

IRP Proposed 26-27 CAISO TPP Portfolios and Initial Busbar Mapping Results

Webinar

Energy Division Staff
November 12, 2025



California Public
Utilities Commission

Introduction

Scope

- Proposed [26-27 TPP Portfolios](#) September 30th, 2025, Ruling comments were received Oct. 22, and reply comments were received by October 31st, 2025.
 - IRP staff are still in process of incorporating stakeholder feedback into the mapping efforts.
- Webinar focuses on an overview of the proposed base case and sensitivity portfolios for the 26-27 TPP and preliminary busbar mapping results, noting that the mapping process is still ongoing and further changes will occur.
- The objectives of this webinar are to:
 - Provide an overview of the proposed 26-27 TPP base case and sensitivity portfolios.
 - Including small modelling updates used in their development.
 - Re-familiarize stakeholders with busbar mapping process and criteria.
 - Recap on the criteria and changes incorporated since the 25-26 TPP mapping.
 - Preview preliminary mapping results of the base case.
 - Provide a summary of busbar mapping results for the proposed base case portfolio and a discussion of the busbar mapping analysis.
 - Provide overview of identified mapping issues and next mapping steps.
 - Provide an opportunity for stakeholders to ask clarifying questions about busbar mapping process and preliminary mapping results.

Logistics

- Webinar slides, updated busbar mapping dashboard, and supporting material are available on the IRP webpage: [Assumptions for the 2026-2027 TPP](#).

Questions: We invite clarifying questions using the "Q&A" feature of this Webex.

- Open Slido by clicking on the three dots on the bottom right
- Write your question in the provided box
- Staff will post the written log of Q&As following the webinar
- We also invite verbal questions at specific intervals throughout this webinar.
 - All attendees have been muted. To ask questions:
 - In Webex:
 - Please “raise your hand”
 - Webex host will unmute your microphone and you can proceed to ask your question
 - Please “lower your hand” afterwards
 - For those with phone access only:
 - Dial *3 to “raise your hand.” Once you have raised your hand, you'll hear the prompt, "You have raised your hand to ask a question. Please wait to speak until the host calls on you“
 - WebEx host will unmute your microphone and you can proceed to ask your question
 - Dial *3 to “lower your hand”
- Comments to the November 3rd, 2025 Ruling for the initial mapping and this webinar are due by November 21, 2025

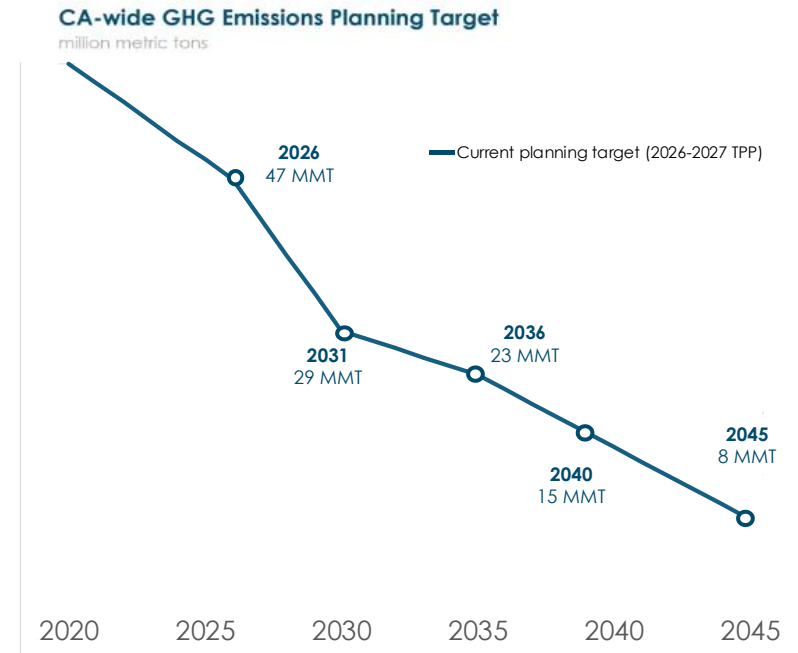
Agenda

Time	Topic	Presenter
9:00 AM	Introduction	Nathan Barcic
9:10 AM	IRP Background	Nathan Barcic
9:15 AM	TPP and Busbar Mapping Overview	Nathan Barcic
9:20 AM	Overview of the Proposed 26-27 TPP Portfolio Analysis	Nathan Barcic
9:25 AM	Input & Assumption Updates for 26-27 TPP Modeling	Sam Schreiber
9:45 AM	26-27 TPP Proposed Base Case Portfolio	Sierra Withers
10:00 AM	Staff Recommended Option for the 26-27 TPP Sensitivity Portfolio	Sierra Withers
10:10 AM	Busbar Mapping Methodology	Joe Hack
10:25 AM	CEC: Land-use and environmental analysis in busbar mapping	CEC Staff
11:05 AM	Overview of preliminary mapping results	Karishma Shamdasani
11:45 AM	Questions & Wrap Up	Nathan Barcic

IRP Background

CPUC & Integrated Resource Planning

- CPUC established the **Integrated Resource Planning** process for setting electricity resource planning targets for CPUC-Jurisdictional LSEs in CAISO's BAA.
 - Consistent with SB 350 (2015) and SB 100 (2018).
 - Designed as a multi-step analytical planning process with input from load-serving entities and stakeholders.
- IRP intends to achieve a resource portfolio that achieves:
 - Reliability
 - Greenhouse Gas Emission (GHG) reductions and clean energy procurement
 - Least cost



Source: Adjusted from CPUC February 2024 Preferred System Plan Portfolio, <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2022-irp-cycle-events-and-materials> to reflect current 26-27 TPP and broadly 24-26 IRP cycle.

Overview of the 2024-26 IRP Cycle

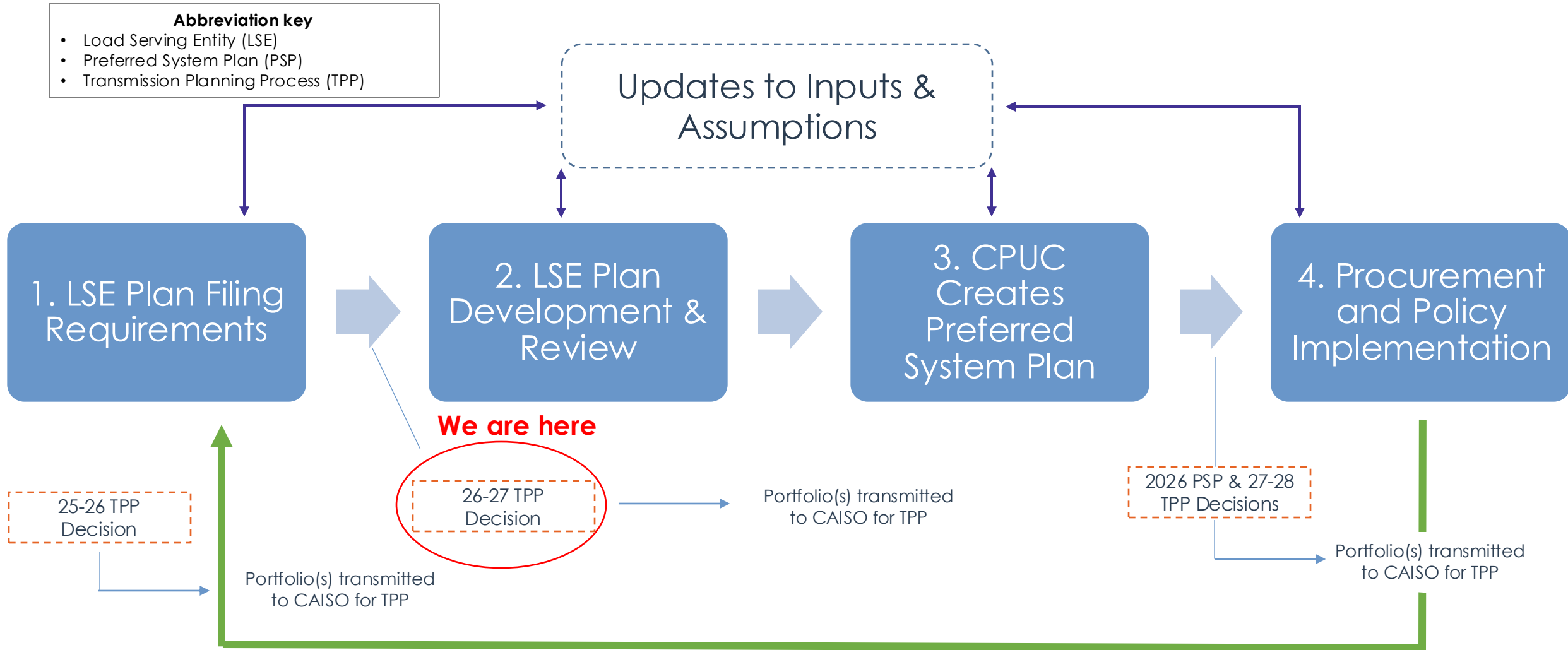
Year 1

Year 2

Year 3 & Beyond

Abbreviation key

- Load Serving Entity (LSE)
- Preferred System Plan (PSP)
- Transmission Planning Process (TPP)



TPP and Busbar Mapping Overview

Overview of the CAISO's TPP

- Every year Commission staff develop a recommended set of portfolios for the California Independent System Operator (CAISO) to use 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
 - 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 can typically analyze one or more sensitivity portfolios
 - The purpose of the sensitivity portfolio analysis is not to lead directly to transmission development immediately, but rather to assist in future planning by identifying relevant transmission needs and potential costs
- The Commission adopted the 25-26 TPP portfolio in Decision (D.) 25-02-026. This Decision included both a base case and a sensitivity portfolio that the CAISO is in the process of analyzing for the current 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 from CPUC jurisdictional LSEs' IRPs submitted in November 2022
 - The sensitivity portfolio was a potential long lead-time resource deployment future reflective of the upper bound of the CPUC's need determination that was adopted in D.24-08-064, pursuant to Assembly Bill 1373

Role of Busbar Mapping in IRP and TPP

- **Resource to Busbar Mapping** (“busbar mapping”): The process of refining the geographically coarse portfolios developed through IRP to specific interconnection locations (i.e., substations) for analysis in the CAISO’s annual Transmission Planning Process (TPP).
 - Joint effort by a working group comprised of CPUC, CEC, and CAISO staff.
 - Mapping focuses on utility-scale generation and storage resources that are not already in baseline.
 - First conducted as “proof of concept” for the 2018-2019 TPP portfolio ([CEC proof of concept report](#)).
 - Guided by the stakeholder-vetted mapping methodology, a document that states guiding principles, establishes mapping criteria, and outlines the iterative inter-agency mapping process.
 - Current [Mapping Methodology for the 26-27 TPP](#).

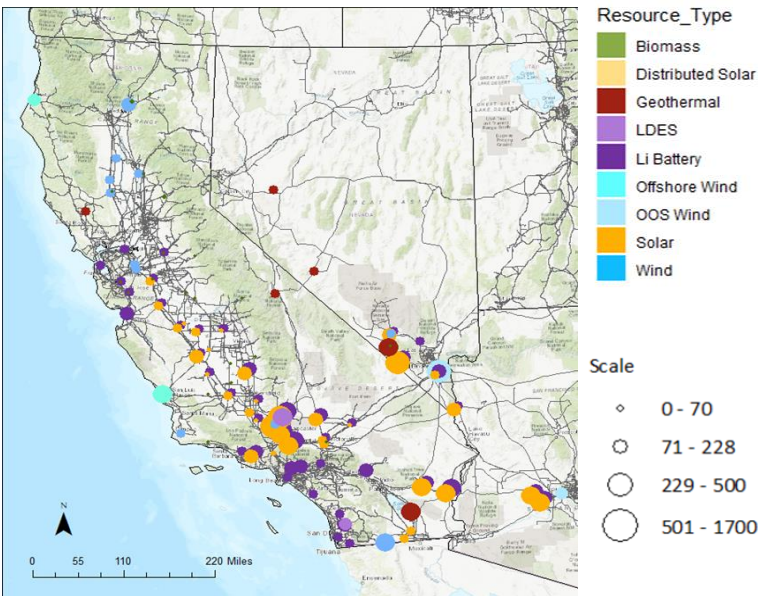
Input: Portfolio developed from LSE plans & RESOLVE model results

Resource Type	MW by 2032
Biomass	134
Geothermal	1,160
Wind	3,531
Wind OOS New Tx	1,500
Offshore Wind	1,708
Utility-Scale Solar	17,506
Battery Storage	13,571
Long-duration Storage	1,000
Shed Demand Response	441
Total	40,551

RESOLVE Resource Name	2032 Total (MW)
Greater_LA_Solar	1
Northern_California_Solar	-
Southern_PGAE_Solar	1,238
Tehachapi_Solar	2,969
Greater_Kramer_Solar	3,166
Southern_NV_Eldorado_Solar	7,382
Riverside_Solar	4,001
Arizona_Solar	-
Imperial_Solar	-



Output: Substation-level location for resources



Overview of the Proposed 26-27 TPP Portfolio analysis

Overview of 26-27 TPP Analysis

- Staff has conducted analysis to support the development of portfolios for consideration for study in CAISO's 26-27 TPP.
 - The analysis is based on the 25-26 TPP portfolio that the Commission adopted in D.25-02-026.
- On September 30, the Commission issued an Administrative Law Judge Ruling Seeking Comments on Electricity Portfolios for 2026-2027 Transmission Planning Process And Need for Additional Reliability Procurement. That Ruling, and the accompanying slide deck, included two TPP portfolio classifications:
 - A recommended 26-27 TPP Base Case
 - A recommended Sensitivity Portfolio
- Today's webinar will cover the overview of the base case and sensitivity portfolios, as well as preliminary mapping results of the base case portfolio.

