the Commission conduct ongoing comprehensive comparisons of benefit amounts of different resources, similar to the analysis included in the ALJ Ruling. GridLiance also argues against including more LLT resources in the base case, because it would result in a portfolio that prioritizes resources that may not be procured over resources that have larger commercial interest. GPI, in reply comments, argues that D.24-08-064 made no commitment to LLT procurement, depending on cost, given that the CPE procurement could be zero. GPI suggests that until OSW developers provide credible cost projections, concrete project development timelines, and start delivering OSW projects, the more conservative OSW buildout proposed for the base case should be retained.

Beyond concerns expressed about OSW volumes, several other parties expressed various concerns. CEJA and Sierra Club suggest that the base case portfolio should include at least 15 GW of natural gas retirements, more than assumed in the 2024-2025 TPP sensitivity portfolio. EDF supports this suggestion in reply comments. Calpine opposes the CEJA/Sierra Club recommendation, noting that, as stated in the ALJ Ruling, the proposed base case adheres to the Scoping Plan GHG limits. Calpine also points out that the 2024-2025 sensitivity portfolio is still being studied.

CalCCA argues that the base case does not reduce the use of fossil-fueled resources enough and could result in a proliferation of reliability must-run (RMR) contracts by the CAISO. CEJA and Sierra Club agree in reply comments. CalCCA suggests that the base case be revised so that natural gas plants are not online beyond the transition period adopted in Public Utilities Code

Section 454.53. PCF also argues that the base case needs to be revised to sufficiently plan for natural gas retirements. In reply comments, Pioneer agrees with the CalCCA and PCF sentiments, and pitches biomass as a carbon-neutral alternative to natural gas.

GSCE comments that the proposed base case is at risk of not being actionable, based on the amount of solar that is needed to be built between 2035 and 2040. CalCCA, Pioneer, and ACP-CA also raise concerns about the amount of solar that is added, especially in the outer years of the planning horizon, and are concerned that the solar is not supplemented with enough storage to make the energy useful for serving load in non-daylight hours. In reply comments, SEIA and LSA disagree, noting that the portfolio is consistent with earlier portfolios and the cost and availability of solar resources.

CalCCA, BHE, and CalWEA also argue that the portfolio should be analyzed for its resource adequacy implications under the slice of day (SOD) paradigm, to ensure that the base case incorporates linkages between IRP and resource adequacy needs.

CalWEA suggests that the volumes of LDES and geothermal should be held constant because they lead to the exclusion of in-state or out-of-state wind, which are lower-cost resources.

CalCCA recommends that the Commission work with the CAISO to enhance its long-term MIC allocation process, pointing out the volume of out-of-state (OOS) resources included in the base case. BHE agrees in reply comments. SCPA recommends that the Commission assess the impact of capping the share of OOS resources at one-third of the total buildout and consider adopting the

resulting portfolio as the base case. SCPA has concerns with the amount of OOS resources in the portfolios and considers it risky to rely too much on other states with other priorities. CalWEA agrees in reply comments that the portfolios are becoming increasingly dependent on OOS resources and that represents risks. CalWEA also advocates that the base case portfolio support the need for the Trout Canyon-Lugo 500 kV transmission upgrade.

In reply comments, Terra-Gen recommends modifying the proposed base case to address perceived under-planning in Northern California, especially for energy storage. Terra-Gen recommends that a minimum of 1,900 MW be allocated for battery storage, consistent with the 2023-2024 TPP base case.

GridLiance notes that the base case portfolio should assume additional resources in places that have significant commercial interest, including those that are outside of, but adjacent to, the CAISO footprint. GridLiance notes that the CAISO has additional transmission upgrade opportunities available adjacent to its grid and argues that the base case should be updated to reflect this, with more resources mapped in Southern Nevada.

ACP-CA suggests that the Commission should consider factors beyond a least-cost analysis, especially evaluating whether the need for new resources declines with additional resource diversity, and considering the total portfolio instead of focusing on the new resources needed. In replies, GPI states that future portfolio diversity may come from other baseload resources such as biomass, geothermal, and LDES, beyond OSW, and using proven technologies in addition to emerging technologies.

Finally, several parties, including AReM, Cal Advocates, and GPI, recommend that Commission staff conduct reliability modeling of the base case portfolio and release the results. ACP-CA and CalWEA agree in reply comments.

3.2. Discussion

After consideration of the numerous comments from parties, we will adopt the proposed base case portfolio as reasonable. Using this base case is consistent with our precedent of building on recently-adopted portfolios to keep the TPP base case moving forward incrementally toward our goals. The proposed base case meets our adopted GHG targets and is consistent with last year's TPP base case, while making appropriate updates such as incorporating key changes to the load forecast.

We do not find it appropriate to reduce reliance on the individual IRP resources planned by LSEs, as suggested by some parties for various purposes, because the plans represent a reasonable approximation of the resources that LSEs intend to procure. The timeframe for this analysis required using the November 2022 IRP plans, and we also note that using updated procurement data may have selectively eliminated some resource types, including OSW. For this TPP, we find that it is preferable to maintain consistency with prior TPP base cases.

We do find merit in the idea proposed by GPI that we consider comparing procurement plans to actual procurement as we progress into the next decade, and will pursue that analysis later in this proceeding or a successor proceeding.

At this juncture, we disagree with those parties who propose that we incorporate all or most of the LLT resources called for in D.24-08-064 into the

base case portfolio. While we remain committed to the goals stated in that decision of procuring these critical long-term resources, it is too early to tell at this point in time what volume of those resources can be procured at reasonable cost. When the procurement process is further along, we expect to begin layering in expected volumes into future PSP and TPP portfolios to reflect progress. Until then, it is premature to add them to the base case portfolio for this year. However, we do propose a sensitivity portfolio in Section 4 of this decision that is focused solely on transmission to support the LLT resources.

In response to the parties that noted the need for better alignment between resource adequacy SOD requirements and IRP portfolios, planning, and procurement, we expect that this issue will continue to be relevant in this proceeding (and/or its successor) as well as the resource adequacy rulemaking (R.23-10-011). It is beyond the scope of this proposed decision.

Finally, in response to the parties that requested that production cost modeling be done on the base case portfolio to analyze its reliability characteristics, Commission staff have completed that task and the results are discussed in Section 6 of this decision.

4. Recommended Sensitivity Portfolio

The ALJ Ruling included a recommendation for two options for a sensitivity portfolio to analyze the potential transmission impacts of LLT resource buildout. The staff-preferred option included the maximum volumes in D.24-08-064 for each LLT resource type: geothermal, LDES, and OSW. The OSW and LDES resources need determinations, in particular, were 7.6 GW online between 2035 and 2037 and 2 GW online between 2031 and 2037, respectively,

which are quantities not previously studied in any base case portfolio or in any sensitivity portfolio designed to be a realistic representation of a potential future.

To gain more information about the transmission needs associated with a high-LLT portfolio future, the ALJ Ruling recommended that the CAISO conduct a sensitivity analysis of a portfolio with more LLT resources, specifically geothermal, OSW, and LDES, displacing some amount of other resources that would otherwise have been in the portfolio. The LLT capacity amounts included in the sensitivity portfolios use the amounts reflected in D.24-08-064 as an upper bound, while also including the LLT resource amounts required by D.21-06-035.

The ALJ ruling and the associated slide deck³ presented both a recommended sensitivity portfolio and an alternate sensitivity portfolio. Both the recommended and alternate sensitivity portfolios included additional geothermal, LDES, and OSW resources forced into the adopted 2023 preferred system plan (PSP) portfolio by 2035. The PSP portfolio was based primarily on resource plans submitted by the LSEs. Both potential sensitivity portfolios forced in the same total amount of LLT resources: 2.1 GW of geothermal, 900 MW of LDES modeled in RESOLVE as adiabatic compressed air energy storage (A-CAES), 1.8 GW of LDES modeled in RESOLVE as PSH, and 7.6 GW of OSW, all by 2035. In the total amounts of the specific LLT resources, the portfolios assumed little to no additional deployment of these resources beyond the capacity reflected in D.24-08-064 and the D.21-06-035 requirements (e.g., the 7.6

³ Available at the following link: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2024-26-irp-cycle-events-and-materials/assumptions-for-the-2025-2026-tpp>.

GW of OSW reflects the upper bound of the total capacity considered in the need determination in D.24-08-064 and is inclusive of the 4.5 GW of OSW included in the LSE individual IRPs filed in November 2022).

The recommended and alternate sensitivity portfolios differed in the amount of other resources from the LSE plans that were forced into the portfolio, which impacts the timing, amount, and type of additional resources RESOLVE selects and optimizes on top of the forced-in resources. In the recommended sensitivity portfolio, LSE-selected resources from their individual LSE plans were included in the portfolio only through 2030, and thereafter the model was allowed to optimize the selection of additional resources to meet reliability and GHG goals. This was the recommended sensitivity portfolio because forcing in additional LLT resources in addition to the full amounts of resources that LSEs planned for in their 2022 IRPs made the portfolio larger than necessary to meet GHG goals and reliability standards. Thus, the recommended sensitivity portfolio likely better reflects the reality that LSEs have not purchased all capacity out to 2035 and may change their procurement behavior based on new information, including being allocated some share of the centrally procured volumes considered in D.24-08-064.

In the alternate sensitivity portfolio, all LSE-planned resources were left in the resource mix until 2035, which gave the model less flexibility to optimize for other resources and resulted in some overbuilding of total resources.

These sensitivity portfolios were both designed to provide insights into the transmission implications of the portfolios, as well as the resources that could be displaced if more geothermal, OSW, and LDES resources are procured. The

intent was to support a “least regrets” approach for transmission planning around these additional LLT resources and provide a reasonable alternative future scenario to the proposed base case, reflecting higher LLT resource deployment amounts in line with recent decisions.

Table 2 summarizes the new resource buildout results for the recommended and alternate sensitivity portfolios, including forced-in, LSE-planned, and RESOLVE-selected resources, above and beyond the RESOLVE modeling resource baseline.

The addition of the LLT resources displaces 12-13 GW of other resources by 2040, primarily solar, storage, and some in-state wind, chiefly due to the higher capacity value of the LLT resources. Out-of-state wind build of 2 GW is also delayed from 2035 until 2040. The LLT resources displace more solar and storage resources earlier in the planning horizon between 2030 and 2035, when the solar and storage resources are no longer forced in due to LSE plans.

In the alternate portfolio, where all LSE planned resources are included through 2035, there is less flexibility to delay solar and battery development, especially in 2035, where the portfolio becomes larger than necessary to meet GHG goals and reliability standards as a result of forcing in both LSE-planned resources and the additional LLT resources. Compared to the base case, in the recommended sensitivity, after 2035, about 1 GW less of solar and batteries are built annually with the LLT resources added. By 2040, both sensitivity portfolios, as well as the base case portfolio, have similar amounts of onshore wind.

The three portfolios considered in the ALJ Ruling, as well as this proposed decision’s proposed base case and sensitivity portfolios, retain all natural gas

capacity for reliability purposes through 2040, one of the modeling years that will be transmitted to the CAISO. Importantly, all three portfolios plan for the diverse clean energy resources needed to reduce gas generation output to meet GHG targets in the California Air Resources Board's (CARB's) Climate Change Scoping Plan, which means that the model retains natural gas generation capacity for reliability purposes but shows a significant reduction in gas generation output. In 2045, RESOLVE did not economically retain 3.5 GW of natural gas capacity in the base case portfolio, and 4.5 GW in the sensitivity portfolios.

