



ALJ/JF2/smt 9/12/2024

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R2005003

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

**ADMINISTRATIVE LAW JUDGE'S RULING SEEKING
COMMENTS ON ELECTRICITY RESOURCE PORTFOLIOS
FOR 2025-2026 TRANSMISSION PLANNING PROCESS**

Summary

This ruling invites comments on proposed electricity resource portfolios for use in the California Independent System Operator's (CAISO's) 2025-2026 Transmission Planning Process (TPP). The ruling also includes information about the methodology for mapping of the resources in the portfolios to specific busbars on the transmission system.

Comments in response to this ruling are invited to be filed and served no later than September 30, 2024, with reply comments filed and served no later than October 7, 2024.

1. Background

As part of the longstanding agreement between the California Energy Commission (CEC), CAISO, and this Commission to collaborate on electricity resource and transmission planning, every year Commission staff develop a recommended set of portfolios for the CAISO to use in its annual 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. If approved by the CAISO Board, under the FERC tariff, the project 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 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 CAISO is a High Natural Gas Retirement scenario, designed to assist in planning for the potential future retirement of fossil-fueled resources as their economics decline.

2. Modeling Inputs and Assumptions Updates

To develop the portfolios described in this ruling, staff has made various updates in the RESOLVE capacity expansion model since the development of the 2024-2025 TPP scenarios. All of the updates are broadly applicable to the integrated resource planning (IRP) process and will be used going forward to develop new portfolios in the future. The inputs and assumptions will be

discussed in detail with stakeholders further in 2025. The most significant updates relevant to the development of these portfolios are:

- 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 This results in higher retail sales and gross peak load relative to the 2022 IEPR results, driven by increased building electrification, as well as lower energy efficiency impacts and less behind-the-meter (BTM) photovoltaic adoption.
- 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.

The transmission and interconnection representation changes address some issues that arose during the 2024-2025 TPP process. Last year, RESOLVE selected multiple GW of resources at transmission clusters that are comprised of only a few lower-voltage individual substations. Since those substations cannot readily accept such large capacity additions without potentially significant upgrades not represented in the modeled costs and assumptions, many resources

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.

had to be relocated during the process of mapping resources to individual busbars.

To help mitigate this situation going forward, additional constraints were added to the RESOLVE model to represent feasible limits on resource interconnections at the substation level. Substations are assigned a default interconnection capacity according to voltage, and limits are also set for each cluster by summing across all substations in the cluster. Individual substation expansions are not represented, but RESOLVE can choose to build generic transmission upgrades to interconnect highly economic resources. Actual busbar mapping to a new substation, if needed, will still be performed in the busbar mapping process.

There were several types of updates as a result of the newly-adopted 2023 IEPR load forecast. Annual energy, gross peak, behind-the-meter resources, and hourly profiles were updated, along with associated changes in total reliability need and clean energy generation requirements. The CEC's forecast goes through 2040, while the TPP modeling horizon is through 2045, which necessitates extrapolation.

In general, the gross peak and the total retail sales forecasts are between 3 percent and 7 percent higher. Annual load grows faster than peak due to assumptions about high rates of space heating electrification. In general, according to the 2023 IEPR, building electrification is expected to increase, energy efficiency impacts are expected to be lower, as is BTM photovoltaic adoption, compared to the 2022 IEPR assumptions. Finally, managed net peak load shifts to winter in the early 2040s, also due to increased building electrification.

The geothermal cost updates align with the resources most readily available to be developed and come online. Finally, the update to Arizona solar profiles corrects a previous error that did not reflect the fact that Arizona does not observe Daylight Savings Time.

**3. Recommended 2025-2026
Base Case Portfolio**

This section describes the reliability and policy-driven base case portfolio that Commission staff recommends for analysis by the CAISO in the 2025-2026 TPP cycle.

For this 2025-2026 TPP, the proposed base case portfolio results, as analyzed in the RESOLVE model, are 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>

The proposed base case is designed to be similar to the 2024-2025 TPP base case, with the same policy assumptions. It incorporates the 25 MMT by 2035 GHG emissions target, includes the resources included in the individual load-serving entity (LSE) IRPs submitted in November 2022, and uses the same resource baseline and modeling inputs and assumptions (with the exceptions noted above in Section 1 of this ruling, including updating to the most recent CEC IEPR load forecast assumptions). The key model years for this year's TPP base case are 2035 (10-year projection) and 2040 (15-year projection).

Figure 1 and Table 1 below summarize the new resource buildout results for the proposed base case portfolio, including both LSE-planned and RESOLVE-selected resources, above and beyond the RESOLVE modeling resource baseline.