26-27 TPP Timeline

- The 2026-2027 Transmission Planning Process Portfolio Ruling was issued on September 30th, 2025
 - Described the TPP analysis and sought comment on the proposed base case for the Commission to pass to the CAISO for the annual TPP process, as well as a recommended sensitivity portfolio.

Activity	Timing
Modeling Advisory Group (MAG) Webinar on Potential Updates to the Busbar Mapping Methodology	August 19th, 2025
Ruling on 26-27 TPP (including proposed base case and recommended sensitivity, busbar mapping methodology, and RESOLVE updates)	September 30th, 2025
Ruling on Preliminary Busbar Mapping Results and release of the Dashboard	November 3rd, 2025
Webinar on 26-27 TPP Portfolios and Initial Busbar Mapping Results	November 12th, 2025
Working Group iterates on busbar mapping of portfolios	September-December 2025
Proposed Decision	December 2025-January 2026
26-27 TPP Adopted by Commission via Decision	January-February 2026

Input & Assumption (I&A) Updates for 26-27 TPP Modeling

Summary of RESOLVE Updates Since 25-26 TPP (1)

Further detail can be found in the 2025 Draft Inputs & Assumptions¹

Data	Change
Zonal Topology (Disaggregation of CAISO)	CAISO RESOLVE zone disaggregated into PG&E, SCE, and SDGE, with associated data updates PG&E<>SCE transmission path expansion candidate(s) added to RESOLVE optimization Remote generator representation added to align with SERVIM
Default Candidate Resources	Enhanced Geothermal (EGS) and Generic Long Duration Storage (LDES) added as default candidates Pumped Hydro (PHS) and Adiabatic Compressed Air Storage (A-CAES) combined into a single "Location-Constrained Storage" category
Candidate Regions	Updated to align with CAISO study areas used in transmission planning
Resource Cost	Updated to 2024 NREL ATB New capital cost assumptions for solar, onshore wind, and Li-ion battery New financing costs
Resource Potential	Updates to solar potential using 2024 BLM Western Solar Plan Additional location-constrained storage potential projects included
Minimum Builds	Near-term minimum build constraints added to RESOLVE to reflect recent LSE contracts incremental to the baseline resources (June 2025 IRP Procurement Compliance data)

Summary of RESOLVE Updates Since 25-26 TPP (2)

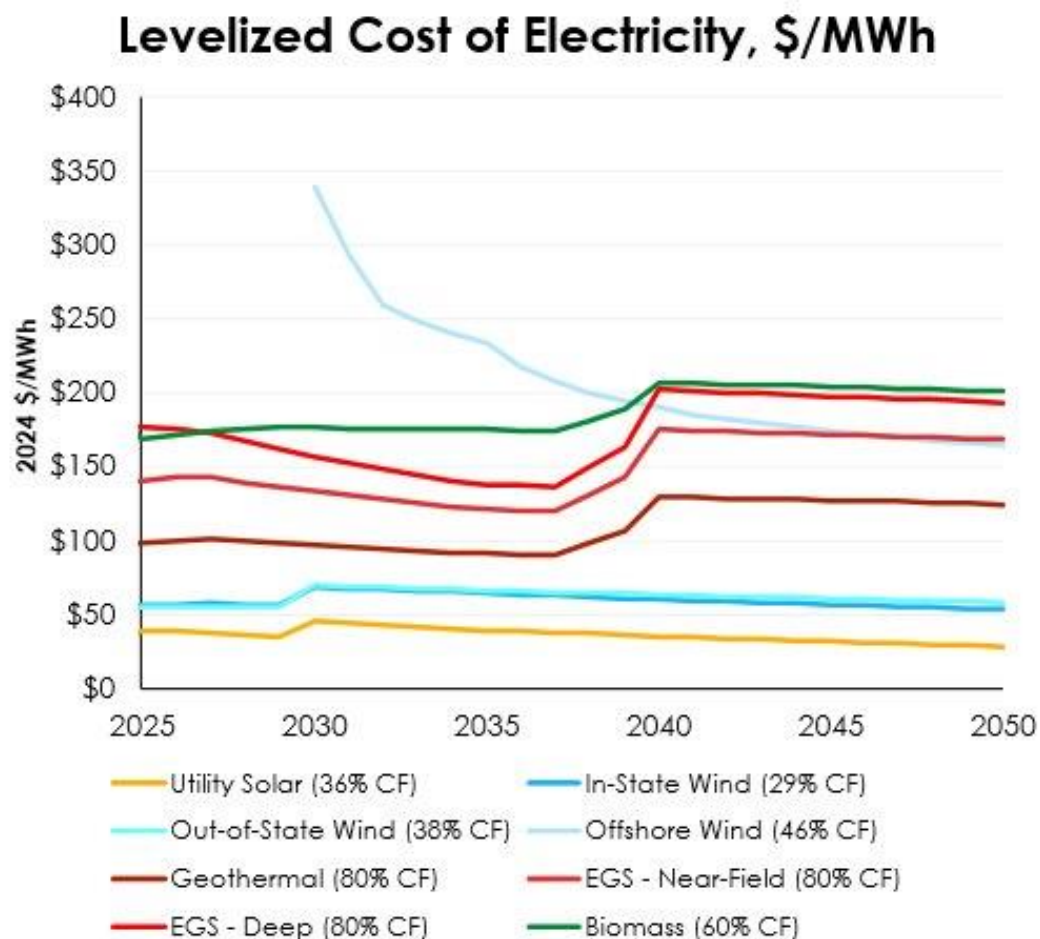
Data	Change
Baseline Resources	Updated to latest available data from CAISO, WECC, and LSE filings
Planned External (Non-CAISO) Builds	Updated to reflect most recent IRP Procurement Compliance data
Load Forecast & Profiles	Updated to 2024 IEPR Historical baseline profile updated to include 2021 & 2022
Generation Profiles	Updates to wind model used by staff to develop profiles 2021 and 2022 weather years included New hourly profiles for EGS to represent thermal ambient derates
Day Sampling	Updated 36 RESOLVE sample days incorporating latest load and generation profiles
PRM and ELCC Inputs	Updated target PRM % and resource ELCCs informed by SERVVM runs 3D solar-storage surface with dimensions for solar, 4-hr battery, and 8-hr battery (multipliers for longer duration storage relative to 8-hr dimension)
GHG Target	Near-term trajectory updated to reflect historical GHG data up to 2022 Long-term trajectory updated to reflect higher CAISO load share for statewide GHG target
Dollar Year	Costs inflated to 2024 dollar year from 2022 dollar year
Inter-Day Sharing	Functionality in RESOLVE to track long duration storage state of charge over a chronological 8760 hours to enable energy sharing over multi-day and/or seasonal periods

Summary of RESOLVE Updates Since 2025 Draft I&A

Data	Change
Resource Regions	Designated candidate wind and geothermal areas in the portion of northeastern CA served by NVE as new Northeast CA region
Resource Potential and Land Use	• Updated to latest available CEC Protected Areas Layer and Core Land-Use Screen, including corrections to the incorporation of the 2024 BLM Western Solar Plan • Incorporated Global Wind Atlas wind speed data into wind resource potential analysis • Clarified treatment of in-state, non-CAISO wind and geothermal potential within IID and NVE service territories • Revised assumptions for estimating the near-field EGS resource potential
Resource Availability	Extended the first available year of Idaho Wind to 2031 due to recent federal policies
Transmission	EGS-resources fully modeled on the CAISO transmission system to study locational dependencies
Resource Cost	Incorporated latest federal policy impacts, including July 2025 Budget Reconciliation Bill and tariffs
Gas Retention Costs	Updated to increase over time to the cost of repowering. More information available in the appendix.

Summary of Resource Cost Updates

- Policy trajectories shifted materially in Q2 2025, leading to the following updates:
 - Impacts of the OBBBA are reflected via revised tax credit assumptions for renewables, energy storage, and other clean firm technologies
 - Wide-ranging tariffs were announced and applied across U.S. trading partners, impacting every technology but which are especially impactful for technologies dependent upon imports from China and Southeast Asia
- Additional policy drivers of near-term resource costs, including Anti-Dumping and Countervailing Duties (AD/CVD) and Foreign Entities of Concern (FEOC) regulations, are being monitored for additional Treasury guidance but are not reflected in these updates



Resource Potential and Transmission Updates

Changes from 2025 Draft Inputs & Assumptions

New Candidate Resource Regions using CAISO Study Areas



- The resource potential regions used in RESOLVE have been updated to align with the CAISO Study Areas used in transmission planning
 - Resource potential is assigned to substations, which are assigned to Study Areas in the CAISO White Paper¹
- Assignments to RESOLVE zones are as follows:
 - PG&E: North of Greater Bay Area (NGBA), Greater Bay Area (GBA), Fresno, Kern
 - SCE: Northern, Metro, North of Lugo (NOL), Eastern, East of Pisgah (EOP), Arizona
 - SDGE: Imperial, Arizona
- Arizona substations owned by the CAISO are divided between SCE and SDGE
- The GLW/VEA systems modeled as part East of Pisgah
- **Candidate wind and geothermal resources near NVE-owned transmission lines in northeastern California are represented as a separate region**

Note: This is a modeling build limit and has no direct impact on actual build rate.

Annual Resource Build Limits

- In the 2025 Draft I&A MAG webinar, Staff updated the near-term solar build limit to 4,000 MW/year through 2028, based on annual procurement rates from LBNL Tracking the Sun¹ and the CAISO Master Generating Capability List (MGC)²
 - For the 26-27 TPP, the limits have been revised to reflect the system need required to meet GHG policy in 2028
- For the 26-27 TPP, Staff introduced near-term build limits for in-state wind and geothermal, reflecting commercial interest, procurement challenges, and project deployment timelines
 - Wind: 250 MW/year through 2030, 1,000 MW/year from 2031 through 2035
 - Geothermal: 200 MW/year through 2032
- The full resource potential, subject to resource-level near-term build limits and transmission deliverability constraints, will continue to restrict capacity additions after these constraints are relaxed

Technology (Cumulative MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036+
Utility-Scale Solar	4,000	9,000	15,000	Full potential							
In-State Wind	250	500	750	1,000	1,250	2,250	3,250	4,250	5,250	6,250	Full
In-State Geothermal	200	400	600	800	1,000	1,200	Full potential				

Status of Final 2025 I&A Document for the 2024-2026 IRP Cycle

- The Draft 2025 I&A document was released by Staff in February 2025 and laid out key data elements and sources of inputs and assumptions for the 2024-2026 IRP Cycle¹
- The Final 2025 I&A document will be released by Staff following the forthcoming IRP Filing Requirements Ruling

Baseline and Contracted Resources

26-27 TPP Proposed Base Case

Baseline Resources

- The IRP Baseline represents online and in-development resources, as of the 2025 Draft I&A
 - Online: from CAISO Master Generating Capability List (MGC), as of Spring 2024
 - In-Development: additional contracts found in the December 2023 LSE Filings (incremental contracts from later LSE filings are forced-in to RESOLVE as minimum builds

Resource Type (cumulative GW)	2026	2028	2031	2036	2041	2045
Natural Gas	26.4	26.4	26.4	26.4	26.4	26.4
CHP	2.4	2.4	2.4	1.9	-	-
Nuclear	0.6	0.6	0.6	0.6	0.6	0.6
Geothermal	1.8	2.1	2.1	2.1	2.1	2.1
Biomass	0.5	0.5	0.5	0.5	0.5	0.5
Biogas	0.3	0.3	0.3	0.3	0.3	0.3
Hydro	9.1	9.1	9.1	9.1	9.1	9.1
In-State Wind	6.5	6.5	6.5	6.5	6.5	6.5
Out-of-State Wind	1.5	3.1	3.1	3.1	3.1	3.1
Utility-Scale Solar	23.3	23.4	23.4	23.4	23.4	23.4
Customer (BTM) Solar	20.8	22.6	25.6	28.5	30.0	31.3
Li-ion Battery (4-hr)	14.2	14.5	14.5	14.5	14.5	14.5
Li-ion Battery (8-hr)	0.3	0.3	0.3	0.3	0.3	0.3
Location-Constrained Storage	1.6	1.6	1.6	1.6	1.6	1.6
Shed DR	3.4	3.4	3.4	3.4	3.4	3.4

Minimum Builds: LSE Contracted Resources

- Contracts incremental to the baseline found in the June 2025 IRP Compliance Filings are forced-in to RESOLVE as minimum builds

PG&E Minimum Builds (MW)

Technology	2026	2028	2031
Geothermal	67	68	68
In-State Wind	72	72	72
Out-of-State Wind	-	-	-
Solar	460	1,045	1,155
Battery Storage (4-hr)	852	1,411	1,521
Battery Storage (8-hr)	112	147	160

SCE Minimum Builds (MW)