Table 2: New Resources Included in Recommended and Alternate 2025-2026 TPP Sensitivity Portfolios (in GW)

RESOLVE Resource Type	2030		2035		2040		2045	
	Rec.	Alt.	Rec.	Alt.	Rec.	Alt.	Rec.	Alt.
Natural Gas	-	-	-	-	-	-	-	-
Geothermal	1.5	1.5	2.1	2.1	2.1	2.1	2.1	2.1
Biomass	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
In-State Wind	5.2	4.9	6.9	6.9	7.2	7.2	8.3	8.3
Out-of-State Wind	4.7	4.9	7.0	7.0	10.5	10.4	15.7	15.7
Offshore Wind	-	-	7.6	7.6	7.6	7.6	7.6	7.6
Solar	14.8	14.8	17.7	19.0	38.4	38.6	57.3	56.5
Li-ion Battery (4 hr)	11.6	11.6	11.6	15.7	11.6	15.7	11.6	15.7
Li-ion Battery (8 hr)	1.2	1.2	2.1	2.8	10.2	7.8	18.7	16.4
Pumped Storage Hydro (12 hr)	0.5	0.5	1.8	1.8	1.8	1.8	1.8	1.8
Other LDES (8-24 hr)	0.3	0.3	1.0	1.2	1.0	1.2	1.0	1.2
Shed Demand Response	-	-	-	-	-	-	-	-
Gas Capacity Not Retained	-	-	-	-	-	-	(4.4)	(4.5)
Total	40.0	39.9	58.0	64.2	90.6	92.6	119.8	121.0

4.1. Comments of Parties

PG&E, CalCCA, CEJA/Sierra Club, SDG&E, GPI, AReM, EDF, SEIA/LSA, and GridLiance supported or provided clarifications to the proposed sensitivity portfolio that at least implies some level of support. All of these parties preferred the staff-recommended sensitivity and not the alternative sensitivity described.

PG&E supports the staff-recommended sensitivity portfolio, but suggests using the latest version of the LSE procurement data filings. CalCCA recommends that the Commission prioritize first using the sensitivity portfolio to identify transmission needs if uncertainty around LLT resource procurement materializes and the CPE procures little or no LLT resources. BAMx agrees in reply comments, and also supports the sensitivity portfolio, noting that it provides a good opportunity to assess the need for transmission upgrades to accommodate OSW development without actually approving the upgrades. NextEra comments make a similar point, noting concerns about the timing of port capability development, and suggesting a sensitivity with a lower amount of LLT buildout.

SDG&E comments that the staff-recommended sensitivity portfolio aligns with recent Commission decisions, reflects realistic resource planning, and allows for flexibility. AReM supports the staff-recommended sensitivity portfolio if it is the only one analyzed, but recommends that modeling a case with a lower emissions target would be a better use of resources than either sensitivity portfolio where higher-cost resources explicitly displace lower-cost resources. In reply comments, CEJA and Sierra Club agree that the sensitivity portfolio should

model DWR procurement but should also include reductions in gas usage to facilitate meeting a lower GHG target.

EDF notes that further study of higher volumes of OSW is particularly critical because OSW generates electricity at different times of day than other intermittent resources. Vineyard agrees in reply comments. SCE, on the other hand, recommends that the OSW quantities be reduced to 4.5 GW, because studying more economic portfolios with realistic estimates is a more prudent use of CAISO limited resources. Pattern makes similar points about the CAISO's limited resources and questions the value of the sensitivity portfolio because fulfilling it would lead to materially higher system costs. GSCE also suggests waiting for more certainty around the LLT resources before pursuing their transmission needs. GSCE instead suggests that this year's sensitivity portfolio should build on last year's sensitivity portfolio, but use the updated load forecast.

CEJA and Sierra Club recommend that the sensitivity portfolio should look at both CPE LLT procurement and natural gas plant retirements, at least at the level assumed in the 2024-2025 TPP high gas retirement sensitivity. MGRA goes further, suggesting that the portfolio analyzed should enable the closure of all natural gas plants in disadvantaged communities. In reply comments, CEJA and Sierra Club agree, while SCE disagrees and supports the staff-recommended sensitivity analysis and particularly its level of retention of natural gas capacity.

PCF argues that the sensitivity portfolios displace clean resources with forced-in LLT resources and should instead be displacing natural gas plants. PCF

also states that the recommended sensitivity portfolio fails to optimize behind-the-meter (BTM) resources or prioritize emissions reductions.

As an alternative scenario, CalCCA and SCPA recommend a high-solar, onshore wind, and storage sensitivity. SEIA and LSA make similar points, and suggest consideration of a second sensitivity portfolio that captures the possibility that OSW does not occur at expected volumes, instead being replaced with solar, onshore wind, and storage.

GPI suggests developing and considering a third alternative sensitivity portfolio option that further reduces the influence of LSE 2022 Plans on resource buildout, while forcing in LLT resources but allowing the model to select the other least-cost resources instead of relying on LSE plans. Finally, CESA argues it is likely not necessary to develop sensitivity cases that force in additional levels of PSH and other LDES resources, since the base case already incorporates the overall amount of LLT procurement needs.

4.2. Discussion

In consideration of parties' comments, we note that in the past we have transmitted two types of sensitivity portfolios to the CAISO for analysis in the TPP. In some cases, the sensitivity portfolios are designed to be plausible future outcomes, where we expect to incorporate portions of the information gleaned from analysis of the sensitivity portfolio into next year's base case scenario. In other cases, the portfolios are deliberately designed to be "stress" cases for particular types of resources, so that we can better understand the total potential costs of the resources, including their associated potential transmission costs. The

staff-recommended sensitivity portfolio for 2025-2026 is designed to be the former type of scenario in the longer term.

With respect to party comments suggesting potential sensitivity portfolios that retire more natural gas capacity, we note that we transmitted a high gas retirement sensitivity portfolio to the CAISO last year and we have not yet received the results. Once we have the full results of that analysis, we can consider whether and how to incorporate additional gas retirement planning into future TPP portfolios. Thus, for this 2025-2026 TPP cycle, the Commission is recommending that the CAISO study the staff-recommended LLT resource sensitivity portfolio.

In response to comments on the proposed decision from Ormat and SCP, we will remap approximately 200 MW of geothermal resources to Northern Nevada, as included in the updated busbar mapping discussed in Section 5 below, to study the transmission implications of the delivery of these resources into Northern California in the sensitivity portfolio.

5. Busbar Mapping

For several years now, Commission staff have been maintaining a summary of the methodology and specific approaches used to map the electricity generation or storage resources to locations (specific busbars) on the transmission system. With each TPP cycle, certain improvements are made.

This year, the following items were modified compared to last year's methodology, which was included in D.24-02-047:

- Inclusion of detailed criteria and methodology for the selection of natural gas plants not retained, based on the criteria initially developed and implemented for the

- 2024-2025 TPP portfolios. Minor changes to include sulfur dioxide emissions data and to update the emissions and heat rate data to the most recent two years available;
- Addition of environmental impacts criteria and additional mapping analysis for potential pumped storage hydro locations;
 - Clarification of work done to identify in-development resources not yet online and recently-online resources that need to be accounted for in busbar mapping, particularly in-development resources in the IRP modeling baseline that will need to be modeled in CAISO's TPP analysis.
 - Identification of other sources of commercial development interest, beyond the interconnection queues, particularly for LLT resources. Sources include potential projects with active federal energy leases, active federal permitting and licensing processes, or state or federal agency funding;
 - Updating of societal environmental impacts analysis to focus on location of interconnection substation, rather than the area around the substation, as that created difficulty with analyzing different radii and factoring in nearby geography and water;
 - Updating of sources of land-use and environmental criteria that use CEC-developed datasets;
 - Improvement in the description of where in the mapping process maximum import capability and transmission implications of resources mapped outside the CAISO are assessed and reviewed by Commission and CAISO staff; and
 - Improvement in the description of where in the mapping process the transmission implications of mapping resources to new areas without existing or planned transmission and interconnection points are analyzed.

The newest version of the methodology was attached to the ALJ Ruling as Attachment A. A copy of Attachment A redlined compared to the previous version was also made available on the Commission's web site at the following link: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2024-26-irp-cycle-events-and-materials/assumptions-for-the-2025-2026-tpp>.

Parties were invited to provide comments and recommendations for future improvements to the busbar mapping methodology, with specific topics highlighted in the questions in the ALJ Ruling.

On November 5, 2024, Commission staff also held a workshop to present and discuss the preliminary results of the mapping of electricity resources in the portfolios to busbars on the transmission system. On October 30, 2024, an ALJ Ruling was issued inviting parties to comment on the preliminary busbar mapping results.

5.1. Comments of Parties on Methodology

Several parties generally supported the additions to the busbar mapping methodology this year, including EDF, Invenergy, SCPA, MGRA, and Pattern. ACP-CA supports the busbar mapping updates to reflect the solar and storage development potential on water and drainage impaired lands of the San Joaquin Valley.

A number of parties had suggested changes to propose to the mapping process. ACP-CA recommends implementing a modest transmission planning reserve margin for new large network upgrades that may have a risk of delay. CalCCA approaches the problem more from the generation side, suggesting that

the Commission investigate data sources that could be used to better understand the improvements and age of equipment at the facilities on the grid to help evaluate the probability of retirement, rather than strictly relying on age-based criteria.

DOW does not support the methodology that allows reconducting analysis with a larger radius from the point of interconnection. Instead, DOW suggests that resources should be mapped to a different substation with lower land-use implications. DOW also asserts that RESOLVE needs to be revised to select additional resources in Northern California, particularly in the San Joaquin Valley, to produce a geographically diverse portfolio for busbar mapping. TerraGen agrees in reply comments. DOW also asserts that the Commission should provide policy guidance to the CAISO to pursue transmission investments in general in lower environmental implication zones.

GridLiance suggests that we examine when constraints have been triggered and shift resource builds to clusters where the interconnection constraints have overly limited RESOLVE portfolio buildouts.

CESA recommends that the busbar mapping process include distributed storage resources.

Several parties commented with specific concerns about reserving transmission plan deliverability (TPD) for LLT resources. PG&E recommends incorporating active LLT resources that are location-specific and are currently in development into the methodology to ensure that these resources do not face transmission delays. In reply comments, ACP-CA, Vineyard, and GreenGen agree that reserving TPD for LLT resources is critically important. NextEra

disagrees with allocating TPD to LLT resources because it prevents nearer-term upgrades to transmission facilities that can add firm capacity on a shorter time horizon.

CalWEA in opening comments, and ACP-CA in replies, suggest that the Commission must ask the CAISO to plan for wind resources to have full capacity deliverability status (FCDS) and therefore reserve deliverability on the transmission system.

Several parties also commented on the mapping of PSH resources. GreenGen supports the proposed criteria for mapping of PSH resources. MGRA recommends that updates specifying land-use screens are critical. In addition, MGRA recommends that the application of the 5-mile radius criterion be clarified. DOW agrees in reply comments. MGRA further recommends that PSH busbar mapping should consider cultural resources, and the application of the land-use screen ranks should also be clarified.

A group of parties also recommended changes specifically to the selection criteria within the busbar mapping methodology related to gas capacity not retained.

Several parties suggested different weighting of the criteria. CalCCA argues that performance-related factors should be weighted most, with local reliability factors receiving the second-highest weighting. Calpine agrees in reply comments. CEJA and Sierra Club suggest that the local reliability factor should not be counted against a facility for gas plant retirement. Instead, they suggest that the previous percentage assigned to the local reliability factor should be

used to weigh the disadvantaged community and air quality factors higher. CalCCA agrees with this recommendation in replies.