Figure 1: Nameplate Capacity of New Resources Included in 2025-2026 TPP Proposed Base Case (in GW)

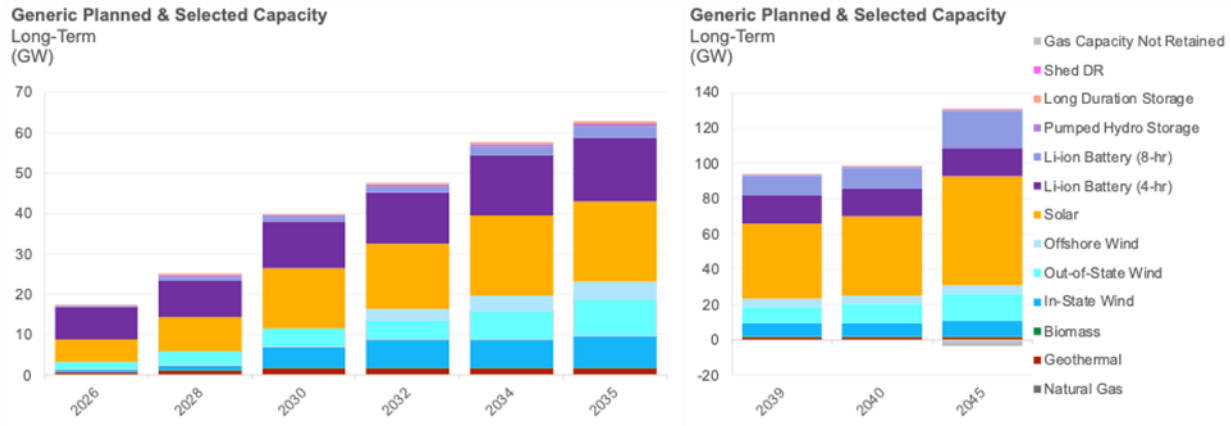


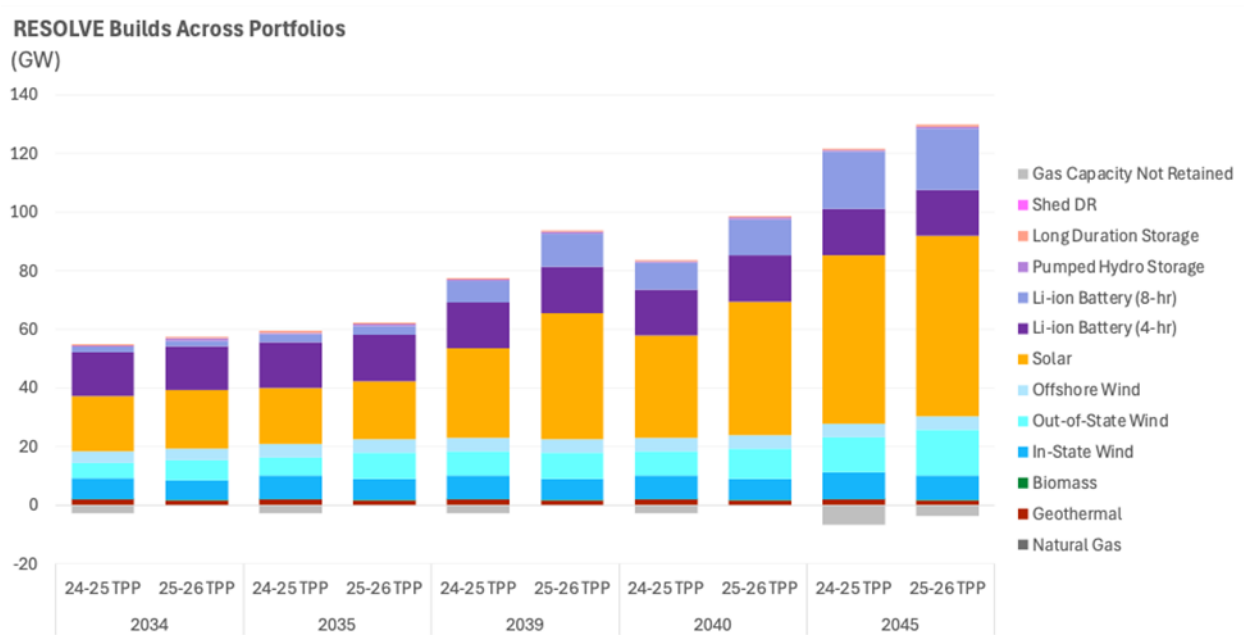
Table 1: New Resources Included in 2025-2026 TPP Proposed Base Case (in GW)

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 Compressed Air Energy Storage (24 hr).

Figure 2 shows a comparison of the planned and selected capacity in the recommended base case portfolio compared to last year’s adopted base case. In general, there is more new capacity in this year’s recommended base case due to higher peak loads from the IEPR load forecast, with the differences being largest in the 2039 model year.