Technology	2026	2028	2031
Geothermal	42	60	100
In-State Wind	-	-	-
Out-of-State Wind	535	535	535
Solar	2,126	3,829	3,829
Battery Storage (4-hr)	2,396	4,541	4,541
Battery Storage (8-hr)	41	876	876

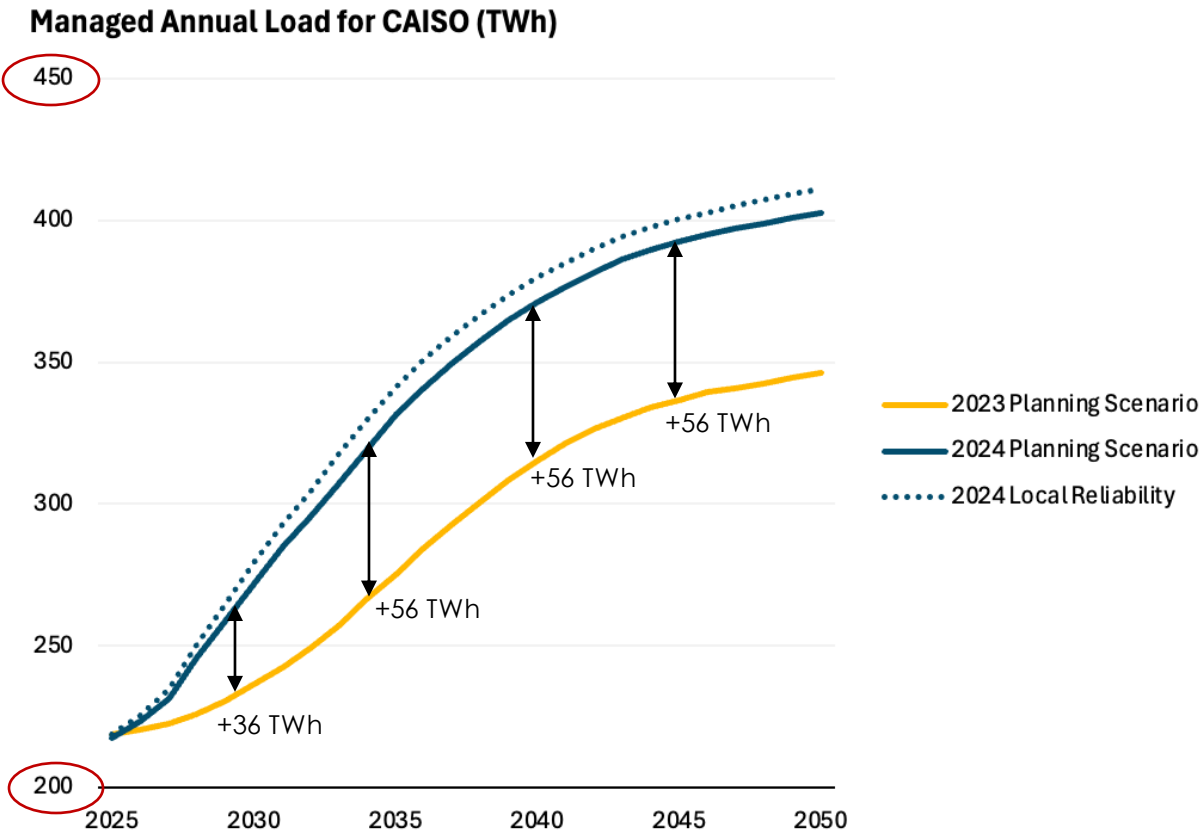
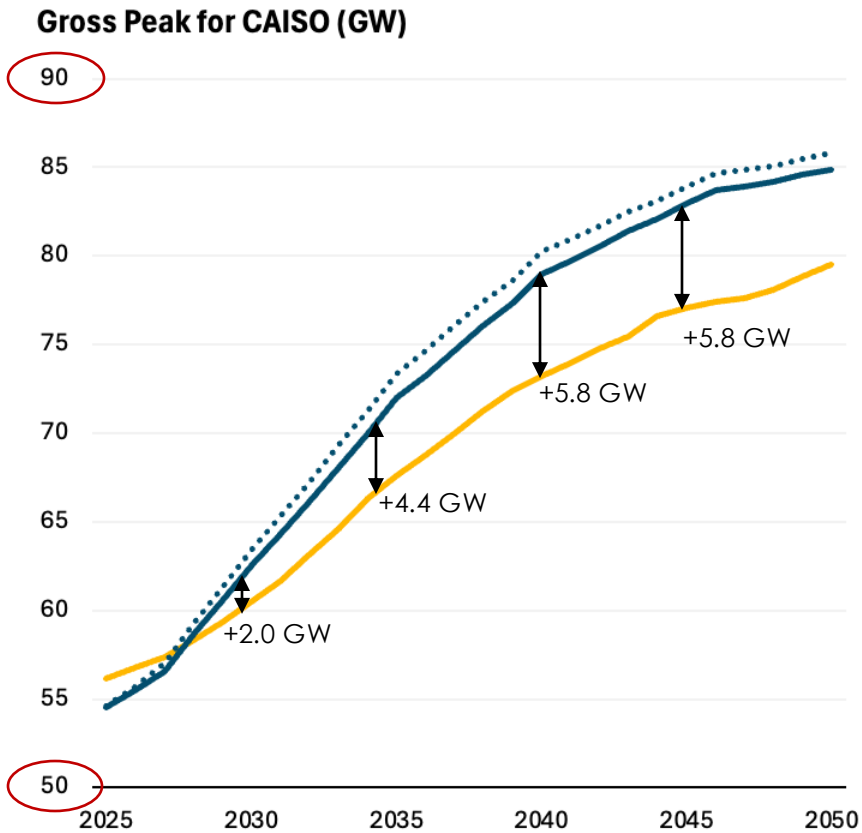
SDGE Minimum Builds (MW)

Technology	2026	2028	2031
Geothermal	-	-	-
In-State Wind	-	-	-
Out-of-State Wind	-	-	-
Solar	175	275	275
Battery Storage (4-hr)	660	760	760
Battery Storage (8-hr)	25	25	25

2024 IEPR Load Forecast

The 2024 IEPR Forecast Drives Additional Resource Needs

- Forecasts for both system peak and annual energy grow significantly in the 2024 IEPR, compared to the 2023 IEPR, driving increased capacity and GHG-free energy needs

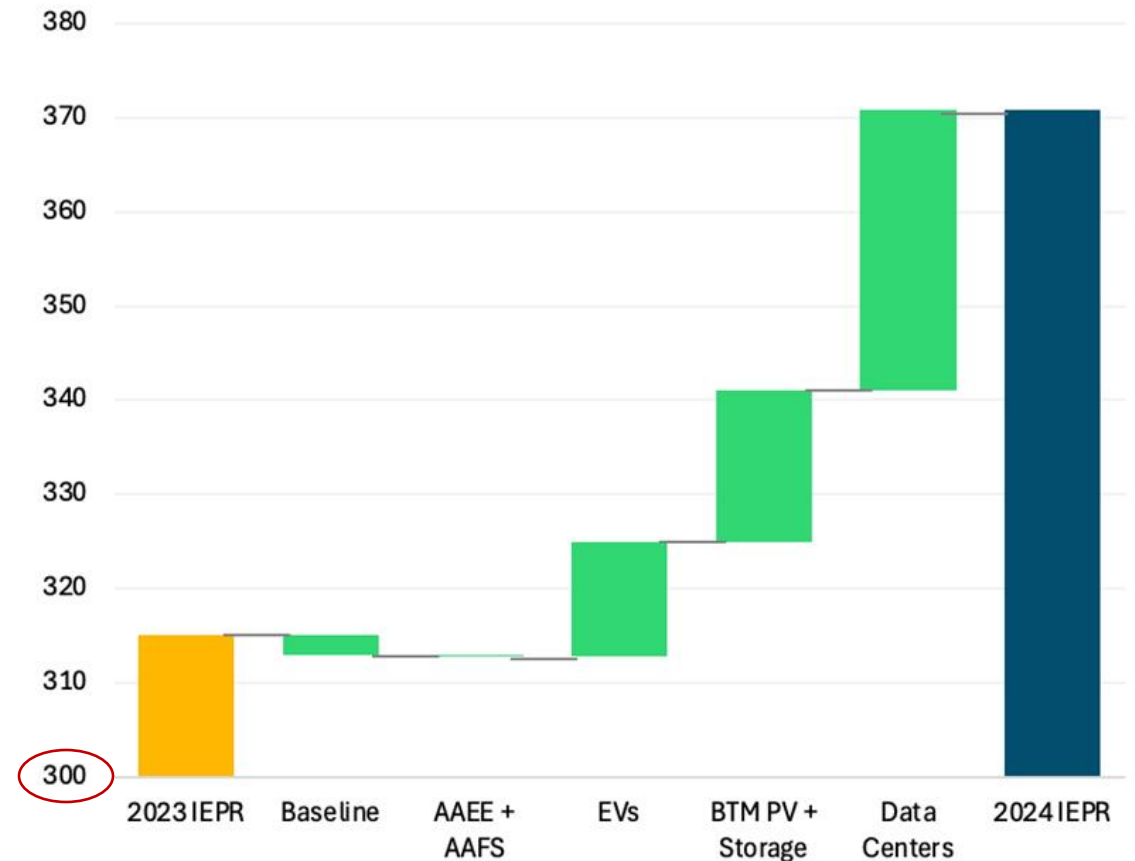


Gross Peak is Managed Peak (sales & losses) + BTM PV. In RESOLVE, Gross Peak and Energy includes the effects of AAEE, AAFS, EV charging, climate change, data centers, and BTM storage. In SERVM, "consumption" peak and energy is modeled, separate from all the above load modifiers including BTM PV. All figures here assume no BTM CHP retirement, which is implemented as a change to baseline consumption in RESOLVE

2024 IEPR vs. 2023 IEPR: Managed Load Waterfall

- Increases in load are primarily driven by:
 - The introduction of significant data center loads in the 2024 IEPR by 2040
 - Less adoption and lower capacity factors for BTM Solar and Storage
 - Updates to electric vehicles, including higher vehicle miles travelled (VMT)
- Changes to the baseline, energy efficiency (AAEE), and building electrification (AAFS) are relatively small
 - In the 2030s, AAFS demand is higher in the 2024 IEPR, but is similar by 2040

Change in IEPR Planning Scenario Managed Load, 2040 (TWh)



26-27 TPP Proposed Base Case Portfolio

Proposed 26-27 TPP Base Case Overview

- Proposed base case designed to be similar to the 25-26 TPP base case with similar policy assumptions
 - Incorporates the 25 MMT GHG target by 2035 (same as 25-26 TPP and 24-25 TPP)
 - Same amount of offshore wind forced in (i.e. half of D.24-08-064 potential, the decision pursuant to AB 1373), but extends the online dates
 - Updated to the 2024 IEPR Planning Scenario (25-26 TPP base case used the 2023 IEPR planning scenario)
 - General increase in selected capacity for 26-27 TPP (when compared to 25-26 TPP base case) due to increased load in the 2024 IEPR; peaks in the 2030s at ~30 GW
- For the proposed Base Case Portfolio staff studied a case that reflects a partial buildout of the maximum procurement volumes considered in the Commission's need determination analysis pursuant to D.24-08-064, related to Assembly Bill (AB) 1373. Staff also included a Least-Cost comparison case.
 - Refer to Appendix for 26-27 TPP Least Cost comparison Portfolio
- CAISO's study of these portfolios focuses on model years that are 10 and 15 years in the future:
 - 2036 — 10-year projection
 - 2041 — 15-year projection

Input from D.24-08-064 Procurement, per AB 1373

- AB1373 (Garcia, 2023) authorizes centralized procurement of specified Long Lead-Time (LLT) resources¹, including geothermal, offshore wind, and long duration storage (LDES) with different durations
- For the 26-27 TPP, the proposed base case requires RESOLVE to select **half of the maximum procurement amounts** specified by the CPUC need determination (D.24-08-064), to come online from 2031-37²
- Offshore wind online dates are assumed to be extended from dates used in previous TPP portfolios
 - Morro Bay online in 2036
 - Humboldt online in 2041