EDF suggests that more weight should be given to the environmental and community factors, over those related to reliability and performance. In reply comments, EDF amplifies this, stating that busbar mapping should identify the most harmful fossil-fueled plants, in order to determine where clean-energy resources and/or transmission should be prioritized.

Cal Advocates recommends that the Commission sort local resources with no local effectiveness factor percentage into the highest quartile instead of the lowest quartile. Cal Advocates argues that the lack of effectiveness factor for a resource located in a local capacity area does not indicate that the resource lacks long-term local resource adequacy attributes. In reply comments, Calpine opposes using proximity to disadvantaged communities as a criterion, given that the evidence does not support a proximity-based approach.

EDF is in favor of removing the exemption from planned retirement to plants in the youngest quartile and plants in the highest effectiveness factor quartile. EDF argues that exempting plants that may be in a disadvantaged community or criteria pollutant non-attainment area, solely because they fall within the youngest or most effective quartile, contradicts our statutory obligation to prioritize the minimization of localized air pollutants and GHG emissions in disadvantaged communities.

EDF also argues that the Commission should create a mapping scenario that retires all fossil-fueled plants in disadvantaged communities by 2035 and all other fossil-fueled plants by 2040. PCF similarly suggests that the Commission

create a detailed plan to retire and replace every natural gas plant, with priority on those in disadvantaged communities. GreenGen agrees in reply comments.

Calpine, on the other hand, supports this year's improvements in the criteria for gas capacity not retained, and generally supports the goal of prioritizing older and less efficient units, as well as units that do not contribute to local reliability, for retirement. Calpine also agrees, in reply comments, with the proposal to apply the gas generation retirement criteria separately to combustion turbines and to combined cycle gas turbines.

On the application of the local effectiveness factor (LEF), PG&E suggests that a more useful metric would be one designed to identify plants that have the greatest potential to utilize carbon capture and storage (CCS) or green hydrogen technologies. Calpine agrees with this suggestion in reply comments. CEJA and Sierra Club disagree, stating that CCS is directly inconsistent with statutory requirements about emitting plants.

CEJA and Sierra Club comment that the LEF should not be counted against a facility for gas plant retirement, but rather local reliability should be a reason to start planning to procure resources and/or transmission to meet the local reliability requirements.

Cal Advocates suggests that any local resources with no LEF be sorted into the highest quartile (i.e., made the lowest priority) for non-retention because local resources with no LEF may be the most important resources to retain for long-term resource adequacy, rather than the least important. Generally, PG&E, Cal Advocates, and Calpine all share concerns about the limitations of the LEF factor in the busbar mapping process.

PG&E suggests that the Commission use the results of the CAISO high-retirement sensitivity portfolio from 2024-2025 to inform resource needs for local areas. CEJA and Sierra Club agree in replies, and also state that the busbar mapping should explicitly include the CAISO's assessment of resources that can replace gas plants on a one-to-one basis in certain local areas. In particular, they suggest that the potential for energy storage to be located at the site of retired gas plants be evaluated in a sensitivity portfolio and in the next PSP.

DOW supports the land-use and feasibility criteria, stating that the land-use and environmental impact criteria should be applied to mapping stand-alone battery storage resources to assess implications on communities, especially those with high fire risk.

Ultimately, PG&E argues that the IRP and TPP analyses will need to identify both transmission and non-transmission solutions to ensure development of a resource portfolio that will substantially reduce "non-preferred" resources in local capacity areas.

A number of parties also commented on the application of the criteria for commercial interest in projects to the busbar mapping. DOW does not support focusing on commercial interest, stating that the state will end up tied to areas chosen by developers instead of energy planners. In reply comments, DOW elaborates that the existence of a land-use application or interconnection request cannot be relied upon to assess actual project viability. DOW states that permitting status is best used to assess project readiness, which is not the same thing as project viability.

GSCE, on the other hand, states that examination of land development rights and permitting progress are reasonable measures of interest and viability for all projects, including, but not limited to LLT resources.

MGRA comments that commercial interest should be evaluated by resource type, separating mature from emerging technologies, in addition to project site evaluation.

SEIA and LSA argue that giving the land-use criteria a larger role in the placement of future transmission infrastructure increases the risk involved with overly-conservative screens. They also comment that the Commission staff proposal to rely on alternative sources of commercial interest uses sources that are not broad enough to serve as a proxy for commercial interest like queue data can.

GridLiance suggests that commercial development interest should be gauged through publicly-available sources, such as application to the Bureau of Land Management and filings with the Public Utility Commission of Nevada, for out-of-state projects. CalWEA argues that Nevada resources in the NV Energy interconnection queue should be included if they could, with planned transmission, connect to the CAISO instead of connecting outside of it.

5.2. Comments of Parties on Preliminary Results

Ten parties, including ACP-CA, CalCCA, Cal Advocates, CESA, and EDF, included comments on the modeling inputs and assumptions that largely mirrored comments described in Section 5.1 above in response to the September 12, 2024 ALJ Ruling. The only new issue raised in the busbar mapping comments that was not raised at the same level previously was with respect to

the assumptions about both the geothermal technology and cost assumptions. EDF's primary recommendation is that the Commission should model more than one type of geothermal technology, with appropriate cost assumptions.

A number of parties also commented on various mapping criteria issues. Parties had suggestions for improving land-use criteria, which included refining mapping tools, incorporating updated protected land data, and focusing on granular land-use criteria to balance development needs with environmental and transmission considerations.

CalWEA comments on several land-use issues, including arguing that the 40 acres per MW land-use factor being used for wind is too high for typical California ridgeline development, stating that the available land can support more wind capacity. CalWEA is also concerned that the CEC's Core Screen is eliminating most of the limited remaining areas of promising wind resources in the state where development is not prohibited. CalWEA recommends that Northeastern California remains a promising area for wind resource development.

GPI comments that advancements made through the Foundational Agrivoltaic Research for Megawatt Scale funding program may warrant altering land-use screens associated with agricultural layers and the downstream busbar mapping criteria in the future.

CORD recommends that the Commission consider additional land-use screens or GIS mapping that uniformly applies wildfire risk across the geographic bound of California and Southern Nevada using historical fire data from both states.

SEIA and LSA recommend avoiding relocating solar capacity due solely to high parcelization. Instead, they recommend that Commission staff collect input from developers about substations where parcelization is the only issue. SEIA and LSA also encourage even more granular focus on the application of land-use criteria going forward to ensure a balance between land-use and other project development criteria.

GSCE recommends that, in the face of a non-alignment flag in a busbar mapping criterion, solar should be re-mapped to lower implication lands where new transmission increases the ability to develop low-implication solar, rather than placing resources where it avoids transmission upgrades.

DOW recommends that the protected-area layer should be applied to PSH projects to help limit unpermittable projects that disrupt the portfolio and waste staff's time evaluating projects that are legally precluded. DOW recommends that the CEC Land Use Screens mapping tool be updated to include the June California Protected Areas Database and California Conservation Easement Database updates, which include an additional 144,000 acres of protected lands and over 200,000 acres of conservation easements. DOW also takes issue with the particular data set used for PSH siting, and recommends incorporating rainfall data to assess groundwater impacts for PSH projects on groundwater, particularly in areas with low rainfall and low groundwater recharge.

MGRA recommends that the mapping specify that the developers preferred location for the upper reservoir of the San Vicente project is untenable because MGRA argues that it is located exclusively within high-impact land-use screening locations with each criterion.

Some parties also recommend improving the commercial interest process by prioritizing high-confidence projects, updating data to reflect current interconnection status, ensuring alignment with long-term planning, or revising the busbar mapping methodology for consistency and commercial viability.

CalCCA recommends differentiating the lower-confidence commercial interest category using the CAISO's Interconnection Process Enhancements (IPE) scoring criteria for commercial interest. For Cluster 15, CalCCA recommends that the Commission weigh more heavily a project that has been given commercial interest points.

CalWEA and Terra-Gen recommend that we ensure that the CAISO interconnection queue study status and other relevant commercial interest data is updated, including projects that have secured contracts with LSEs. Terra-Gen is concerned that by failing to prioritize high-priority projects, the TPP will overlook key areas of the system that are ripe for policy-driven upgrades.

CESA agrees that updates to the commercial interest screens are needed to achieve their purpose, given the recent reforms to the CAISO's interconnection process.

GPI comments that Commission staff should assess and report on whether commercial interest alignment should be prioritized differently in different planning years, including whether the current mapping methodology considers increased uncertainty in long-term planning horizons, based on available data. GPI also recommends considering the balance between developer commercial interest and California state interests, as well as the plan year, when prioritizing criteria alignment. GPI recommends clarifying which instances of criteria

misalignment warrant adjusting busbar mapping away from commercial interested alignment and the basis for determining acceptable versus unacceptable commercial interest misalignment. This would lead to defining standardized quantitative thresholds for commercial interest criteria or reporting on the effective cutoff in each busbar mapping year. Ultimately, GPI recommends adopting a consistent frame of reference, language, and level identification method for commercial interest alignment criteria in the busbar mapping methodology documentation, workshop slides, and dashboards, in order to produce criteria consistency and reduce confusion.

CalCCA recommends that the Commission determine which resources cannot meet the portfolio levels with capacity already progressing through the interconnection queue to determine which resources should be classified as LLT resources for purposes of the IPE System Need score. In addition, CalCCA recommends that resources from prior CAISO cluster studies without a PPA or a shortlist position be de-prioritized for mapping.

SEIA and LSA comment that in general, for areas where there is more high-confidence commercial interest solar capacity in the queue than was mapped, the Commission should seek to maintain the current allocation by considering if there is a legal reason that the capacity cannot remain in that location, whether there is available transmission capacity, whether transmission capacity is the only issue, and what portion of the viable capacity has been in the queue for nearly seven years. SEIA and LSA also recommend focusing more on the correlation between mapping results and lower-confidence commercial interest instead of higher-confidence commercial interest. Because of the

CAISO's queue reform, SEIA and LSA argue that even projects with only a Phase I study will have met a relatively high threshold for viability.

GPI is particularly focused on recommended improvements to biomass/biogas busbar mapping. GPI recommends the following improvements: more transparency, updating the methodology to include criteria that support mapping biomass to facilities in the vicinity of Tier 1 high Hazard Zone areas, and identifying updated sources as inputs to incorporate more up-to-date "biomass/biogas energy source areas" in subsequent busbar mapping methods, to the extent possible. In particular, GPI recommends that biomass siting decisions incorporate updated feedstock source data, including from the BioRAM or BioMAT programs. GPI also suggests focusing on net emissions, commercial interest, feedstock consideration, and ancillary benefits, consistent with the treatment of bioenergy in the RPS program, even if other community and environmental impact factors are sub-optimal. GPI also points out that the amount of biomass/biogas in the baseline, plus the new capacity in the queue, is considerably below the amount of biopower in CARB assumptions and reports discussing associated emissions. Finally, GPI strongly recommends applying net emissions considerations when siting biomass/biogas resources because this method is widely accepted and is consistent with RPS treatment.

CEJA and Sierra Club would prefer that bioenergy facilities not be mapped to already-burdened disadvantaged communities.

Other specific land-use considerations were discussed by several parties. CalWEA suggests we reconsider the assessment of wind capacity as a substantial fire threat. DOW recommends that future iterations of busbar mapping

crosswalk with the BLM's Updated Western Solar Plan and Final Programmatic Environmental Impact Statement to check for potential conflicts with anticipated solar generation or transmission facilities.