Figure 2. Comparison of Planned and Selected Capacity (GW) in 2024-2025 TPP Base Case vs. 2025-2026 TPP Proposed Base Case



4. Recommended 2025-2026 TPP Sensitivity Portfolio

On August 22, 2024, the Commission adopted a decision³ containing a need determination for procurement of long lead-time (LLT) resources by the Department of Water Resources as a Central Procurement Entity. The need determination included geothermal, long-duration energy storage (LDES), and offshore wind (OSW) resources. The OSW and LDES resources need

³ See D.24-08-064.

determinations, in particular, were 7.6 GW and 2 GW 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.

While certain recent sensitivity portfolios have included large amounts of OSW (e.g., the 2023-2024 TPP OSW Sensitivity Portfolio, which included 13.4 GW of OSW) and LDES (e.g., the 2024-2025 TPP High Gas Retirement Sensitivity, which included 3.7 GW of LDES), those sensitivity portfolios were designed to gather additional long-term transmission information to help inform future portfolio development and did not necessarily reflect ranges that should be associated with a base case portfolio. These past sensitivity portfolios were not intended to reflect likely or realistic deployment of the specific resources over the timeframe studied in those previous TPPs.

To gain more information about the transmission needs associated with a high-LLT portfolio future, Commission staff recommend 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 include 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.

This ruling and the associated slide deck⁴ present both a recommended sensitivity portfolio and an alternate sensitivity portfolio. Both the recommended and alternate sensitivity portfolios include additional geothermal, LDES, and OSW resources forced into the adopted preferred system plan (PSP) portfolio by

⁴ 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>

2035. The PSP portfolio was based primarily on resource plans submitted by the LSEs. Both potential sensitivity portfolios force in the same total amount of LLT resources: 2.1 GW of geothermal, 900 MW of LDES modeled in RESOLVE as compressed air energy storage (CAES), 1.8 GW of LDES modeled in RESOLVE as pumped storage hydro (PSH), and 7.6 GW of OSW, all by 2035. In the total amounts of the specific LLT resources, the portfolio assumes 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 GW of OSW reflects the upper bound of the need determination in D.24-08-064 and is inclusive of the 4.5 GW of OSW included in the LSE individual IRPs).

The recommended and alternate sensitivity portfolios differ in the amount of other resources from the LSE plans that are 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 are included in the portfolio only through 2030, and thereafter the model is allowed to optimize the selection of additional resources to meet reliability and GHG goals. This is the recommended sensitivity portfolio because it 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.

In the alternate sensitivity portfolio, all LSE-planned resources are left in the resource mix until 2035, which gives the model less flexibility to optimize for other resources and potentially results 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 are displaced if more geothermal, OSW, and LDES resources are procured. The

intent is 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.

The full analysis of the recommended and alternate sensitivity portfolios is posted 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>

Figure 3 shows the results of both the proposed and alternate sensitivity portfolios, compared to the recommended base case portfolio, and 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 system becomes over-reliable 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, all three cases have similar amounts of onshore wind.

The three portfolios retain all natural gas capacity for reliability purposes through 2040, the modeling year that will be transmitted to the CAISO. Importantly, all three portfolios plan for the diverse clean energy resources needed to reduce gas generation outage to meet GHG targets in the California Air Resources Board’s Climate Change Scoping Plan, which means that the natural gas generation is retained primarily for capacity purposes to ensure reliability but generation output is expected to be significantly reduced. 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.

Figure 3. Change in Resource Buildout for LLT Cases Compared to Proposed 2025-2026 TPP Proposed Base Case