AB1373 Minimum Builds

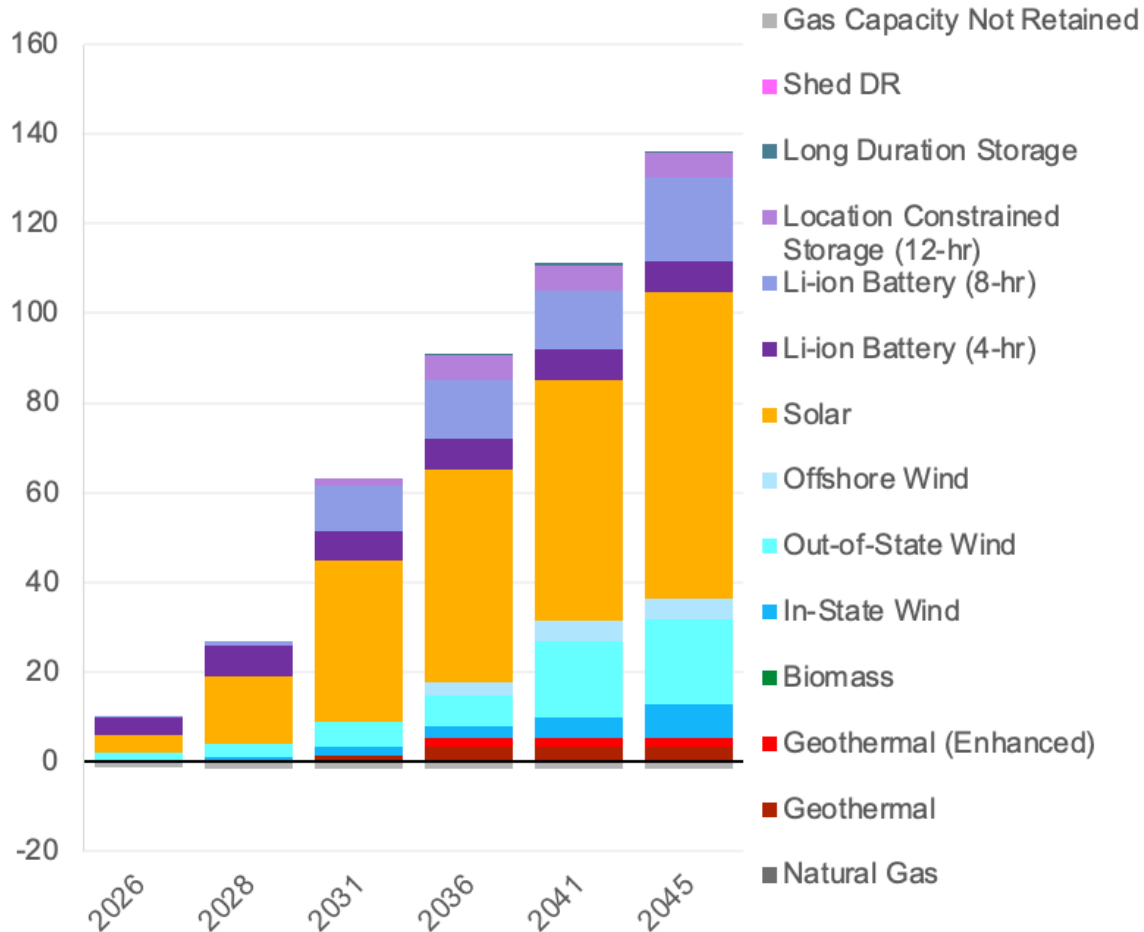
Procurement Type	Minimum Build	Note
Offshore Wind - Morro Bay	2.9 GW	Online 2036
Offshore Wind - Humboldt	1.6 GW	Online 2041
Geothermal	0.5 GW	
Long Duration Storage (12+hr)	0.5 GW	
Long Duration Storage (Multi-Day)	0.5 GW	

RESOLVE Modeling Results: 26-27 TPP Proposed Base Case Portfolio

26-27 TPP Proposed Base Case

Selected Builds

Selected Capacity (GW)



Geothermal is selected for reliability needs due to its high ELCC and high capacity-factor, GHG-free energy; most of the conventional geothermal potential is built out by 2036, and EGS is also built in that year (prior to the expiration of tax credits)

Almost all available out-of-state **wind** is selected; near-term in-state wind build limits bind through 2028, and the loss of tax credits slows adoption until the 2040s

Solar and **storage** are resources that scale to meet growing GHG-free energy demand

Small amounts of **gas** with high fixed O&M are non-retained early on

The partial amounts of the maximum procurement volumes of offshore wind and multi-day storage as considered in AB1373, are forced in; RESOLVE selects above partial AB1373 procurement forced-in amounts for geothermal and location-constrained LDES

Selected Builds

- New resources (nameplate GW), both LSE planned and RESOLVE selected, above the IRP-RESOLVE modeling resource baseline

Resource Type (cumulative GW)	2026	2028	2031	2036	2041	2045
Natural Gas	-	-	-	-	-	-
Geothermal	0.1	0.3	1.2	3.4	3.4	3.4
Geothermal (Enhanced)	-	-	-	1.7	1.7	1.7
Biomass	-	-	-	-	-	-
In-State Wind	0.3	0.8	2.0	2.6	4.8	7.7
Out-of-State Wind	1.4	2.9	5.5	7.0	17.0	19.0
Offshore Wind	-	-	-	2.9	4.5	4.5
Solar	4.0	15.0	35.9	47.5	53.7	68.5
Li-ion Battery (4-hr)	3.9	6.7	6.8	6.8	6.8	6.8
Li-ion Battery (8-hr)	0.2	1.0	10.0	13.2	13.2	18.6
Location Constrained Storage (12-hr)	-	-	1.6	5.4	5.4	5.4
Generic Long Duration Storage (12-hr)	-	-	-	-	-	-
Generic Long Duration Storage (24-hr)	-	-	-	0.5	0.5	0.5
Generic Long Duration Storage (100-hr)	-	-	-	-	-	-
Shed DR	-	-	-	-	-	-
Gas Capacity Not Retained	(1.3)	(1.7)	(1.7)	(1.7)	(1.7)	(1.7)

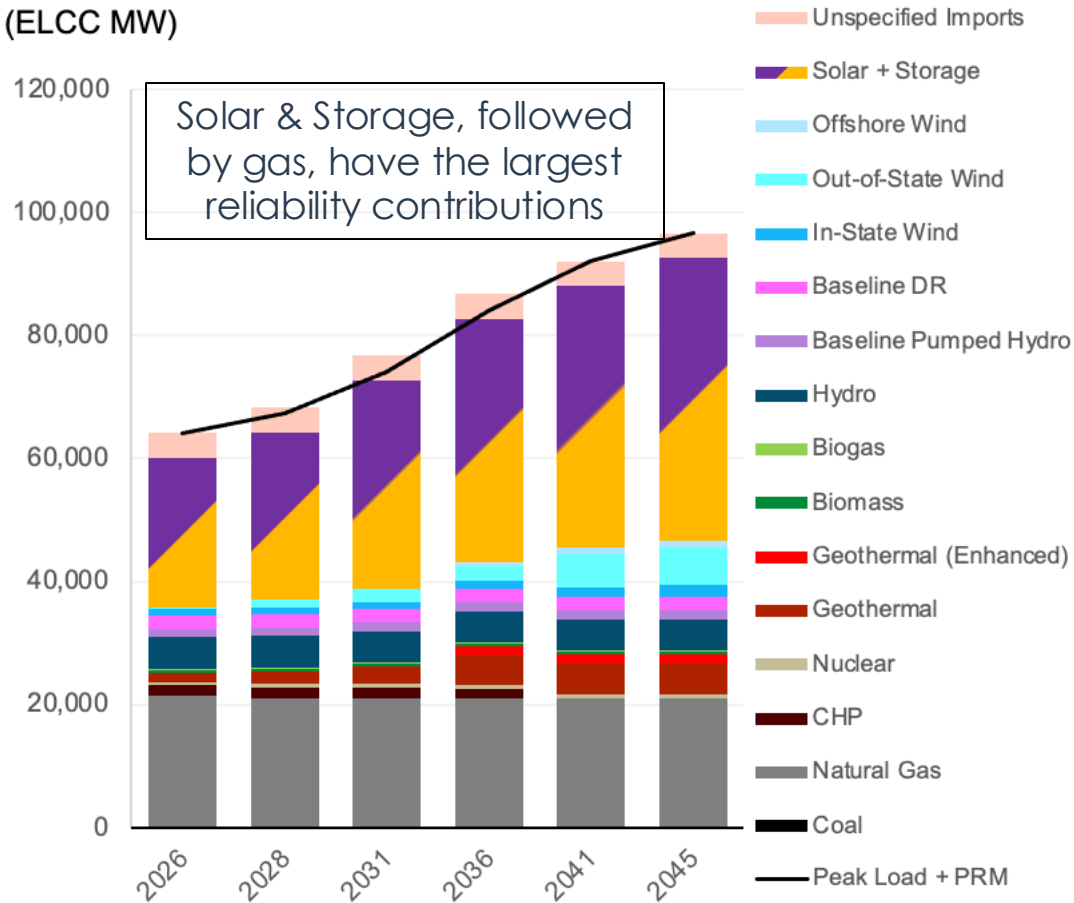
Selected Builds – Forced-in vs. RESOLVE-Selected

- Significant amounts of conventional geothermal and location-constrained storage are selected beyond AB1373 forced-in amounts
- RESOLVE does not select offshore wind or multi-day storage beyond the forced-in amounts, though the latter is selected a year earlier than required, likely to capture tax credits before expiration

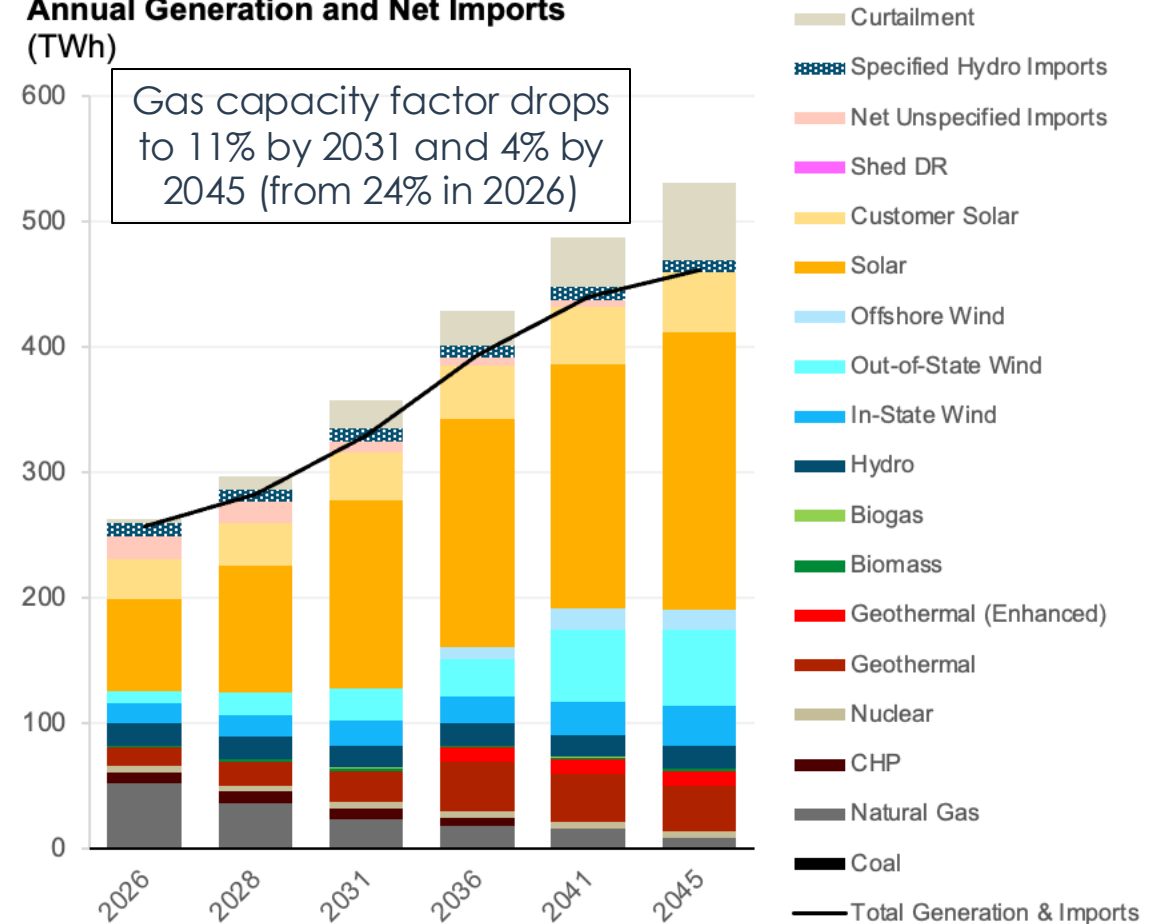
	2036			2041			2045		
Resource/Input	AB1373	RESOLVE-Selected	Total	AB1373	RESOLVE-Selected	Total	AB1373	RESOLVE-Selected	Total
Conventional Geothermal	-	3.4 GW	3.4 GW	0.5 GW	4.6 GW	3.4 GW	0.5 GW	4.6 GW	3.4 GW
Enhanced Geothermal (EGS)	-	1.7 GW	1.7 GW			1.7 GW			1.7 GW
Offshore Wind	2.9 GW	-	2.9 GW	4.5 GW	-	4.5 GW	4.5 GW	-	4.5 GW
Location-Constrained Storage (12-hr)	-	5.4 GW	5.4 GW	0.5 GW	4.9 GW	5.4 GW	0.5 GW	4.9 GW	5.4 GW
Generic LDES (12-hr)	-	-	-		-	-		-	-
Generic LDES (24-hr)	-	0.5 GW	0.5 GW	0.5 GW	-	0.5 GW	0.5 GW	-	0.5 GW
Generic LDES (100-hr)	-	-	-		-	-		-	-