CESA is concerned that the busbar mapping results are not aligned with the market shift toward paired energy storage under the resource adequacy slice-of-day framework. CESA argues that to accommodate on-site solar, paired energy storage resources require a much larger footprint that may trigger land-use and environmental screens. CESA points out that only about half of the energy storage capacity is mapped to locations with solar, despite co-location being a policy priority.

Finally, PG&E comments that adding substation load to the mapping criterion will ensure more resources are mapped to areas where there is demand for generation, limiting transmission or substation upgrades and moving the portfolios towards greater integration of resources, transmission, and load.

A number of parties also commented on transmission-related issues, including evaluating non-transmission alternatives for gas retirement planning, addressing transmission constraints, and ensuring that the CAISO reserves transmission plan capacity for LLT resources.

Specifically, CalCCA comments that in order to inform gas retirement planning, the Commission should evaluate transmission and non-transmission alternatives, to determine whether alternatives are feasible within existing land-use and economic constraints. Cal Advocates is concerned that there are around a dozen instances where the identified transmission upgrades provide greater

transmission capability than is necessary to mitigate the exceedances identified, which results in higher costs.

CalWEA raises several issues. First, CalWEA suggests that the Commission should advocate that CAISO reserve TPD capacity for all location-specific LLT capacity in the adopted portfolio, reserving existing capacity as needed. CalWEA also suggests that the CAISO should remain open to enabling the use of reserved TPD capacity in certain narrow circumstances related to MTR needs. Finally, CalWEA suggests that we evaluate a 230 kV or 500 kV substation located north of the City of Susanville, because significant wind resources are located there and the Colgate substation upgrade is too far from Lassen County to be useful.

There were several other geographically-specific suggestions in comments. TerraGen suggests that the Commission address the Collinsville-Tesla Substation constraint and consider updated data and prioritize mapping these high-priority and in-development resources at the proposed capacity and point of interconnection. ENGIE comments that significant resources in the NV Energy and CAISO interconnection queues underscore the need for transmission alternatives to support Nevada resources.

GSCE suggests that significant additional solar and storage resources be shifted to north of Path 26 to account for RESOLVE's lack of detailed transmission modeling. GridLiance also comments that RESOLVE fails to recognize additional cost-effective transmission expansion opportunities being studied by the CAISO, pointing out that when RESOLVE is modified to include the GridLiance Trout Canyon and Sagebrush upside opportunities, the CAISO

system net savings were more than \$500 million in excess of the costs of the expansion projects. GridLiance also comments that the transmission cluster constraints implemented are inaccurate because the constraints do not recognize the expanded substations that were approved in the latest TPP, nor does RESOLVE adjust the substation limit when an additional upgrade is selected.

GPI comments that forecasting bottom-up demand and addressing distribution system capacity constraints are increasingly critical to supporting California's emissions reduction goals through transportation and building electrification, as well as load and generation distributed energy resource (DER) adoption in general. GPI also recommends including bottom-up distribution planning process (DPP) inputs into busbar mapping, such as the extended DPP forecast and planning horizon forecasts, as well as granular DPP IEPR disaggregation and known or pending load results.

Several parties commented with suggestions to map more or fewer resources to specific areas on the transmission system. For example, TerraGen suggests that resources should be mapped to trigger transmission upgrades in the PG&E North of Greater Bay Area study area. GSCE supports steering more solar resources to the Fresno transmission area than selected in RESOLVE, due to the potential to develop in the Westlands Water District. NextEra also agrees that more resources should be in the Fresno area to improve the overall reliability of the grid, while SEIA and LSA recommend continuing to monitor development in this area.

Several parties, including ACP-CA, ENGIE, and GridLiance, point out that the CAISO has announced plans to address the East of Pisgah constraint as part

of its 2024-2025 TPP, and therefore recommend that resources not be reallocated away from the Southern Nevada area.

CORD also comments that East of Pisgah is experiencing rapid development, noting the number of interconnection requests, that is outpacing transmission deliverability, and suggests that the CAISO fully study the upsizing opportunities in this area. NextEra agrees. CORD also suggests paying increased attention to the Southern Nevada region of the CAISO considering the environmental factors such as increased wildfire risk to transmission and renewable development on other parts of the CAISO grid.

Consistent with earlier comments, Equinor commented on the initial busbar mapping results with the recommendation that the Commission align the base case and busbar mapping with the AB 1373 needs assessment in D.24-08-064, with a focus on offshore wind amounts, because the transmission development is needed to support the OSW development.

A number of parties are also concerned about MIC issues, with some parties recommending that the CAISO and Commission incorporate Nevada's full 18 GW of potential, enhance long-term MIC planning to support out-of-state resources in general, or develop land-use and environmental screening tools for such resources.

ENGIE urges the CAISO to incorporate the full amount of capacity identified by the 2040 FCDS RESOLVE tool for Central, Northern, and Southern Nevada, in order to fully study the transmission development needed to bring Nevada's extensive project portfolio in development to market. ENGIE, CORD, and GridLiance also offer similar comments to those already summarized,

encouraging recognition of the full resource potential in Southern Nevada and MIC development to accommodate it.

ACP-CA comments that the long-term MIC needs are not adequately planned-for through the current process, and California is likely to need more reliance on OOS resources in the future to meet both reliability and climate goals. CalCCA agrees. In particular, ACP-CA recommends that the Commission specify that the CAISO should plan for incremental MIC above the existing limits and should map the 2040 portfolios in order to account for RESOLVE-selected resources and account for region-specific commercial interest.

DOW recommends that the Commission and CEC staff develop comparable land-use and environmental screening tools for OOS resources to allow for more informed consideration of those resources compared to in-state resources for which the environmental and land-use screens are already in use.

Finally, some parties submitted comments about specific resource areas or projects that they request to have re-mapped (or not mapped). GSCE recommends mapping fewer resources to the Whirlwind and Windhub substations, because they fail parcelization criteria, have incorrect core land-use assumptions, and low commercial interest. SEIA and LSA recommend not relocating resources based on parcelization alone, particularly in locations that have high-confidence commercial interest and other good criteria alignment, specifically citing to Whirlwind and Windhub.

GSCE also comments that no solar is currently being developed at the Vincent substation, arguing it therefore fails both the parcelization criterion and the fire threat criterion. The commercial interest criteria seems to rely more on

signed generator interconnection agreements rather than on deliverability. GSCE also argues that there is limited suitable land around the Colorado River substation for future solar development. Likewise, GSCE argues that the Mohave substation has too much solar mapped to it, none of which is in development. GSCE argues the solar at Mohave and Red Bluff should be re-mapped due to environmental considerations.

DOW supports staff conducting further analysis and remapping for Red Bluff, Colorado River, and the Tehachapi area substations. DOW also supports remapping of solar resources for the North of Lugo area with a focus on the Kramer substation and including the Coolwater substation.

MGRA comments that the busbar mapping dashboard lists inaccurate commercial interest metrics for San Vicente, including several out-of-date FERC license statuses. They argue that projects without current FERC license status should not be mapped. MGRA also argues that the proposed San Vicente project is located in a land area that has the second highest environmental sensitivity ranking of all potential projects and does not have commercial interest, since it does not have a FERC license status or an active CAISO queue position. Finally, MGRA argues that the busbar mapping dashboard maps LDES to a SDG&E substation, but RESOLVE selected an SCE substation, in alignment with LSE IRPs.

5.3. Discussion

Busbar mapping results for the portfolios and supporting mapping documentation and data is posted to the following link on the Commission web site concurrent with the publication of this proposed decision:

<https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2024-26-irp-cycle-events-and-materials/assumptions-for-the-2025-2026-tpp>

In working through the busbar mapping of resources to the transmission system, Commission staff identified four key policy questions for this year's TPP cycle, all of which were reflected, to some degree, in comments from parties.

These issues are:

- **North Coast OSW**: How much certainty of deliverability for North Coast OSW should be guaranteed?
- **LLT resources generally**: For which resource types and amounts should the Commission seek to have the CAISO reserve deliverability?
- **OOS wind on new transmission**: What direction should the Commission give to the CAISO regarding transmission triggered to deliver OOS wind resources?
- **Northern California in-state/on-shore wind**: What direction should the Commission give to the CAISO regarding transmission triggered to deliver Northern California wind resources?

On the issue of North Coast OSW deliverability, the issue is that most deliverability on the existing transmission in the Northern California area has already been allocated to resources currently in the interconnection queue, which then serves to limit deliverability availability to new resources in general, and

OSW in particular. The issue is not inherently rectified by the TPP portfolios identifying new transmission needs, as the mapped portfolios do not include resources that fully align with the CAISO queue resources that have already received TPD through the interconnection process.

This reflects a general difference between the IRP portfolios, including both their resource mix and mapped resource locations, and the resources seeking interconnection through the CAISO queue. Differences between planned and actual resource development and procurement are expected, but further implementation of the CAISO's recent IPE Initiative is expected to reduce these differences in the future.

In particular, there are more battery storage projects in the queue with TPD than the total amount of battery storage in the 2040 portfolio. Notably, although the battery storage can be sited with much fewer constraints than most other resources (certainly fewer than OSW), if the CAISO does not reserve some deliverability for OSW and ensure there is adequate transmission available for that deliverability, it will all be used by the storage in the queue, assuming all of the storage is actually developed (which may or may not be a reasonable assumption). If the CAISO takes into account all of the storage with TPD and adds the deliverability needed for OSW, there is a risk of overbuilding the transmission system at considerable cost, if not all of the storage or OSW is developed. To avoid this, we are asking Commission staff to work with CAISO staff to identify a portion of the storage projects with TPD with the largest impact on the OSW area. Initially, approximately 1,540 MW in 2035 and 960 MW in 2040 have been identified as likely needing to be included in the analysis. We propose

this additional amount of TPD-allocated storage resources to be included in addition to the mapped portfolio resources for study in the 2025-2026 CAISO TPP, to inform and enable the necessary transmission capacity to support the deliverability of these key OSW resources. This identification and inclusion of additional resources in the TPP studies follows the same process already used to identify assigned TPD unaccounted for by the mapping result that would impact deliverability and MIC expansion needs for OOS wind and other LLT resources. This process was first implemented for the 2022-2023 TPP to address a Commission request in a July 1, 2022 Transmittal Letter to the CAISO⁴ to expand and preserve deliverability and incremental transmission capacity for LLT renewables, particularly OOS geothermal and wind. Subsequently, D.23-02-040, which adopted the 2023 PSP and transmission the 2023-2024 TPP portfolios to the CAISO, asked Commission staff to work with the CAISO to again implement this request for the 2023-2024 TPP portfolios.

On the issue of preserving the potential for deliverability of the other LLT resources, especially those identified in D.24-08-064, the CAISO is already working to further refine reservation of deliverability for specific types of LLT resources through its IPE reforms as part of the still-ongoing IPE 2023 Track 3 Initiative.⁵ The CAISO has already been reserving deliverability for both OSW

⁴ The letter is available at the following link: <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2019-2020-irp-events-and-materials/tpp-portfolio-transmittal-letter.pdf>

⁵ More detail about the IPE reforms is available at the following link to the CAISO website: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Interconnection-process-enhancements-2023>

and OOS wind on new transmission. An open question is what other LLT resources, if any, should have reserved deliverability. In addition to OSW and OOS wind, other LLT resources may have unique policy advantages, particularly for resource diversity. If no deliverability is reserved for certain LLT resource types that are identified by the Commission, we run the risk that transmission, once developed, may be used by resources that come online because they are easier to site, faster to come online, and currently more cost-competitive, compared to the LLT resources.