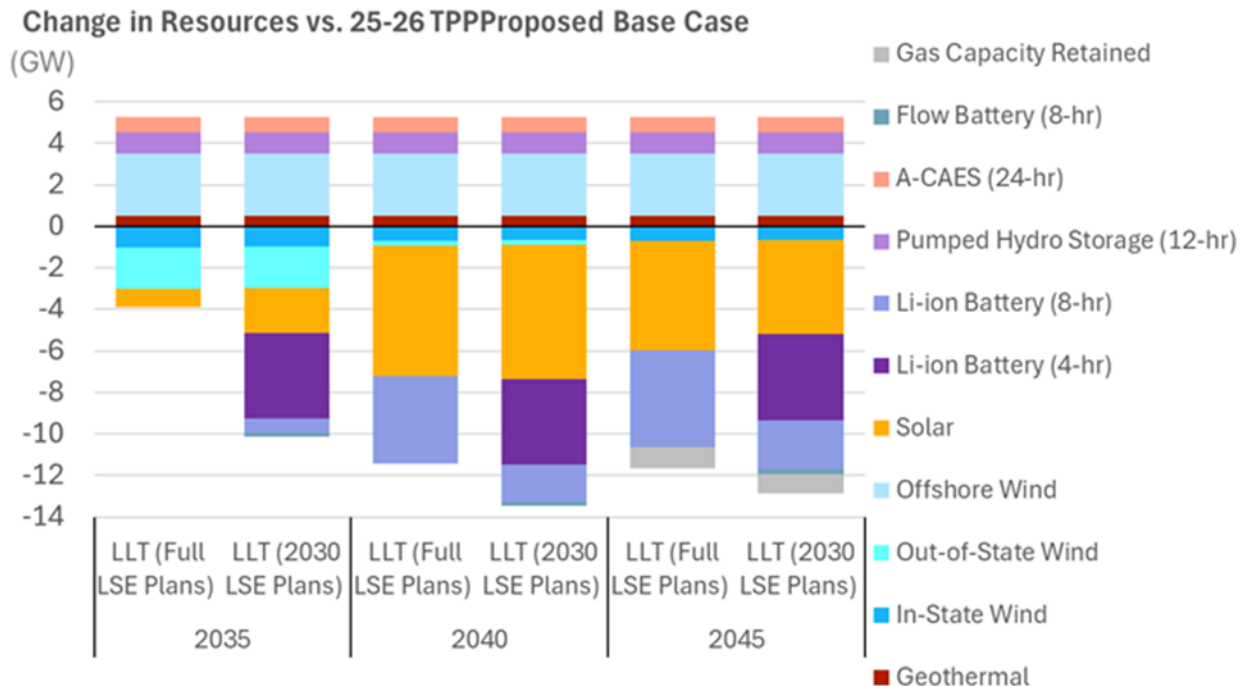


Table 2: New Resources Included in Recommended and Alternate 2025-2026 Sensitivity Portfolios (in GW)

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

The staff-recommended sensitivity portfolio would increase costs by a net present value (NPV) of approximately \$3.2 billion compared to the base case portfolio, due to the higher costs of the LLT resources. The alternate sensitivity portfolio would increase costs by approximately \$4.9 billion NPV compared to the base case portfolio, due both to the higher costs of the LLT resources and the overbuilding of resources by forcing in all LSE-planned resources in addition to the LLT resources.

5. Busbar Mapping Methodology Updates

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 have been 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 thermal 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 is attached to this ruling as Attachment A. A copy of Attachment A redlined compared to the previous version is also 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 are invited to comment on Attachment A in response to this ruling and provide comments and recommendations to future improvements to the busbar mapping methodology, with specific topics highlighted in the questions in the next section.

Busbar mapping efforts for the recommended portfolios have begun and Commission staff will post the initial results to the following link and alert the service list for this proceeding when results are ready, no later than October 31, 2024: <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>

Commission staff also intend to present initial mapping results in a workshop and seek further informal feedback from parties.

6. Questions for Parties

This section includes specific questions to which parties are requested to respond in their comments filed in response to this ruling.

1. Please provide any comments or concerns about the updated modeling inputs and assumptions described in Section 2 of this ruling.
2. Do you recommend any changes to the proposed base case portfolio in Section 2 of this ruling? If so, provide rationale and justification for your recommended changes.
3. Do you support the staff-recommended or alternate sensitivity portfolio in Section 3 of this ruling? Which one and why? If you recommend any changes to the sensitivity portfolio you support, or if you recommend a different portfolio altogether, provide a complete description, rationale, and justification for your recommendations.
4. Do you recommend any changes to the busbar mapping methodology or process described in Section 5 of this ruling and in Attachment A? If so, provide rationale and justification for your recommended changes.
5. Do you recommend any changes specifically to the selection criteria within the busbar mapping methodology related to “gas capacity not retained” in Attachment A? If so, provide rationale and justification for your recommended changes.
6. Do you recommend any additional criteria or processes for improving the busbar mapping for future iterations, specifically in the potential improvement areas listed below? If so, provide rationale and justification, as well as pertinent data sources, for your recommended changes:
 - a. Assessing commercial development interest beyond interconnection queues and other sources currently used in the methodology;
 - b. Application of existing or additional land-use and environmental impact criteria to mapping stand-alone battery storage resources;
 - c. Mapping battery storage to existing renewable generators and utilizing their existing interconnections;
 - d. Mapping additional storage energy to existing storage to increase its duration, but not exceeding its existing maximum interconnection ability; or

- e. Other potential improvements not specifically covered above in this question, to improve efficient use of existing and already-planned transmission.
7. Include any comments in response to this ruling that are not covered in the other questions above.

IT IS RULED that:

1. Interested parties may file and serve comments in response to this ruling and the questions in Section 6 by no later than September 30, 2024.
2. Interested parties may file and serve reply comments in response to this ruling by no later than October 7, 2024.

Dated September 12, 2024, at San Francisco, California.

/s/ JULIE A FITCH

Julie A. Fitch
Administrative Law Judge

ATTACHMENT A