Reliability and Energy Mix

**PCAP PRM Contribution
(ELCC MW)**

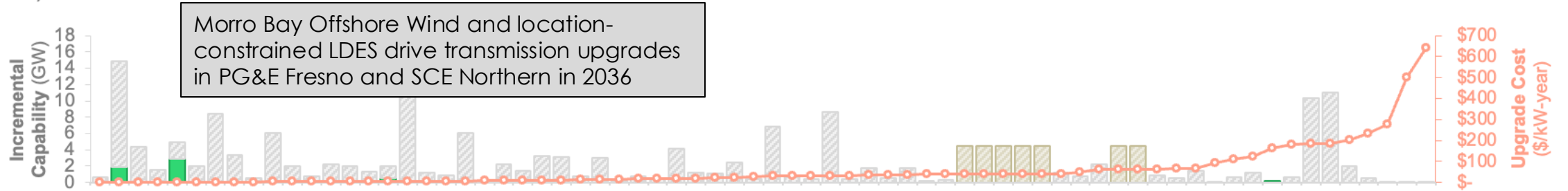


**Annual Generation and Net Imports
(TWh)**

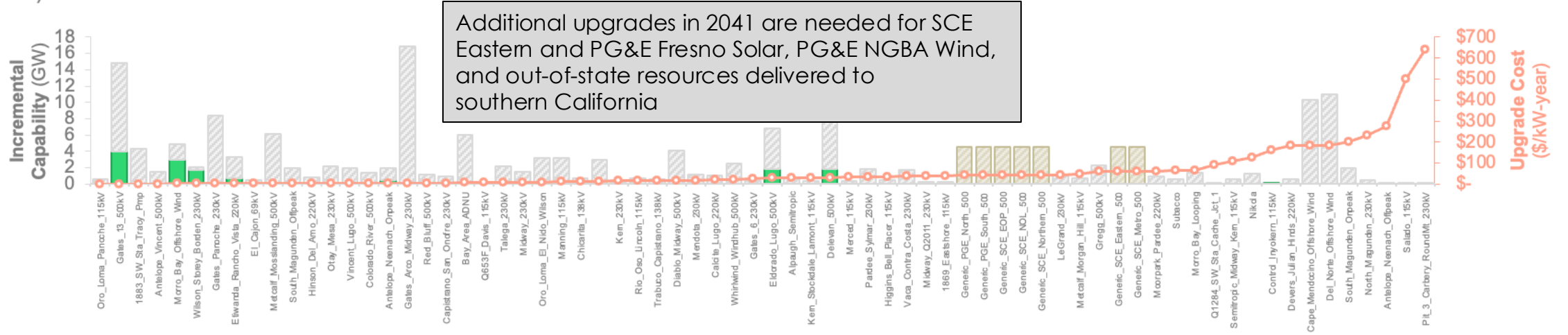


RESOLVE-Selected Transmission Upgrades

Selected Transmission Upgrades by Cost, 2036
(GW)

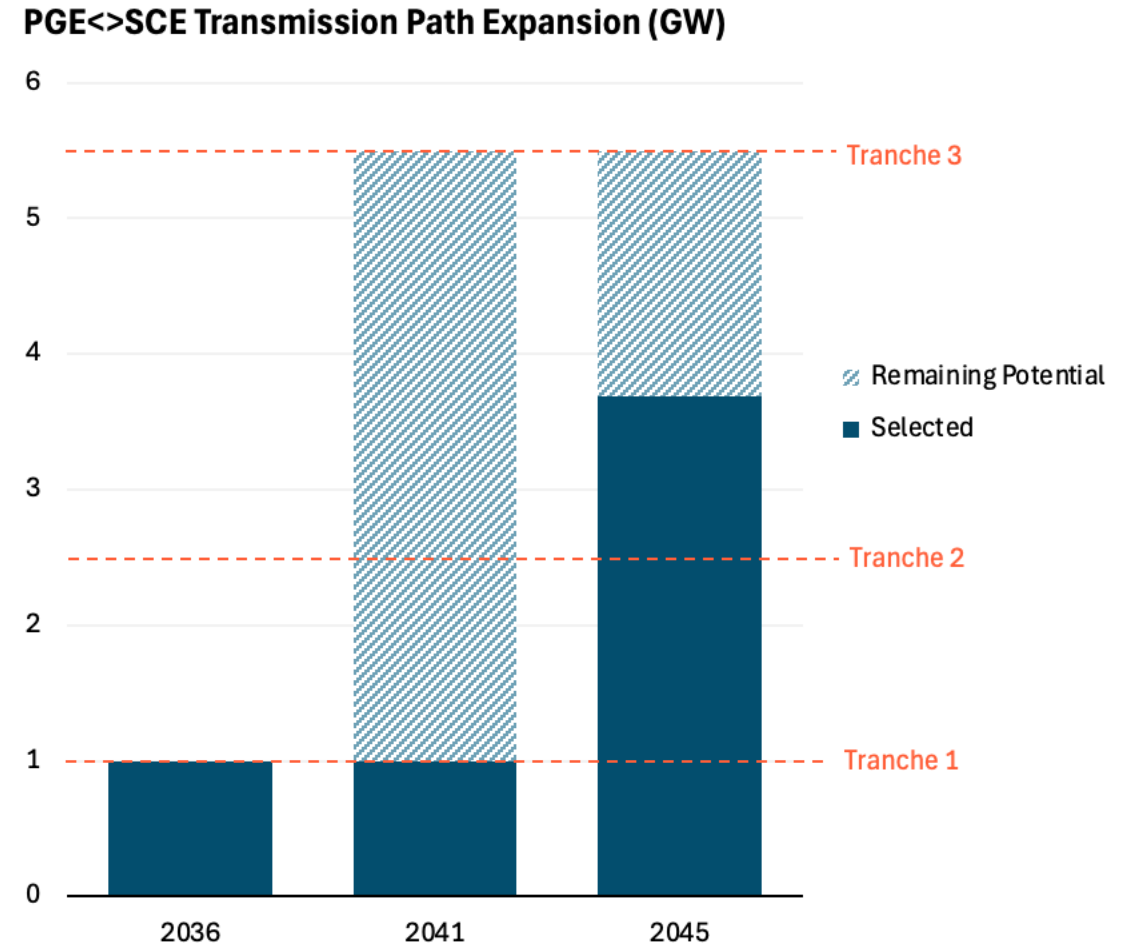


Selected Transmission Upgrades by Cost, 2041
(GW)



PG&E<>SCE Transmission Expansion

- Path 26/Path 15 expansion(s) are selected primarily to increase import capacity into PG&E
- The first tranche (1 GW) is optimally selected in the first available year (2036)
- An additional ~2.5 GW expansion, including all of tranche 2, is optimally selected in 2045

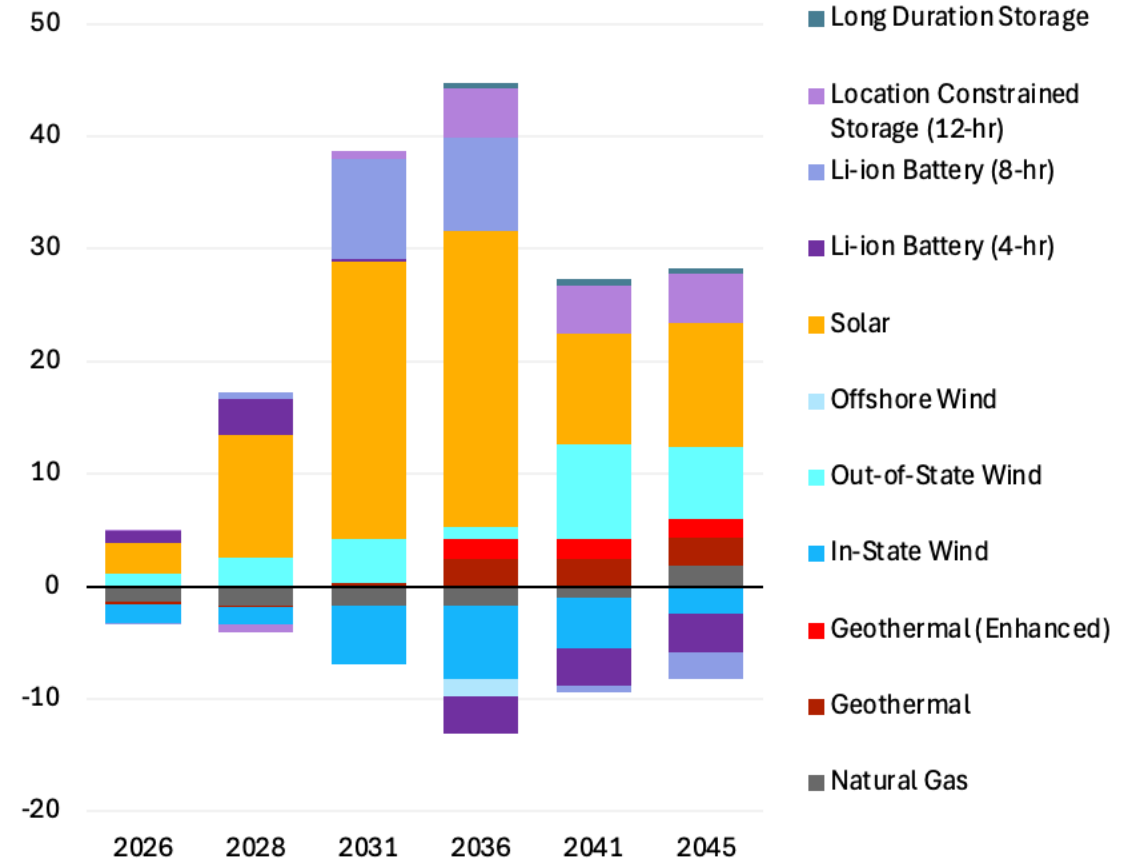


26-27 TPP Proposed Base Case

Total Capacity Comparison with the Adopted 25-26 TPP Base Case

- Note: both the previous and the upcoming TPP base case had some amount of resources forced-in, though quantities and resource types differ. Notably, the model never optimally selects offshore wind.
- General increase in selected capacity for 26-27 TPP due to increased load in the 2024 IEPR forecast
 - 25-26 TPP used the 2023 IEPR forecast; capacity differences peak at ~30 GW in the 2030s
- Most incremental capacity is solar, storage, and geothermal (the latter starting in the mid-2030s)
- Shifts from in-state to out-of-state wind, in part because of changing resource potential assumptions
- Extension of offshore wind online dates from 2032-35 to 2036-41
- Shifts from shorter- to longer-duration storage, in part because of significant amounts of 4-hr battery forced-in for 25-26 TPP
- Gas is not retained earlier in the 26-27 TPP, but more gas is retained by 2045

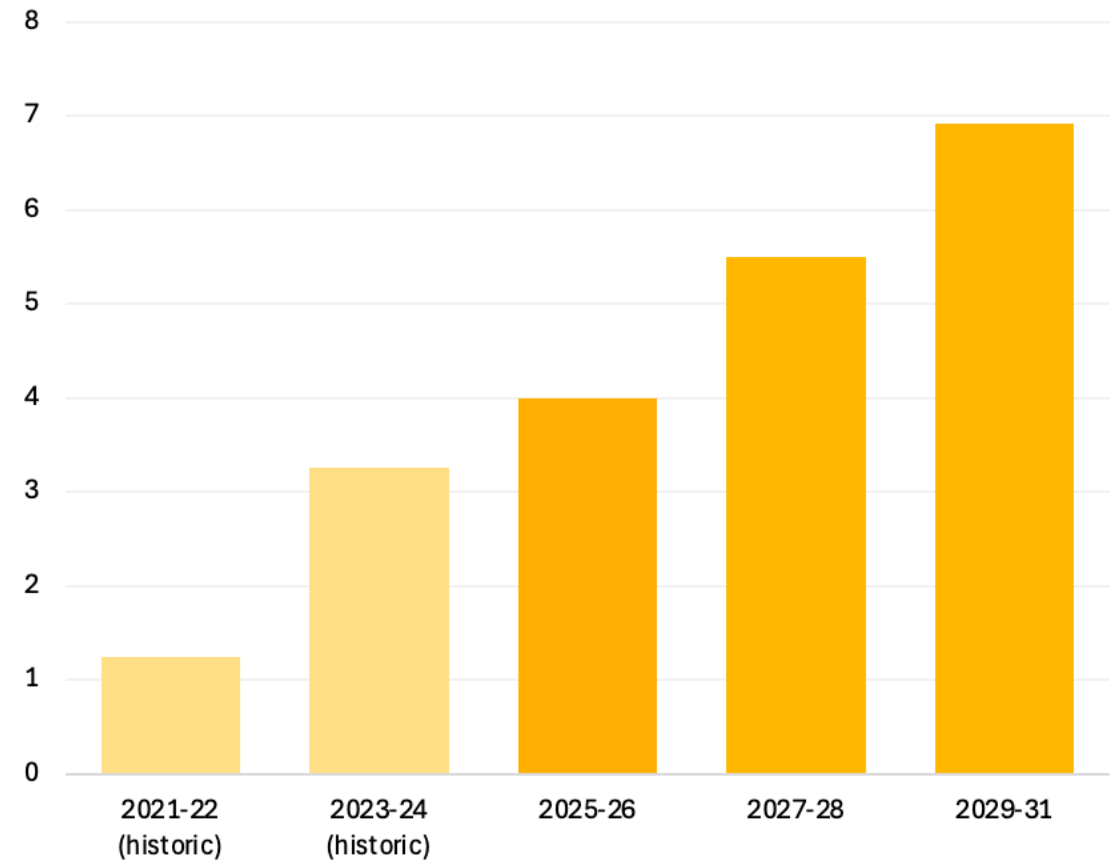
Total Capacity: 26-27 TPP minus 25-26 TPP (GW)