Certain types of resources have unique value and may become more cost-competitive in the future, but they currently have longer and more difficult development processes, are limited by geographic location, and/or may be more expensive. The resources that meet these criteria fully currently are geothermal, biomass, OSW, and non-battery LDES. Thus, we will ask the CAISO to reserve deliverability for all of these types of resources in the 2035 portfolio, using the amounts and locations included in the portfolio's busbar mapping results, to the extent consistent with the CAISO tariff and still-ongoing 2023 IPE Track 3 Initiative. These requested amounts are inclusive of the OOS and OSW resource amounts for which the CAISO is already reserving deliverability. We will also ask the CAISO to reserve deliverability for these resources in the results of their 2024-2025 TPP, if transmission solutions or upgrades are identified and approved, and if the resources that are mapped in the 2024-2025 TPP base case are in the same or greater quantities in the 2025-2026 TPP recommended base case.

The CAISO has already been reserving deliverability for OOS wind on new transmission, and CalWEA strongly recommends that we ask them to do the same for in-state/on-shore wind. However, as discussed further below, we are going to ask the CAISO to further study the transmission needed for portions of the OOS wind on new transmission and in-state wind, and not yet trigger upgrades needed by these resources yet, to allow time for additional study in next year's TPP. It would not make sense to reserve deliverability for projects that are not yet triggering transmission upgrades. Thus, we will only ask the CAISO to reserve deliverability for specific portions of these resources, to the extent consistent with the CAISO tariff and still-ongoing 2023 IPE Track 3 Initiative, until we proceed to trigger the development of the transmission for them. Considering the amount of in-state and OOS wind in development and in the portfolio that can take advantage of existing or already-approved transmission, we will ask the CAISO to reserve deliverability for a portion of these resources in this TPP, specifically excluding resources mapped as energy only and the mapped resources with potential transmission upgrades identified for further study, until we have time to reevaluate the additional transmission needed. Specifically, we will ask for the 1,150 MW of in-California wind that is mapped to substations in far Northeast California and outside of the CAISO balancing area that will likely require new transmission upgrades to be delivered to the CAISO to be excluded from reservation of deliverability. Thus, we will ask the CAISO to reserve deliverability for approximately 5.6 GW of in-state onshore wind as mapped in the 2035 portfolio, corresponding to the total amount of non-energy-only wind, and excluding the 1,150 MW discussed above.

In addition, approximately 1,500 MW of Wyoming wind and 1,750 MW of New Mexico wind mapped and assumed by Commission staff and the interagency busbar mapping working group to need new transmission not previously approved or assessed in previous TPPs also should not yet trigger upgrades. Thus, deliverability should not be reserved for these particular resources yet.

Aside from these exceptions as described above, we will ask the CAISO to reserve deliverability for the approximately 5.7 GW of OOS wind resources that will utilize the new transmission lines already in development or approved. We will ask the CAISO to reserve deliverability for that 5.7 GW of OOS wind as mapped in the 2035 portfolio (approximately 1.1 GW of Idaho wind, 1.5 GW of Wyoming wind, and 3.1 GW of New Mexico wind), noting that the majority of these resources (approximately 4.9 GW) are within the scope of previous requests for which the CAISO is already reserving deliverability.

We note that the reservation of deliverability for diverse resources is something we intend to reevaluate with each TPP cycle. We also hope that the reservation of TPD for diverse resource types pushes some technological resource diversity onto the existing and planned CAISO grid. We are optimistic that the interconnection Cluster 15 will help support these efforts, so that in-state or in-CAISO resources to support the state's SB 100 goals can be fully developed.

With respect to transmission development for OOS wind, there is significantly more of the OOS wind resource on new transmission in this year's portfolio compared to last year (last year's portfolio had 6 GW in 2034 and this year's has 9 GW in 2035). The new amounts, if fully developed, will require

additional transmission beyond those projects that are already approved and in development, including SunZia, SWIP-North, and TransWest.

Commission staff have initially mapped most of the new resources to New Mexico, reflecting the fact that wind development is generally further along in this area. However, New Mexico wind amounts in 2035 will require additional transmission lines beyond the Sunzia line that is currently in development. In its 20 Year Outlook, the CAISO had identified two high-level solutions to this problem, with the first being a new line to Palo Verde and new lines in the SCE Riverside area, or a new line further north into the Lugo area. Separately, there is currently a proposed second parallel line to SunZia called RioSol.

In addition, the Wyoming wind amounts in 2035 in the portfolio will require either changes to TransWest to enable more capability for the CAISO between its Utah and Nevada interconnection points or the development of a new line from the Intermountain Power Plant to the El Dorado area. This issue also impacts the 2.9 GW of Wyoming wind included in the current 2024-2025 TPP base case with a 2034 model year.

Further, some of the other in-development transmission may likely be already fully subscribed or close to it. Thus, the CAISO may need to begin identifying new transmission lines from the ground up, without having the benefit of knowledge about specific developer interest from interconnection requests. The optimal delivery points within the CAISO may not already be known. In addition, complex inter-regional lines require additional negotiations with other balancing authorities.

Given uncertainties at this stage, this year we will ask the CAISO not to trigger upgrades related to the additional OOS wind amounts in the portfolio that are beyond the amounts that can be accommodated on the already-identified and in-development transmission upgrades. Specifically, we are referring to the 1,150 MW of Northern California onshore wind mapped to substations outside of the CAISO, 1,500 MW of Wyoming wind first mapped in 2035 as interconnecting to the CAISO in Southern Nevada area, the 1,707 MW of Wyoming wind first mapped in 2040 as interconnecting to the CAISO in Northern California, and the 1,750 MW of New Mexico wind first mapped in 2035 as interconnecting on new transmission to the CAISO in the Lugo area. Likewise, we will ask the CAISO to defer triggering any similar upgrades for the Wyoming wind resources and the Northern California onshore wind mapped to outside of the CAISO in the current 2024-2025 TPP. Instead, we will ask them to undertake a special study of the various routes and combinations for the OOS wind amounts to learn more information about the details of potential routes. This will allow for analysis of alternative locations for injecting the resources onto the CAISO grid and the potential transmission solutions. In parallel, Commission staff will be doing additional modeling with new OOS wind profiles and cost estimates to confirm the need for the high level of OOS wind in this year's portfolio. This will also allow for additional stakeholder engagement to assess the need and interest in OOS wind at particular locations and potential transmission solutions.

We realize that multi-state transmission takes a lot of time to develop and build, but given the uncertainty associated with this amount of transmission for a

large increase in OOS wind resources, we are comfortable with the one-year delay until the next TPP in order to better assess the options, benefits, and risks.

Finally, there is a similar issue with respect to in-state/on-shore wind in Northern California, where 1.1 GW of wind is mapped to the Eastern side of the Sierra Nevada mountains in the NV Energy system (not within the CAISO). This area currently has commercial interest with two projects being developed. However, the resources would currently have to connect through the Bonneville Power Administration (BPA)-NV Energy connection, which has limited capacity, and then be imported into California through the California Oregon Intertie (COI).

Similar to the OOS wind issues generally discussed above, for this year's TPP, we are asking the CAISO to do additional study on transmission solutions to upgrade the NVE/BPA system or directly interconnect the CAISO grid to deliver these in-state (but out-of-CAISO) wind resources. This can advance the identification of transmission locations and costs, without triggering potentially expensive or not-well-targeted solutions. This is also a complex question that requires interfacing with BPA and NVE about potential regional solutions. Thus, conducting further study this year will prepare us in next year's TPP to actually trigger the appropriate transmission when more details are known.

Turning to the comments from parties, as many parties acknowledged when making their comments, there are many good ideas from parties that can and should be considered when Commission staff update the criteria for the next round of busbar mapping. There are several good land-use criteria and other general criteria improvements, as well as improvements to commercial interest

criteria and data. These recommendations and improvements will be considered for implementation in next year's TPP process, which will also provide further opportunities for stakeholder review and engagement.

For this year, there is a change that we will make based on DOW's comments. We will add the protected-areas screen to the analysis for mapping of PSH facilities. Commission and CEC staff had considered including this data already, and we agree with DOW's comments that it would be preferable to include it to improve the screening for realistic PSH facility siting.

Consistent with the comments of several parties, the commercial interest criteria are in need of an update subsequent to the adoption of the CAISO's IPE reforms and Commission staff will work on this in the next IRP cycle.

With respect to bioenergy mapping, we will ask Commission staff to improve the datasets and analysis for future cycles. Some biomass will also be re-mapped in this portfolio, to improve criteria alignment, which is consistent with improvements Commission staff typically make during the analysis process.

With respect to the transmission constraint issues raised by parties, Commission staff are already working to map resources in such a way as to only trigger transmission as cost-effectively as possible, including in the Northern California areas raised by parties (in particular, the Collinsville-Tesla constraint). Based on technical information and feedback from the CAISO, Commission staff will do their best to optimize the exceedances that are occurring.

We will not ask Commission staff to systematically shift more solar and storage resources to the San Joaquin Valley and the Westlands area in particular. Some additional resources have been sited there through the standard mapping

approach, and the Fresno study area, which includes the Westlands area, now already has approximately 25 percent of the total solar in the overall portfolio mapped to it and more than double the amounts mapped to other key study areas for solar, in alignment with the established busbar mapping criteria. We will not plan a larger shift at this time, in part because additional solar would likely require more transmission development, and in part because some geographic diversity of solar generation is helpful to the system as a whole. The mapping criteria also already includes an analysis for over-drafted groundwater basins for utility-scale solar mapping. Details of the mapping results are included in the busbar mapping documentation.

In addition, some solar and battery storage resources were shifted North of Path 26, in alignment with parties' comments and the mapping criteria set forth, which factored in reliability improvements as shown in production cost modeling analysis. We also note that RESOLVE is being upgraded to add functionality to model Path 26 constraints, which will improve representation in future cycles and help limit the need for staff to make additional manual shifts during busbar mapping efforts.

We will not ask Commission staff to systematically shift more resources to Southern Nevada in order to trigger additional transmission there for several reasons, including the various busbar mapping criteria (e.g., alignment to commercial interest across all regions and alignment with land-use mapping criteria), reliability improvements for mapping resources elsewhere, and the benefits of geographic diversity. The results of this additional analysis cannot be fully captured in the initial portfolio development using the RESOLVE model,

which is an example of why TPP portfolio development is a multi-step process, relying on RESOLVE, SERVIM, and busbar mapping. It is also due to the uncertainty around solar siting and the impact of the Bureau of Land Management's 2024 Western Solar Plan (2024 WSP) that will impact the area.⁶ While the 2024 WSP did heavily reduce the amount of land potentially available for solar development in the area, GridLiance, in its comments, notes that significant solar potential remains under the 2024 WSP. In alignment with that potential, a large amount of solar (approximately 6 GW in 2040) is currently mapped to the Southern Nevada area. Some additional resources may be sited in Southern Nevada through the standard mapping approach, but we will not plan a larger shift at this time.

Commission staff are working with CAISO staff to ensure that the MIC needs of the mapped resources are clear and up to date. The CAISO gets MIC requests at the start of the TPP process, so Commission staff, after the adoption of this decision, will continue to work with the CAISO to make minor mapping adjustments to reflect the more up-to-date MIC requests that the CAISO receives during the TPP process.