Solar Build Rates Through 2031

- Solar is the scalable energy resource due to near-term wind and geothermal limits, and significant builds are needed to meet the 2030 GHG target
- Build rate accelerates from ~3-4 GW/yr (recent historical) to ~7 GW/yr by 2030

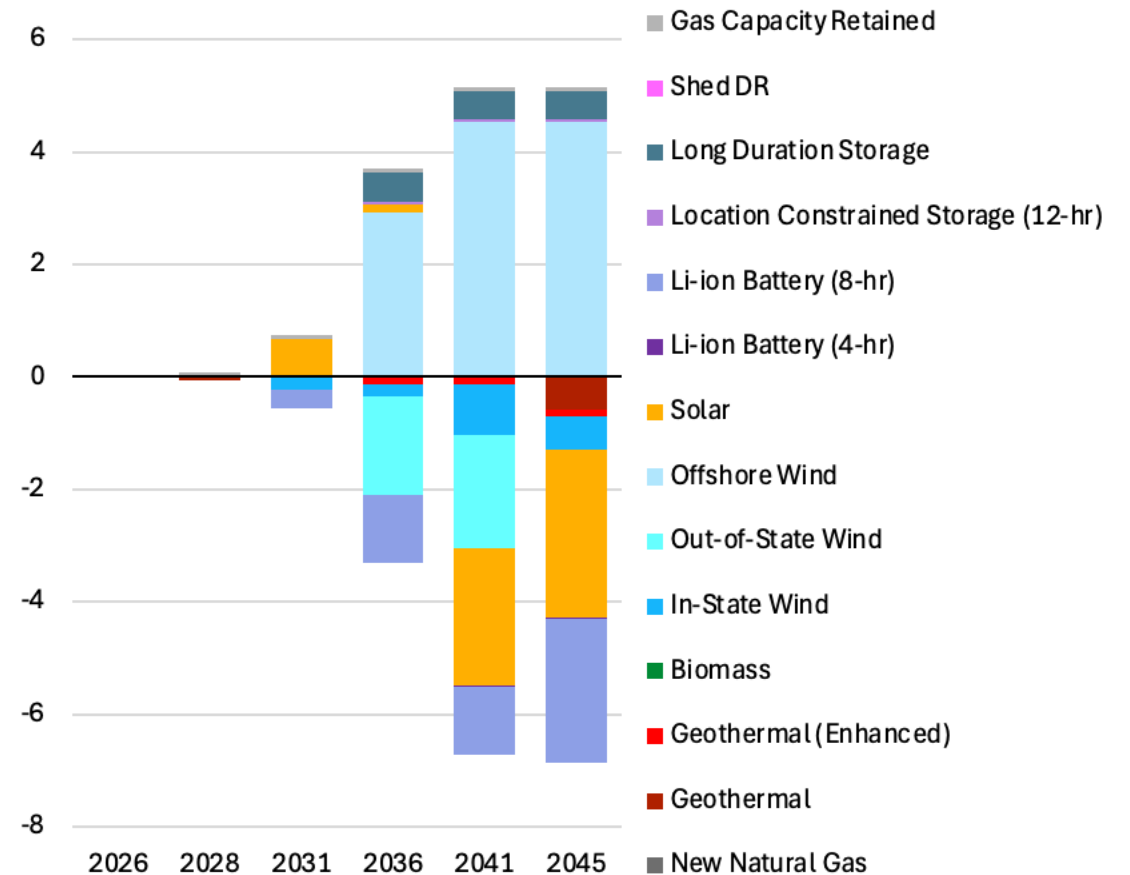
Solar Build Rate (GW/yr)



Selected Builds Comparison with Least-Cost Comparison Case

- Offshore wind and multi-day storage are forced-in to the proposed base case
 - AB1373 amounts of geothermal and 12-hr+ storage (full, not just partial) are already exceeded in least-cost comparison case
- Forced-in offshore wind and multi-day storage primarily displace solar and battery, and a small amount of in-state wind
 - ~2 GW out-of-state wind extended from 2035 to 2045
 - Small amount of geothermal (above AB1373 amounts) avoided in 2045

Proposed Base Case minus Least-Cost Comparison (GW)



RESOLVE-Optimized Cost Comparison with Least-Cost Comparison Case

RESOLVE-Optimized Costs (\$MM in 2024\$)

Case	2026	2028	2031	2036	2041	2045	NPV
Least-Cost Comparison Case	\$8,758	\$11,983	\$18,094	\$24,231	\$28,392	\$34,865	\$394,735
Proposed Base Case	\$8,758	\$11,995 +\$12 (0.1%)	\$18,066 -\$28 (0.2%)	\$26,174 +\$1,943 (8.0%)	\$30,730 +\$2,338 (8.2%)	\$37,317 +\$2,452 (7.0%)	\$417,749 +\$23,014 (5.8%)

- Partial AB1373 procurement volumes for offshore wind and multi-day storage increase costs by ~\$1.9-2.5 Billion
 - Minimal differences before AB1373 procurement (2031 and earlier)

Summary & Conclusions

Summary & Conclusions

- Compared to the **2023 IEPR**, the **revised 2024 IEPR has higher demand and peak load**, driving an **increase in resource buildout**
 - 25-26 TPP used the 2023 IEPR forecast; load growth in the 2024 IEPR (which is being used for the current 26-27 TPP) drives additional resource builds, up to ~30 GW above the 25-26 TPP
 - Shifts from in-state to out-of-state wind, in part because of changing resource potential assumptions
- **GHG target leads to an over-reliable system in some years**; Planning Reserve Margin is not binding from 2028-2036
- Aggressive near-term **solar build rate accelerates** from ~3-4 GW/yr to ~7 GW/yr by 2030 to meet GHG goals due to near-term wind and geothermal limits, in excess of reliability build need
- PG&E<>SCE transmission path expansion candidate(s) added to RESOLVE optimization, and Path 26/Path 15 expansion(s) are selected primarily to **increase zonal import capacity into PG&E TAC area**, but expansion benefit reduces post-offshore wind addition
- RESOLVE **selects above partial AB1373 procurement forced-in amounts for geothermal and location-constrained LDES**; RESOLVE does not currently select any offshore wind due to resource's high cost under current cost assumptions

Staff Recommended Option for the 26-27 TPP Sensitivity Portfolio

Background – Purpose of Sensitivity

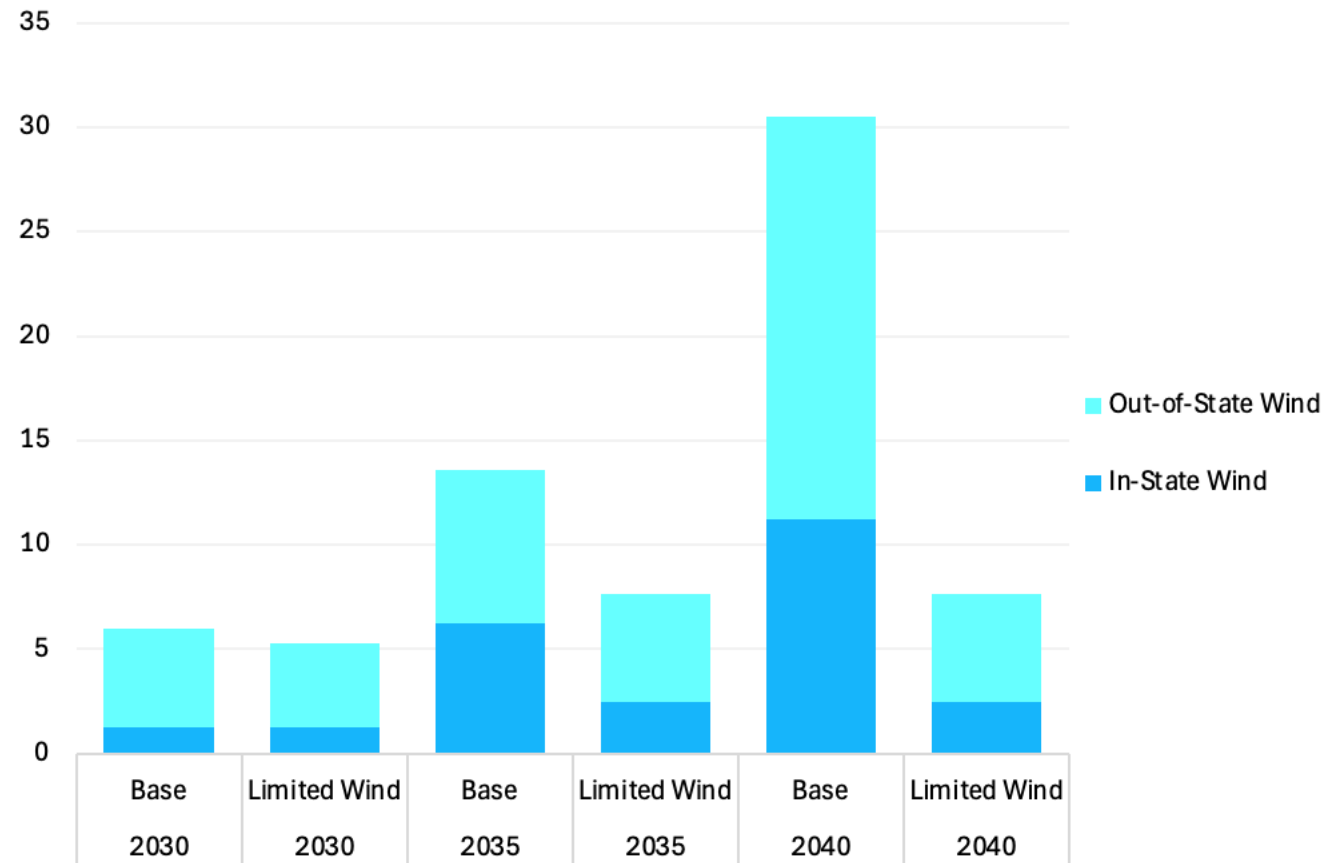
- In addition to the Proposed 26-27 TPP Base Case portfolio, Staff is proposing to transmit one sensitivity portfolio to the CAISO focused on a limited wind deployment future
- The sensitivity would represent a future with reduced in-state and out-of-state wind procurement, and without offshore wind
 - Reflects the recent lack of wind development in California, the increased difficulty of permitting wind in California, and the current changes in federal policy toward wind projects
 - Designed to serve as a plausible alternative scenario associated with the proposed base case (as opposed to a TPP sensitivity that gathers additional transmission information to support future portfolio development and explore incremental optionality or risk)
 - Would provide insights into transmission implications and resources that would be needed to replace wind in the recommended base case portfolio and recently adopted TPP portfolios if its development were significantly limited

RESOLVE Modeling Results: Proposed 26-27 TPP Sensitivity Portfolio

Limited Wind Sensitivity – Resource Potential Inputs

- The limited wind potential sensitivity explores significant reductions to resource potential (as shown in the graphic to the right)
 - Maximum 2.5 GW In-State Wind
 - Out-of-State Wind limited to existing transmission rights (SunZia, SWIP-North, TransWest), plus 2 GW of additional SunZia potential
 - No Offshore Wind

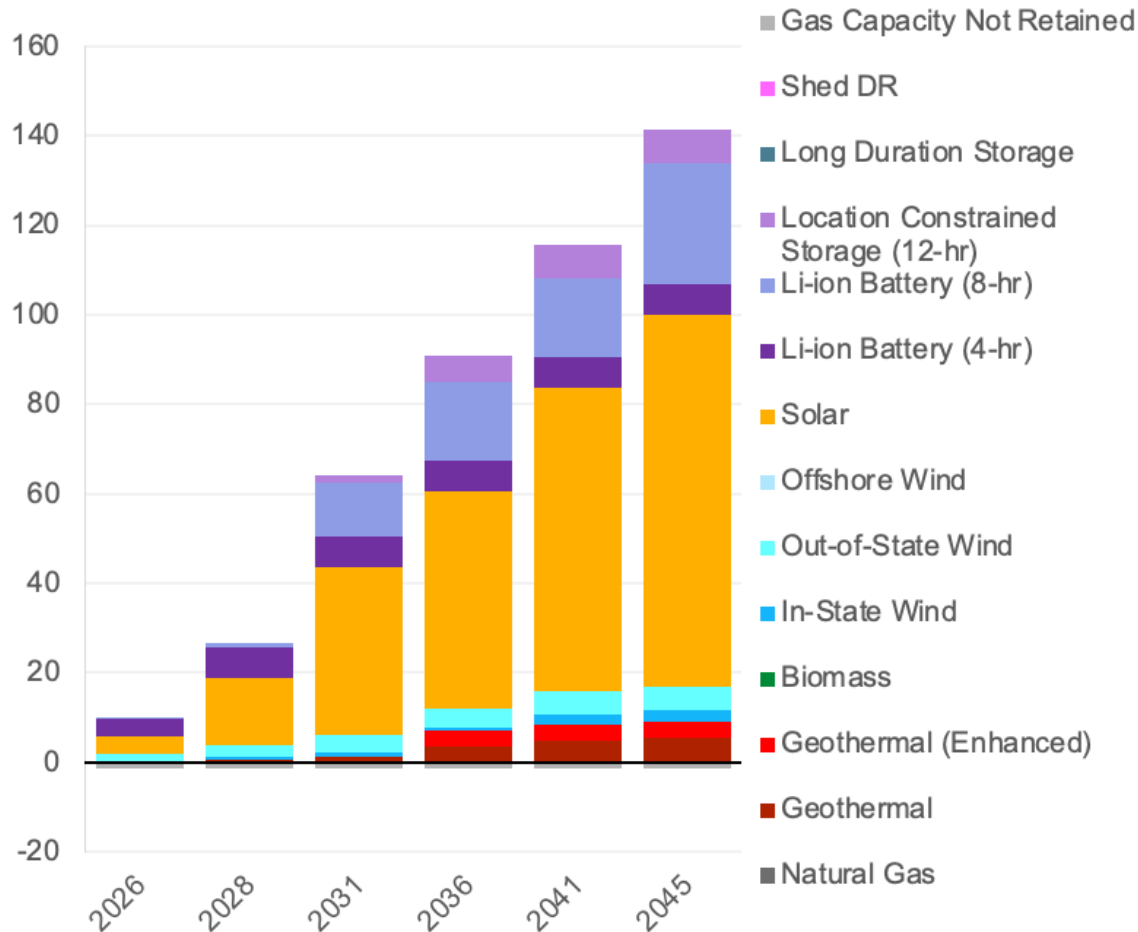
Onshore Wind Resource Potential (GW)