Similarly, but new for the 2025-2026 TPP, the CAISO will also receive input from retail providers that are not jurisdictional to the Commission but are within the CAISO Balancing Area Authority on their own planned resources and mapping locations for those resources. The Commission's portfolios for the TPP utilize CEC load assumptions that include the projected load needs for non-

⁶ See more details available at the following link: <https://www.blm.gov/press-release/bureau-land-management-releases-proposed-western-solar-plan>

jurisdictional retail providers, and thus the portfolios include resources intended to meet those loads. CAISO staff will need to include the resource mapping information provided by the non-jurisdictional retail providers, and substitute out corresponding resources from the portfolio the Commission will transmit to the CAISO. To that end, after the adoption of this decision, Commission staff will work with the CAISO to review the replacements made by the CAISO and potentially make minor mapping adjustments to address any mapping conflicts that may occur.

We also do anticipate that CEC and Commission staff will begin work on developing comparable land-use and environmental screens for key out-of-state areas that are anticipated to be developed, consistent with the recommendation of DOW. This is another effort that will be more relevant for future TPP cycles.

With respect to the specific substation issues raised by stakeholders, Commission staff have taken those into account in the final busbar mapping included with this decision, to the extent feasible and warranted.

We also agree with SEIA and LSA's assessment, in part, and have not remapped solar solely because it has high parcelization, if the locations have good alignment on other criteria, including environmental and commercial interest, and if there has been some historic building in that location. Staff have also not removed solar from certain Tehachapi or North of Lugo substations because of the high parcelization, because the fact that there are several online projects there shows that there is commercial interest.

On the specific issue of the appropriate substation for the pumped storage resources mapped to align with the San Vicente project, we have not modified

the mapping away from the SDG&E substation. While this location does have some higher environmental impact criteria flags, those flags only identify *potential* land-use conflicts and environmental impact implications. They are not project-specific siting or environmental impact assessments. In addition, the pumped storage potential area has good criteria alignment for use of existing infrastructure and the likely water source. We want to ensure a complete analysis of the project for TPP purposes by including its mapping in the portfolios. The San Vicente project is somewhat unique, in that it has received state funding, is sponsored by a public utility, and is in the position where its initial FERC permit has expired but it has not yet been submitted for a FERC license. We also note that while we will continue to map the project to a SDG&E busbar, as with all of the other mapped resources in the portfolio, this does not imply Commission endorsement of any particular project or any ultimate contract.

Overall, we also agree with many of the suggestions of stakeholders to improve transparency of the busbar mapping process and allow for more and earlier engagement with stakeholders. We have made significant improvements in this area over the past several TPP cycles, but the desire for transparency and stakeholder engagement always must be balanced against timing constraints in the annual cycle. Commission staff will continue to work on improving this balance in subsequent TPP cycles.

6. Production Cost Modeling of Recommended Base Case Portfolio

As with past TPP portfolios, Commission staff have conducted production cost modeling (PCM) of the recommended base case portfolio for the key years

needed by the CAISO for its TPP, to ensure that it meets reliability standards and that the GHG emissions are within an acceptable range. For the 2025-2026 TPP base case portfolio, Commission staff conducted the PCM using Strategic Energy and Risk Valuation Model (SERVM) on the busbar-mapped version of the recommended portfolio.

Several modeling updates to SERVM were made prior to conducting the analysis, but after the Commission adopted the 2023 PSP in D.24-02-047. More detailed documentation of the updates is available in a report published in the Resource Adequacy rulemaking (R.23.10-011) titled “Loss of Load Expectation Study for 2026 Including Slice of Day Tool Analysis.”⁷ The updates include updating the model’s range of historical weather and hydroelectric production data to be derived from 2000 through 2022. This data is used to model historically-based distribution of hourly electric demand, renewables production, and hydroelectric profiles. The updates result in an increase in modeled weather variability, due to the inclusion of the extreme hot weather conditions in 2022. The weather-normalization model for creating weather-year-based hourly electric demand profiles for SERVM was also revised.

In addition, the model was calibrated to match the 2023 IEPR managed demand forecast from the CEC, including changes to the annual peak and energy forecasts, as well as penetration of demand-side resources.

⁷ See especially the section titled “Methodology and Inputs Overview.” Available at the following link: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/slice-of-day-compliance-materials/2026_lole_final_report_07192024.pdf.

Wind models for both on-shore and offshore wind were revised. Generating and storage unit forced outage rates and maintenance rates were updated. Fossil-fueled thermal unit output derating based on weather was also incorporated.

Updates were also made to the baseline of existing and in-development generating and storage units, based on the CAISO Master Generating Capability List from January 2024, the LSE filings submitted for IRP compliance on December 1, 2023, the Western Electricity Coordinating Council 2032 Anchor Data Set from December 2023, and the unit operating parameters and constraints derived from the CAISO Masterfile from May 2024.

The representation of the 2025-2026 TPP RESOLVE-selected new resources in SERVM was adjusted to avoid double counting of recently-online or under-construction projects. The adjustment was necessary because the updated baseline of generating and storage units in SERVM included more resources than the older 2023 PSP vintage baseline used in RESOLVE. Details of the steps Commission staff took to adjust the RESOLVE portfolio for the SERVM analysis are available in the supplemental slide deck and accompanying workbook available at the following link: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2024-26-irp-cycle-events-and-materials/assumptions-for-the-2025-2026-tpp>

Finally, load and resource projections for non-CAISO regions were updated based on publicly-available non-CAISO IRPs and extrapolation from FERC Form 714 and Energy Information Administration Form 861 data. Data for

this and the other key SERVM input updates described above are posted on the Commission's website.⁸

SERVM modeling was conducted on the portfolio after the resources were preliminarily mapped to transmission busbars. Busbar mapping considers transmission and interconnection constraints in more detail than the RESOLVE model and incorporates changes to siting of new resources between SERVM regions compared to the raw RESOLVE results. After initial mapping, the PG&E sub-region had much lower reliability results and higher GHG emissions relative to the SCE sub-region. Therefore, some solar and battery storage resources were re-mapped to augment placement of new build in the PG&E sub-region instead of SCE. This more optimal placement of busbar-mapped new build within the CAISO resulted in modeled results with higher reliability, lower renewables curtailment, lower amounts of fossil-fueled generation, and ultimately lower emissions.

Tables 3 and 4 present the key metrics for the recommended base case portfolio, including loss of load expectation (LOLE) and GHG emissions from various sources (in-CAISO generation, unspecified imports, and behind-the-meter (BTM) combined heat and power (CHP)). The tables include comparisons of GHG emissions metrics from RESOLVE and SERVM. The SERVM results for 2035 and 2040 reflect the more optimal busbar-remapping of new resources mentioned above, that prioritizes placement in the PG&E sub-region.

⁸ See the following link: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2024-26-irp-cycle-events-and-materials/system-reliability-modeling-datasets-2024>.

**Table 3. Reliability and GHG Results in
Key Planning Years for Proposed 2025-2026 TPP Base Case After
Mapping to Busbars on the Transmission System**

Metric	2035		2040		Units
	RESOLVE	SERVM	RESOLVE	SERVM	
Model					
<i>LOLE</i>	NA	<i>0.008</i>	NA	<i>0.086</i>	<i>days/year</i>
Expected Unserved Energy (EUE)	NA	10.3	NA	258.1	MWh
Loss of Load Hours (LOLH)	NA	0.011	NA	0.147	hours/year
LOLH/LOLE (average length of outage)	NA	1.4	NA	1.7	hours/day
Normalized EUE (EUE divided by total electric demand)	NA	0.00000	NA	0.00009	percent
CAISO emitting generation	17,629	41,455	8,503	41,496	GWh
CAISO generator emissions	6.9	18.0	3.3	17.1	MMT
Unspecified imports	21,698	10,538	24,244	13,240	GWh
Unspecified import emissions	9.3	4.5	10.4	5.7	MMT
CAISO BTM CHP emissions	4.1	4.1	0	0	MMT
<i>Total CAISO emissions</i>	<i>20.3</i>	<i>26.6</i>	<i>13.7</i>	<i>22.8</i>	<i>MMT</i>
GHG emissions difference		6.3		9.1	MMT

**Table 4. Reliability and GHG Results in
Near-Term Years for Proposed 2025-2026 TPP Base Case – RESOLVE Portfolio
Results (No Busbar Mapping)⁹**

Metric	2026		2030		Units
	RESOLVE	SERVM	RESOLVE	SERVM	
Model					
<i>LOLE</i>	NA	0.002	NA	0.000	<i>days/year</i>
EUE	NA	3.5	NA	0.0	MWh
LOLH	NA	0.002	NA	0.000	hours/year
LOLH/LOLE (average length of outage)	NA	1.0	NA	0.0	hours/day
Normalized EUE	NA	0.00000	NA	0.00000	percent
CAISO emitting generation	53,329	71,234	28,991	50,415	GWh
CAISO generator emissions	20.9	30.6	11.4	22.4	MMT
Unspecified imports	25,358	4,984	20,598	9,434	GWh
Unspecified import emissions	10.9	2.1	8.8	4.0	MMT
CAISO BTM CHP emissions	4.1	4.1	4.1	4.1	MMT
Total CAISO emissions	35.9	36.9	24.3	30.5	MMT
GHG emissions difference		1.0		6.2	MMT

As parties involved in the IRP process over the past several cycles are likely aware, there are differences between the RESOLVE and SERVM models in many aspects. Some differences, particularly in terms of GHG emissions estimates, are expected. SERVM models individual unit dispatch for the full 8,760 hours of a year, with more detailed constraints and accounting for outages. In this cycle, in particular, there is a known difference in assumptions between RESOLVE and SERVM with respect to the capacity factors used for OSW and OOS wind, with RESOLVE using the earlier higher capacity factors, and SERVM

⁹ Commission staff have not mapped to busbars the resources in the intermediate years of 2026 and 2030, as the incremental units in these years represent specific (as opposed to generic) project locations selected by RESOLVE and only the 10- and 15-year portfolios are needed for the CAISO's TPP analysis.

using updated figures that were adjusted downward. This accounts for a portion of the difference in emissions results.

However, as discussed above and as shown in Tables 3 and 4 above, despite the 2035 and 2040 busbar mapping prioritizing siting new resources in the PG&E region as well as the known wind capacity factor differences, the difference in GHG emissions between RESOLVE and SERVM persists. The result for the 2025-2026 TPP recommended base case is similar to the differences in modeled GHG emissions for 2035 and 2039 in the last TPP base case portfolio that were generally attributed to inherent model differences.

In general, we are most focused on the SERVM results for 2035, since this is the first critical planning year for purposes of CAISO TPP analysis and the key driver in identifying transmission needs and resulting recommendations for transmission investments to be sent to the CAISO Board. The Commission transmits both a ten-year and a 15-year portfolio, but according to the CAISO comments on the proposed decision, consistent with its FERC tariff, the CAISO has discretion on a case-by-case basis about transmission projects identified in the 15-year timeframe and the 2040 TPP analysis does not require immediate commencement of recommendations for transmission investments to the CAISO Board for all projects identified.

The SERVM results show an acceptable level of reliability, with LOLE results below our planning standard of 0.1 days per year in both 2035 and 2040. For GHG emissions in 2035, the estimate is 26.6 MMT, which is slightly above the top end of the range for the CAISO portion of the California electricity sector (range of 20.3 MMT to 24.3 MMT) for 2035 set by CARB in the most recent

Climate Change Scoping Plan.¹⁰ For 2040, the Scoping Plan range for the CAISO portion of the electricity sector is between 13.7 MMT and 18.2 MMT, while the SERVM GHG emissions estimate is 22.8 MMT.

These are still modeled estimates projecting out 10 and 15 years into the future where many inputs have significant uncertainty and both models can continue to be improved and calibrated during that time.

As in past IRP cycles, Commission staff are planning updates to the inputs and assumptions for both RESOLVE and SERVM beginning in the first quarter of 2025, to continue to improve and produce better model alignment during the next IRP cycle. In addition, model calibration work will consider tighter model alignment with respect to unit operating constraints, GHG pricing, and representation of individual transmission access charge areas within the CAISO and flow constraints between them. Commission staff will also consider ways to better model and plan for the strong winter load growth projected to occur by 2040 due primarily to building and transportation electrification.

For the 2025-2026 TPP, we are satisfied that these results are acceptable and sufficient to conclude that the base case portfolio is a reasonable one for the CAISO to analyze further for transmission needs. We will continue to closely monitor actual progress toward the new resource investment and GHG reduction results from these portfolios and will conduct similar analysis with our TPP portfolio recommendations next year and in subsequent years.

¹⁰ For more information, *see* more details on CARB's Resolution 22-21, available at the following link: <https://ww2.arb.ca.gov/sites/default/files/barcu/board/res/2022/res22-21.pdf>. The statewide range for 2035 is between 25 MMT and 30 MMT.

7. Summary of Public Comment

Rule 1.18 allows any member of the public to submit written comment in any Commission proceeding using the “Public Comment” tab of the online Docket Card for that proceeding on the Commission’s website. Rule 1.18(b) requires that relevant written comment submitted in a proceeding be summarized in the final decision issued in that proceeding.

No public comments were received in this proceeding that relate to the topics addressed in this decision.

8. Comments on Proposed Decision

The proposed decision of ALJ Julie A. Fitch 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 or before January 30, 2025 by the following parties: ACP-CA; Advanced Energy United (AEU); CAISO; CalCCA; CalWEA; Center for Energy Efficiency and Renewable Technologies (CEERT); CEJA and Sierra Club, jointly; CESA; CWG; DOW; EDF; ENGIE; Equinor; Fervo; GridLiance; GPI; GreenGen; GSCE; Hydrostor; Invenergy; LSA and SEIA, jointly; MGRA; NextEra; Ormat Technologies (Ormat); PCF; PG&E; SCP; Terra-Gen; Vineyard; and Westlands Water District (Westlands).

Reply comments were filed on or before February 4, 2025 by the following parties: ACP-CA; BAMx; CAISO; CalCCA; CalWEA; Cat Creek Energy (CCE); CEERT; CEJA and Sierra Club, jointly; DOW; Form; GridLiance; GPI; GreenGen; GSCE; Horizon; Independent Energy Producers Association (IEP); Invenergy;

MGRA; NextEra; Pattern; PG&E; SEIA and LSA, jointly; Vineyard; and Viridon California LLC.

The main themes of comments and reply comments are summarized in this section. Where warranted and as summarized below, changes have been made to the text of the decision in response to the comments.

GPI asks for clarification that the use of the term “thermal” does not refer to any renewable resources. GPI is correct. We have made this change for clarity in several sections of the decision.

GPI and Invenergy also suggest that we state or clarify the assumptions in the portfolio about the status of the Diablo Canyon Power Plant. We clarify that the portfolios recommended in this decision include an assumption for the retirement of Diablo Canyon as of 2025, as required by law.¹¹ Invenergy also suggests that more OSW resources should be modeled on the Central Coast, due to the fact that the Diablo Canyon Power Plant is still operating. We decline to do that in this year’s portfolios, given uncertainty associated with the expected retirement of Diablo Canyon and our legal requirements to plan as if it has already retired.

Numerous parties, including but not necessarily limited to ACP-CA, Equinor, and GSCE, appear to have some misunderstanding about whether we are transmitting both a 10-year and a 15-year portfolio as required by SB 887. We

¹¹ See Public Utilities Code Section 454.52(f)(1) which states: “The commission shall not include the energy, capacity, or any attribute from Diablo Canyon Unit 1 beyond November 1, 2024, or Unit 2 beyond August 26, 2025, in the adopted integrated resource plan portfolios, resource stacks, or preferred system plans.”

have clarified that we are transmitting both the 10-year and the 15-year portfolios and asking the CAISO to utilize the results, in compliance with Public Utilities Code Section 454.57. We do note, as pointed out by CAISO in its comments, that the CAISO has discretion (“the right, but...not an obligation, to approve projects in the 15-year time horizon”). Thus, the CAISO will study the 15-year portfolio, and may approve projects in the 15-year horizon on a case-by-case basis, based on need and the time required to build the individual projects.

Several other parties, including EDF, CEJA/Sierra Club, CEERT, PCF, and SCP, raise legal questions in their comments about whether this decision complies with SB 887’s requirements to “substantially reduce” reliance on non-preferred resources in local areas. Some of these parties point out that the decision references the GHG reductions predicted by RESOLVE (71 percent reduction below 2026 levels by 2035), which are higher than those computed by SERVM (which estimates a 42 percent reduction in emissions below 2026 levels by 2035). IEP, in its reply comments, points out that even if the SERVM projection is correct, 42 percent is still a “substantial” reduction, and we agree. We expect that the real GHG emissions reductions will likely fall somewhere between the estimates of the two models.

With respect to the requirements for emissions reductions in local areas, we have made a change requested by CWG in their comments, to correctly quote the SB 887 requirements. We also note that the GHG reductions projected have substantial positive impacts not only statewide, but also in local areas. In addition, we expect very soon in this proceeding to begin a process to engage with stakeholders about additional ways that we may be able to further improve

our analysis and ability to address local impacts for future portfolio development.

Several parties, including CEERT, EDF, CEJA/Sierra Club, and PCF, criticize the proposed decision for allegedly failing to take direct action to promote development of transmission projects that would allow for the retirement of gas-fired generation units. CEERT, in particular, argues that the Commission should develop “a detailed schedule for the retirement of natural gas generation plants” within 90 days. However, neither the Commission nor the CAISO has the authority to order retirement of independently-owned generating plants. Retirement decisions are made by the plant owners, though the development of transmission may influence the economics of those fossil-fueled plants over time.

We also continue to emphasize that natural gas generation is not retained in the portfolios primarily to produce energy. The main purpose of retaining natural gas plants is for capacity value, where the units provide backup supply during high-demand periods or emergency situations, when demand is expected to exceed supply, which would otherwise lead to outages for customers.

Several parties also comment on recent Federal executive orders and actions related to OSW, with some, including GSCE, suggesting that there is now additional uncertainty surrounding OSW development, which should lead to a reduction in reliance on OSW in the portfolios in this decision and more expected development of in-state resources, particularly solar. Other parties, including EDF and ACP-CA in reply comments, come to the opposite conclusion, arguing that development of transmission now to support delivery of the OSW projects

for which leases have already been obtained is now even more important in light of recent Federal actions. We will continue to monitor and assess the potential impacts in the future, but we do not make any changes to the current portfolio, because doing so would be speculative at this time.

AEU and EDF, in their comments, object to the higher geothermal cost assumptions used in this year's portfolio modeling. We decline to change these assumptions at this stage, because they are based on the most recent and best-available NREL ATB cost estimates at the time the analysis was conducted. However, we note that these assumptions will be updated again for next year's modeling. In addition, the costs in this year's modeling did not prevent geothermal resources from being selected by the model as needed for clean firm capacity, and we note that more geothermal resources were selected this year than in any previous base case.

CalCCA, in its comments, points out that it has already been two years since the LSEs filed individual IRPs, and CalCCA would like to avoid continued reliance on the November 2022 IRPs, suggesting that the Commission commit to either: 1) using the upcoming November 2025 IRP filings as the basis for next year's TPP portfolios, or 2) using more recent procurement data submitted semi-annually by LSEs. CalCCA's first option is not feasible, because the modeling to support next year's TPP portfolios will need to be completed before the IRP filings occur, in order to allow time for stakeholder input. We do intend, however, to update the modeling baselines for TPP analysis prior to next year's recommended TPP portfolios, and will plan to use the most recently available and feasible procurement data. We also note that there are several options for

treatment of LSE planned resources (those not yet under contract or built), especially in later years of the portfolio, including using LSE plans, modeled optimization, or some combination of both.

On the general topic of the recommendation that the CAISO reserve deliverability on the transmission system for specific resources, PG&E's and CAISO's comments, along with several other parties, seek clarity on the specific resources for which deliverability should be reserved. The intent in the proposed decision, which has now been clarified in the text, is for deliverability to be reserved in the amounts and locations of resources as identified in the portfolio that has been mapped to busbars by Commission staff, as discussed in Section 5 of this decision. We have also clarified that the deliverability intended to be reserved as a result of this decision is inclusive of resources for which deliverability has already been reserved in the past (including 4.5 GW of OSW resources).

CAISO's comments also seek clarity on whether the reservation of deliverability for the resources in the base case portfolio should be applied to the 2024-2025 base case portfolio as well. On this issue, we have clarified that if particular resources have triggered a needed transmission project or upgrade in the 2024-2025 TPP base case, and those same resources are included again (or in even larger quantities) in the 2025-2026 base case portfolio, then we recommend that deliverability should be reserved for those resources in both the 2024-2025 and 2025-2026 portfolios.

CESA, Terra-Gen, and Form (in reply comments) argue out that the use of the term "non-battery LDES" for which transmission deliverability is

recommended to be reserved was incorrect in the proposed decision, and ask that we clarify that we meant “non-lithium-ion-battery LDES.” In fact, the use of the term “non-battery LDES” was intentional, since battery technologies (those in existence at the time of this decision) are not known to be location-constrained. Thus, it is likely that battery technologies do not need deliverability to be reserved specifically for them, because individual project locations are not fixed. Therefore, we have not made a change to this language in the decision.

A few parties, including SCP and Ormat, recommend that we include additional geothermal resources in Northern Nevada and model them as deliverable into Northern California. This is a reasonable request to be included in the sensitivity portfolio, where we will remap approximately 200 MW of geothermal resources, in order to study the transmission needs associated with delivering it to California in the future.

Several parties, including ENGIE, Fervo, GridLiance, and Hydrostor, recommend in their comments that more resources be mapped to Southern Nevada, both because RESOLVE initially selected resources there and because there is commercial interest. While we acknowledge the importance of resource development in this area, we decline to map additional resources there for the reasons already stated above in the text of the decision, related, in part, to the need for geographic diversity and a portfolio that is balanced geographically and by resource type. We also note that a large amount of solar resources is already mapped to Southern Nevada, even after busbar mapping.

Similarly, we decline to map more solar resources into the Westlands area, as requested by Westlands, GSCE, and SEIA/LSA, for the reasons already stated

in the text, related to the fact that a large proportion of solar resources is already mapped to the Westlands area.

SEIA/LSA, in their comments, also request that we specifically endorse transmission projects that have been identified in prior TPP base case analyses, but have not yet been triggered for development. We do not generally endorse individual transmission projects, and will not do so here. At the same time, we encourage the CAISO to move forward with projects that its analysis finds necessary to accomplish the buildout and delivery of the base case portfolio we recommend herein.

ACP-CA and ENGIE, in their comments, ask us not to request that the CAISO hold off on triggering new transmission to support OOS resources, reasoning that if the resources are needed, the transmission development should start as soon as possible. While we generally agree, we do not believe that a one-year period to study the potential projects and begin regional discussions is too much of a delay in the context of areas where potential new transmission solutions have yet to be identified and where cooperation with other regional entities is required. Thus, we have not changed the nature of this request to the CAISO.