26-27 TPP Proposed Sensitivity Case: Limited Wind

Selected Builds

**Selected Capacity
(GW)**



Geothermal is selected for reliability needs due to its high ELCC (contribution to reliability) and high capacity- factor, GHG-free energy; the entire conventional geothermal potential is built out to fill need otherwise met by wind; significant amounts of EGS is also built in 2036 (prior to the expiration of tax credits)

Limits to **wind** potential bind in most years, with the exception of in-state wind in the 2030s (shortly after the loss of tax credits)

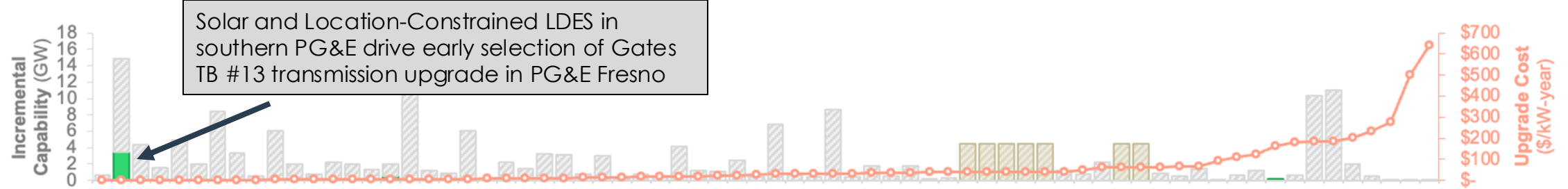
Solar and **storage** are resources that scale to meet growing GHG-free energy demand and fill some of the need otherwise met by wind

Small amounts of **gas** with high fixed O&M are non-retained early on

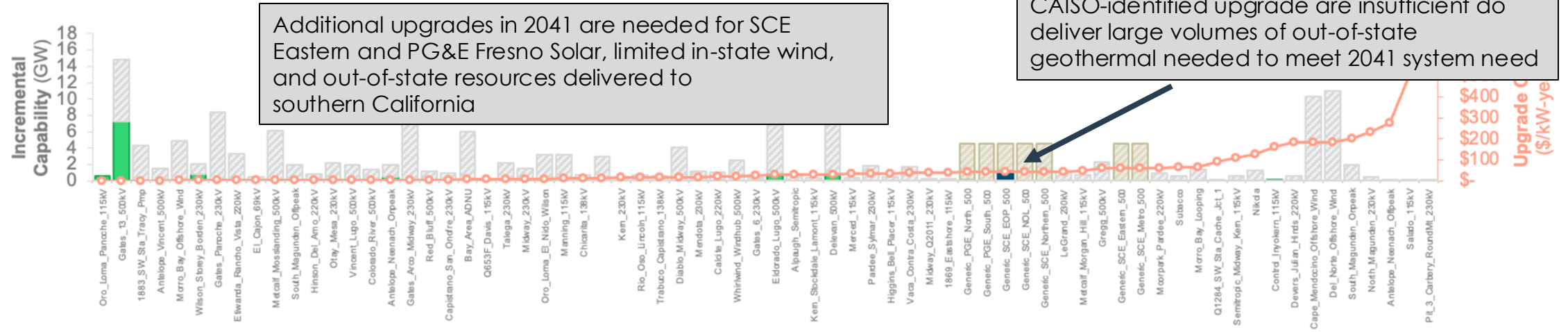
Actual buildout will depend on procurement options, therefore, geothermal selection in model could be considered a proxy for other resources with similar attributes, e.g. high ELCC

RESOLVE-Selected Transmission Upgrades

Selected Transmission Upgrades by Cost, 2036
(GW)

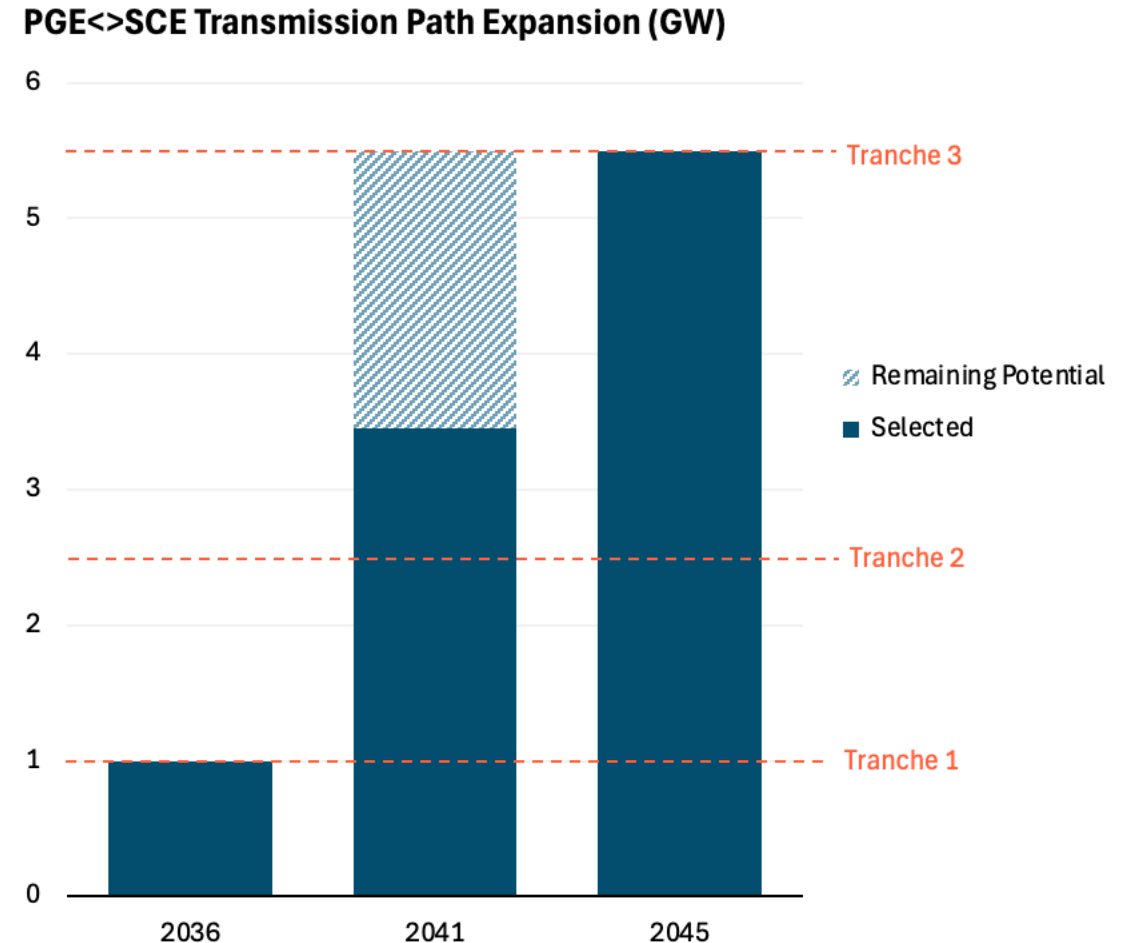


Selected Transmission Upgrades by Cost, 2041
(GW)



PG&E<>SCE Transmission Expansion

- Path 26/Path 15 expansion(s) are selected primarily to increase import capacity into PG&E
- The first tranche (1 GW) is selected in the first available year
- Significant expansion is selected by 2041, with the whole 5.5 GW potential built out by 2045



RESOLVE-Optimized Cost Comparison with Least-Cost Comparison Case

RESOLVE-Optimized Costs(\$ MM in 2024\$)

Case	2026	2028	2031	2036	2041	2045	NPV
Least-Cost Comparison Case	\$8,758	\$11,983	\$18,094	\$24,231	\$28,392	\$34,865	\$394,735
Limited Wind Potential	\$8,759 +\$1 (<0.1%)	\$12,001 +\$18 (0.1%)	\$18,104 +\$10 (0.1%)	\$24,816 +\$585 (2.4%)	\$29,720 +\$1,328 (4.7%)	\$36,071 +\$1,206 (3.5%)	\$405,466 +\$10,731 (2.7%)

- Cost differences with the least-cost comparison case are relatively small until 2041, when wind build in least-cost increases significantly; limiting the wind potential increases costs by ~\$1.2-1.3 Billion in those years

26-27 TPP Proposed Sensitivity Case: Limited Wind

RESOLVE-Optimized Cost Comparison with Base Case

RESOLVE-Optimized Costs (\$MM in 2024\$)

Case	2026	2028	2031	2036	2041	2045	NPV
Proposed Base Case	\$8,758	\$11,995	\$18,066	\$26,174	\$30,730	\$37,317	\$417,749
Limited Wind Potential	\$61,000 +\$1 (<0.1%)	\$68,538 +\$6 (<0.1%)	\$79,801 +\$39 (<0.1%)	\$94,317 -\$1,448 (1.5%)	\$107,210 -\$1,330 (1.2%)	\$119,314 -\$1,566 (1.3%)	\$1,549,513 -\$14,613 (0.9%)

- Despite the limits to onshore wind potential, the Limited Wind case has lower costs in 2036 and beyond, due to relatively expensive offshore wind and multi-day storage forced-in for partial AB1373 procurement volumes in the base case
 - Forcing in offshore wind (including associated transmission) is more expensive than limiting onshore wind
 - Minimal differences before 2036 (first model year with AB1373 procurement)

Summary & Conclusions

Summary & Conclusions

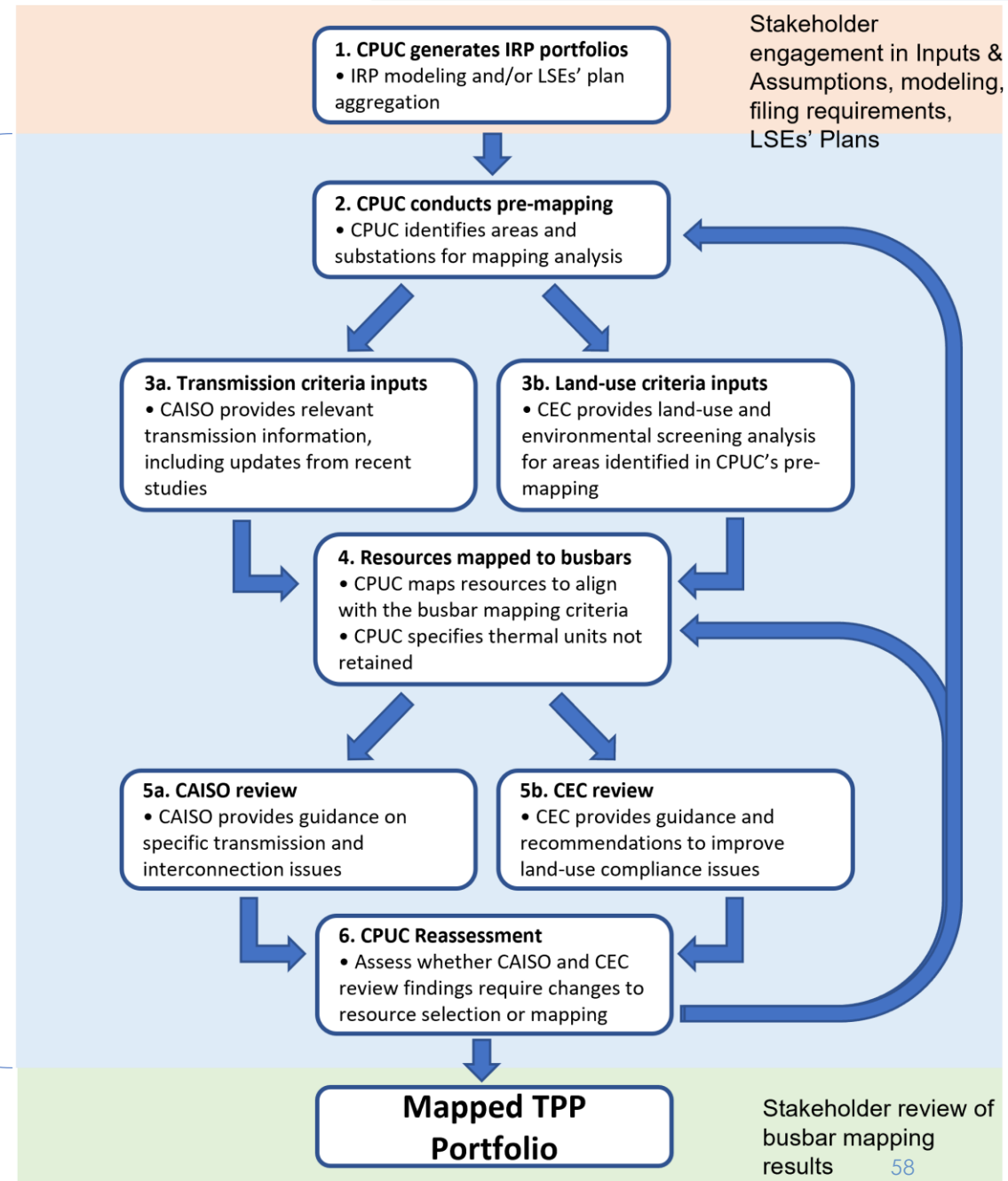
- Primarily replaces wind with **additional solar and storage**, plus ~3 GW of **geothermal** (conventional and enhanced)
 - More reliance on geothermal for capacity & energy with limited wind
- Forcing in offshore wind is **more expensive** than limiting onshore wind
- Limits to wind potential bind in most years, with the exception of in-state wind in the 2030s (shortly after the loss of tax credits)
- **Additional expansion of the Path 26/Path 15 expansion** compared to the Proposed Base Case is required to meet PG&E load