ACP-CA, Equinor, Hydrostor, and Invenergy also request, similar to their comments on the ALJ ruling, that we include more LLT resources in the base case, in order to trigger the necessary transmission to support their development earlier. We expect this will be an area of ongoing refinement in the next few years, but prefer to see the results of the sensitivity portfolio analysis this year before considering adding more LLT resources to the base case.

PCF and CEJA/Sierra Club (in reply comments) recommend that we include more DERs in the portfolio in general, with CESA specifically requesting that we include more distributed storage resources in the busbar-mapped portfolio. We decline to make these changes, noting that many DERs are accounted for in the load forecast and not included in the mapped resource portfolios relevant for transmission development. There are also various types of demand response resources available for selection and analyzed in the RESOLVE modeling, and those resources were not selected.

Finally, MGRA, in its comments, objects to how we have characterized the environmental impacts of the proposed San Vicente PSH project in the proposed decision, but does not object to having the project analyzed for TPP purposes. We have made a small modification to the description of the San Vicente project in the text of the decision, but have not modified the outcome.

9. Assignment of Proceeding

Alice Reynolds is the assigned Commissioner and Julie A. Fitch is the assigned Administrative Law Judge in this proceeding.

Findings of Fact

1. With each annual TPP cycle, Commission staff make updates to inputs and assumptions, which can include resource cost assumptions, import assumptions, transmission constraints, and/or other updates.
2. The base case portfolio being recommended in this decision is broadly consistent with the previous TPP portfolio recommended in D.24-02-047.

3. There will be additional opportunities for party comments on the inputs and assumptions being used to model the next round of IRP portfolios in early 2025.

4. The 2024-2025 TPP cycle included a sensitivity portfolio with a high amount of natural gas generation retirement. This sensitivity analysis is not yet complete.

5. The 2022-2023 TPP resulted in a total of 12 transmission projects approved to reinforce the grid in San Diego and Los Angeles load centers, where many natural gas power plants are located.

6. The base case portfolio recommended by staff is consistent with precedent of building on recently-adopted portfolios to move the base case incrementally toward the state's clean energy goals.

7. The base case portfolio recommended by staff meets our adopted GHG targets and is consistent with last year's TPP base case, with appropriate updates.

8. Generally, sensitivity portfolios we have recommended to the CAISO for TPP analysis are either plausible future scenarios or intentional stress cases, designed to better develop understanding of the potential bounds of transmission costs.

9. Many of the LLT and diverse resources in the portfolio have longer lead times, potentially higher costs, and/or less geographic flexibility than most solar and storage resources that make up the majority of the new resources being procured in the electricity portfolios.

10. If transmission deliverability is not reserved by the CAISO for the LLT and diverse resources in the portfolio, it is possible or likely that transmission may not be available by the time the diverse resources are developed.

11. There is approximately 50 percent more OOS wind in this year's 10-year-out base case portfolio compared to last year's due to the first key model year for TPP now being 2035.

12. OOS wind and Northeastern California in-state wind development will require development of complex new transmission outside of the CAISO, with cooperation from other regional entities.

13. There is not sufficient time to adopt many busbar mapping methodology improvements proposed by parties in this year's TPP cycle, but party input will be considered carefully for next year's busbar mapping.

14. The San Vicente PSH project is somewhat unique, because it has received state funding, is sponsored by a public utility, and has not yet submitted a FERC license application.

15. PCM conducted by Commission staff in SERVVM resulted in reliability metrics estimated to be below the LOLE planning standard of 0.1 in all modeled years (2026, 2030, 2035, and 2040).

16. PCM conducted by Commission staff in SERVVM resulted in GHG estimates in 2035 that are slightly outside the high end of the CARB Scoping Plan range for the electric sector, in part due to assumption differences associated with wind capacity factors, among other key assumptions.

Conclusions of Law

1. It is reasonable to wait for the 2024-2025 TPP analysis of the sensitivity portfolio with high natural gas retirements before considering incorporating aspects of the results into this year's TPP base case.
2. The base case portfolio proposed by Commission staff is reasonable and should be adopted.
3. The upper limit of the total volume and type of LLT resources included in the need determination in D.24-08-064 are premature to be incorporated into the base case portfolio for this year's TPP.
4. It is reasonable to ask the CAISO to study a sensitivity portfolio in this year's TPP that incorporates the LLT resources included in D.24-08-064.
5. The sensitivity portfolio should include LSE-planned resources only until 2030, to allow for the model to optimize for other resource selection and reduce the risk of an overbuilt and unrealistic portfolio being analyzed.
6. The sensitivity portfolio is designed to be an optimistic but plausible alternative scenario, reflecting the maximum amount and types of LLT resources included in D.24-08-064.
7. It is reasonable to update the busbar mapping methodology for this year's TPP to incorporate the items discussed in further detail in Section 5 of this decision, including but not limited to criteria for fossil-fueled thermal plants not retained, additional of environmental impact criteria for PSH, clarification of incorporation of in-development resources, updating of commercial development interest criteria, updating of societal environmental impacts analysis, and updating of sources of land-use and environmental criteria.

8. It is reasonable to ask Commission staff to work with the CAISO to identify an appropriate portion of the interconnection queue resources with TPD not aligned with the mapped portfolio that impact portions of the transmission system needed by North Coast OSW to be studied in the TPP to ensure enough transmission will be available and deliverability can be reserved for North Coast OSW, as all non-OSW projects currently in the interconnection queue are not likely to be built.

9. It is reasonable to ask Commission staff to continue to identify an appropriate portion of interconnection queue resources with TPD not aligned with the mapped portfolio that impact portions of the transmission system needed to ensure MIC for out-of-CAISO LLT resources like OOS wind for which the Commission is requesting deliverability reservations that are not already accounted for by previous TPP efforts.

10. It is reasonable to ask the CAISO to reserve deliverability on the transmission system for a portion of the diverse and LLT resources with long development timelines, geographic constraints, and/or policy advantages.

11. Transmission deliverability should be reserved for geothermal, biomass, OSW, and non-battery LDES resources in the quantities and locations included in the busbar mapped 2035 base case portfolios, inclusive of the OSW resources for which deliverability has already been reserved by the CAISO in the past TPP base case.

12. Transmission deliverability should be reserved for a portion of the OOS wind and in-state wind resources in the busbar mapped 2035 base case portfolio, with the exception of the onshore wind busbar-mapped as energy only, the

1,150 MW of onshore wind in far Northeastern California outside of the CAISO, 1,500 MW of OOS wind from Wyoming, and 1,750 MW of OOS wind from New Mexico, because we are not asking CAISO to trigger investment in the transmission to support these resources yet.

13. It is reasonable to request that the CAISO not trigger the approval of significant new transmission to support Northeast California wind and OOS wind on new regional transmission lines this year, but rather study these options and interface with regional partners outside of California, in order to plan for future development of this transmission with a better understanding of routing options and potential costs.

14. It is reasonable to adopt the suggestion of DOW to apply the protected-areas screen to the analysis for busbar mapping of PSH facilities.

15. Commercial interest criteria and other busbar mapping analysis should be reviewed and updated, if necessary, in advance of next year's TPP in response to the CAISO's adoption of the IPE reforms.

16. It is reasonable to shift solar resources North of Path 26 in this year's busbar mapping to improve modeled reliability, due to the existing transmission constraints.

17. Additional resources should not be systematically shifted to Southern Nevada, beyond seeking to best align with the busbar mapping criteria, due, in part, to uncertainty around solar siting, alignment with the busbar mapping criteria throughout the CAISO system, and considerations for a geographically-balanced portfolio.

18. Commission and CEC staff should begin work on developing land-use and environmental screens for key out-of-state areas anticipated for renewable development.

19. For this year, it is reasonable not to remap solar solely due to high parcelization.

20. The San Vicente PSH project should continue to be mapped to and San Diego substation, but this does not imply Commission endorsement of the project or any contract for it.

21. The SERVVM updates made by Commission staff prior to conducting PCM of this year's recommended base case portfolio are reasonable, including but not limited to, updating the range of historical weather and hydroelectric data, updating the demand forecast and penetration of demand-side resources, revising wind models, updating fossil-fueled thermal unit output derating, and updating of the baseline of existing and in-development resources.

22. The PCM results for reliability and GHG emissions for the recommended base case portfolio are in a reasonable range to request that CAISO study the portfolio further.

O R D E R

IT IS ORDERED that:

1. The California Public Utilities Commission (Commission) transmits for analysis a reliability and policy-driven base case portfolio to the California Independent System Operator (CAISO) for its 2025-2026 Transmission Planning Process (TPP) that meets a 25 million metric ton greenhouse gas emissions level in 2035, incorporates the individual load serving entity resource plans submitted

to the Commission in 2022, is consistent with the 2024-2025 Transmission Planning Process base case portfolio, includes the assumption and modeling updates discussed in Section 2 of this decision, and includes the results of the mapping of resources to busbars discussed in Section 5 of this decision. The base case portfolio includes modeled years of 2035 and 2040, and CAISO TPP analysis is requested for both years.

2. The California Public Utilities Commission (Commission) requests that the California Independent System Operator (CAISO) analyze the transmission needed for the base case portfolio reflected in Ordering Paragraph 1, but not yet trigger approval of the solutions necessary to support out-of-state wind resources on new transmission and in-state wind resources that are beyond of the CAISO balancing area and are specifically identified in the results of the mapping of resources to busbars discussed in Section 5 of this decision. Instead, the Commission recommends that the CAISO conduct the analysis and begin regional discussions (with entities responsible for regional planning and balancing areas outside of the CAISO planning area) about the appropriate siting and potential costs of such upgrades, for further consideration in next year's Transmission Planning Process.

3. The California Public Utilities Commission (Commission) requests that the California Independent System Operator (CAISO) reserve deliverability on the transmission system for the full amount of resources of the following types in the base case portfolio: geothermal, biomass, offshore wind, and non-battery long-duration energy storage, in quantities and locations consistent with the portfolio mapped to transmission busbars by Commission staff as discussed in Section 5 of

this decision. For out-of-state wind and on-shore/in-state wind, the Commission requests reservation of deliverability for specific portions of the amounts in the 2035 base case portfolio, not including energy-only onshore in-state wind, 1,150 megawatts (MW) of onshore wind in far Northeastern California outside of the CAISO balancing authority area, 1,500 MW of Wyoming wind, and 1,750 MW of New Mexico wind, to account for the further study needed, as discussed in Ordering Paragraph 2. The Commission further requests that the CAISO reserve deliverability for these types of resources in the results of their 2024-2025 base case portfolio, if transmission solutions or upgrades are identified and approved for the resources, and if the resources mapped in the 2024-2025 base case portfolio appear in the same or greater quantities in the 2025-2026 recommended base case portfolio.

4. The California Public Utilities Commission (Commission) transmits a sensitivity portfolio to the California Independent System Operator for its 2025-2026 Transmission Planning Process for analysis that includes the long lead-time resources included in Decision 24- 08-064 and incorporates the individual load serving entity resource plans submitted to the Commission in 2022 with planned resources out through 2030.

5. Rulemaking 20-05-003 remains open.

This order is effective today.

Dated February 20, 2025, at Sacramento, California.

ALICE REYNOLDS
President
DARCIE L. HOUCK
JOHN REYNOLDS
KAREN DOUGLAS
Commissioners

Commissioner Matthew Baker
recused himself from this agenda item
and was not part of the quorum in its
consideration.