Busbar Mapping Methodology

Busbar Mapping Process

- Busbar Mapping can be viewed as a sequence of steps involving CPUC, CEC, and CAISO staff providing inputs and expertise at various stages.
 - CEC staff provide land-use and environmental information, data analysis, and implications assessment.
 - CAISO staff provide similar info for transmission and interconnection topics.
 - CPUC applies analysis and information to conduct the mapping itself and coordinates the information transfers.
- Overall process is an iterative effort that requires several rounds of the mapping process
- Goals of the mapping process:
 - Identify plausible locations for portfolio resources that align with CPUC policy requirements, maintain reliability, and minimize cost to ratepayers.
 - Align mapped resources to the extent feasible with the guiding principles and the mapping priorities of each criteria.

Methodology addresses these steps



Busbar Mapping Methodology

- **Busbar Mapping Methodology:** Methodology document states guiding principles, establishes mapping criteria, and outlines the iterative inter-agency mapping process.
 - Current [Mapping Methodology for the 26-27 TPP](#).
- **Updates included in Current Methodology:** Staff implemented a number of updates this cycle. Those updates included:
 - Integrating PTO feedback and per-unit cost guide data to estimate the economic feasibility to interconnect at individual bars.
 - Replacing the High Fire Threat Districts with the 2024 USFS Wildfire Hazard Potential map and classified USFS fire threat data into consistent low/medium/high bins to align with the busbar mapping criteria alignment levels of 1-5.
 - Extending the CEC Protected Area Layer (PAL) to cover in-CAISO regions in western Arizona and southern Nevada. Clarified how interconnection queue data from neighboring balancing area authorities is used to estimate commercial interest.
 - We refer interested parties to the [09/30 Methodology Ruling](#) here and [this webinar](#) from August for more information on methodology updates.
- **Future Methodology updates:** Staff anticipate conducting more updates to the methodology for the next cycle:
 - Supplementing commercial interest criteria with non-CAISO queue data other data sources besides CAISO queue data is a focus for the 27-28 TPP.

Mapping Criteria Overview

- The mapping Methodology, used since the 24-25 TPP portfolios, has the busbar mapping criteria organized into seven categories:
 1. System level transmission capability
 2. Substation level interconnection viability
 3. Land-use implications and feasibility factors
 4. Environmental (conservation and biological) impact factors
 5. Environmental (societal) and community impact factors
 6. Commercial & development interest
 7. Consistency with prior TPP portfolios
- Staff rank criteria alignment using a five-level scale to summarize mapped resources' alignment with the various criteria priorities.
 - Not all criteria screens use all five levels of alignment.

Level 1	Level 2	Level 3	Level 4	Level 5
Strong compliance with criteria; alignment with criteria's prioritized conditions	Mostly favorable compliance with criteria; not fully aligned with priorities but not near to triggering unfavorable criteria	Mixed compliance with criteria; little alignment with priorities; potential alignment with conditions criteria seek to limit or avoid	Some noncompliance with criteria; some alignment with conditions criteria seeks to limit or avoid	Significant noncompliance with criteria; no alignment with stated criteria; meets conditions criteria seek to limit or avoid

Criteria 1: System Level Tx Capability

- Mapped resources should abide by the estimated system level transmission constraints, triggering only those upgrades which are determined to be cost-effective or necessary to meet policy and reliability requirements.
- Mapping uses information from the new CAISO White Paper – 2024 Transmission Capability Estimates for use in the CPUC's Resource Planning Process.
 - [Link](#) to 08/29/2024 White Paper and appendices
 - Adds more substations and updates constraint info, including approved upgrades from recent TPPs.
- Analysis incorporates on-peak and off-peak limits and identified upgrades for CAISO transmission constraints
 - Actual constraints (binding amounts identified in CAISO studies) and Default constraints (non-binding limits – largest amount CAISO has studied)
- Identify mapped OOS resources as utilizing existing Maximum Import Capability (MIC) or require MIC expansion

Tx Capacity Utilized by Mapped Resources (MW)	Kramer- Victor/Roadway - Victor Constraint			Kramer- Victor/Roadway - Victor Constraint			Lugo 500/230 kV Transformer Constraint		
	HSN	SSN	Off-Peak	HSN	SSN	Off-Peak	HSN	SSN	Off-Peak
Existing Capacity:	826	826	1,237	1,156	1,156	1,311	1,576	1,576	1,619
Wind	-	-	-	-	-	-	-	-	-
Solar	103	415	1,567	114	457	1,644	145	585	2,053
Geothermal	53	53	-	53	53	-	53	53	-
Biomass	-	-	-	25	25	-	25	25	-
Li_Battery	1,029	514	(1,029)	1,079	539	(1,079)	1,264	632	(1,264)
Total Utilized:	1,185	982	539	1,270	1,075	566	1,487	1,295	789
Remaining:	(359)	(156)	698	(114)	81	745	89	281	830
Tx Upgrade Amt:	430	430	480	430	N/A	N/A	980	N/A	N/A



Flags without (left) and with (right) upgrades

Total Resources (MW) by Substation		Geothermal	Biomass	Distributed Solar	Solar	Solar	Li_Battery	Tx Criteria Flag	Tx Criteria Flag	Tx Criteria Flag	Tx Criteria Flag
Substation	Voltage	FCDS	FCDS	FCDS	FCDS	EODS	FCDS	FCDS	EODS	FCDS	EODS
Calcite	230	-	-	-	200	230	185	1	1	1	1
Control	115	53	-	-	-	-	-	3	1	1*	1
Coolwater	115	-	-	-	150	204	104	3	1	1*	1
Kramer	230	-	-	-	620	741	700	3	1	1*	1
Kramer	115	-	-	2	90	-	75	3	1	1*	1
Pisgah	230	-	-	-	100	-	-	1	1	1	1
Roadway	115	-	-	3	111	120	150	3	1	1*	1
Victor	230	-	3	2	100	-	50	3	1	1*	1
Victor	115	-	22	-	-	-	-	3	1	1*	1

Table: 23-24 TPP non-compliance flags determined from transmission constraints utilization calculations

Criteria 2: Substation-level Interconnection

- Mapped resources should
 1. Be within a viable distance of transmission from economic, land-use, and environmental perspectives and
 2. Be able to interconnect to transmission of an appropriate voltage in a viable and cost-effective manner.
- Initial mapping analysis includes only:
 - Distance from substation for in-CAISO solar, onshore wind, and geothermal resources
 - Interconnection voltage analysis for in-CAISO solar, onshore wind, and storage resources
- The interconnection criteria are expanded for the 2026-2027 TPP to integrate PTO feedback and per-unit cost guide data to estimate the economic feasibility to interconnect at individual busbars:
 - Staff have coordinated with PTOs to collect interconnection data, including existing headroom (pre-TPD allocation), number of available interconnection positions, upgrade condition, and available area within the fence line¹
 - Feedback is synthesized to estimate the scope of upgrades required to feasibly interconnect at each busbar
 - PTO per-unit cost guides are used to assign a generic interconnection cost to each busbar as a function of PTO, voltage, and scope of upgrades needed
- Estimated interconnection costs are used to determine criteria alignment
 - Substations with higher interconnection costs, including those that would require extensive upgrades or new substations to facilitate new projects, are de-prioritized over cheaper alternatives in the mapping analysis

Criteria 2: Substation Upgrade Categorizations and Descriptions

- Five categorizations of substation upgrade needs are created based on information received from PTOs

Upgrade Scope	Description of Interconnection Feasibility and Required Upgrade(s)
Minimal	High position availability; only a new gen tie and circuit breakers are required
Moderate	Moderate position availability, or open positions are expected soon; interconnecting is assumed to require additional connecting lines and/or a step-down transformer
High	Little or no position availability, but there exists room to expand within the existing footprint; interconnection will require bus extension within the fence line, as well as a step-down transformer and new connecting lines
New Substation	No room to expand within the fence line; new loop-in substation required
Short-Circuit Duty Limit	Loading at the substation has surpassed the short circuit duty limit, making new interconnections infeasible at the location

Replacement of the CPUC High Fire Threat District Map

- In previous busbar mapping cycles, Staff used the CPUC High Fire Threat Districts (HFTD) map¹ to study fire risk around substations
 - This data layer reports areas of the state with heightened risk of ignition and fire spread, for wildfires caused by power lines and other electrical infrastructure
 - CPUC Fire Safety Rulemaking requires the state to take these data into account in planning
 - Under the requirements of D.17-01-009,² the Safety and Enforcement Division (SED) makes available the maps that together make up the HFTD, which will direct future utility and communication infrastructure provider fire-safety activities in California
- Given permitting challenges to proposed renewable energy projects exposed to fire risk, alternate data layers that instead identify exogenous wildfire risk can be used to screen available land around substations for sites that minimize risk to structures
- For the 2026-2027 TPP, Staff has replaced the CPUC HFTD map with the 2024 USFS Wildfire Risk to Communities datasets³ for assessment of burn probability at mapped resource locations

¹ <https://www.cpuc.ca.gov/industries-and-topics/wildfires/fire-threat-maps-and-fire-safety-rulemaking>

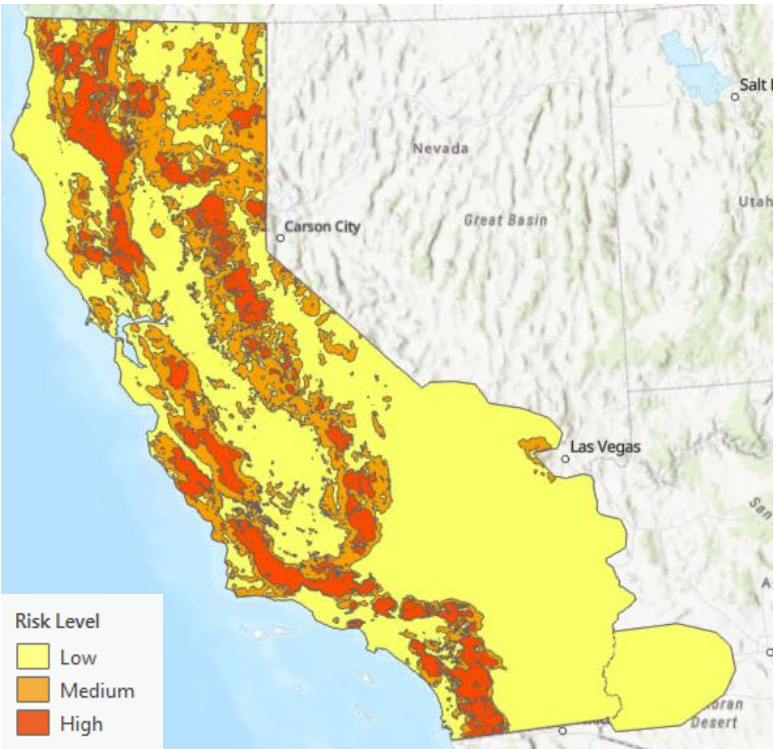
² <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M172/K762/172762082.PDF>

³ <https://www.fs.usda.gov/rds/archive/catalog/RDS-2020-0016-2>

USFS Wildfire Risk to Communities Datasets

- The U.S. Forest Service (USFS) maintains datasets that assess *in-situ* wildfire risk, burn probability, and fire intensity at a 30-m spatial resolution
- Raster layers include:
 - Risk to Potential Structures
 - Burn Probability
 - Exposure Type
 - Conditional Flame Length
 - Flame Length Exceedance Probability
 - Wildfire Hazard Potential
- When mapping resources, Staff will seek to limit mapping resources to (and triggering transmission upgrades in) areas with elevated fire threat
- For the 2026-2027 TPP, the **Burn Probability** layer from the 2024 USFS Wildfire Risk (2nd Edition) is used to estimate the fire threat at mapped project locations

Fire Threat Alignment Threshold

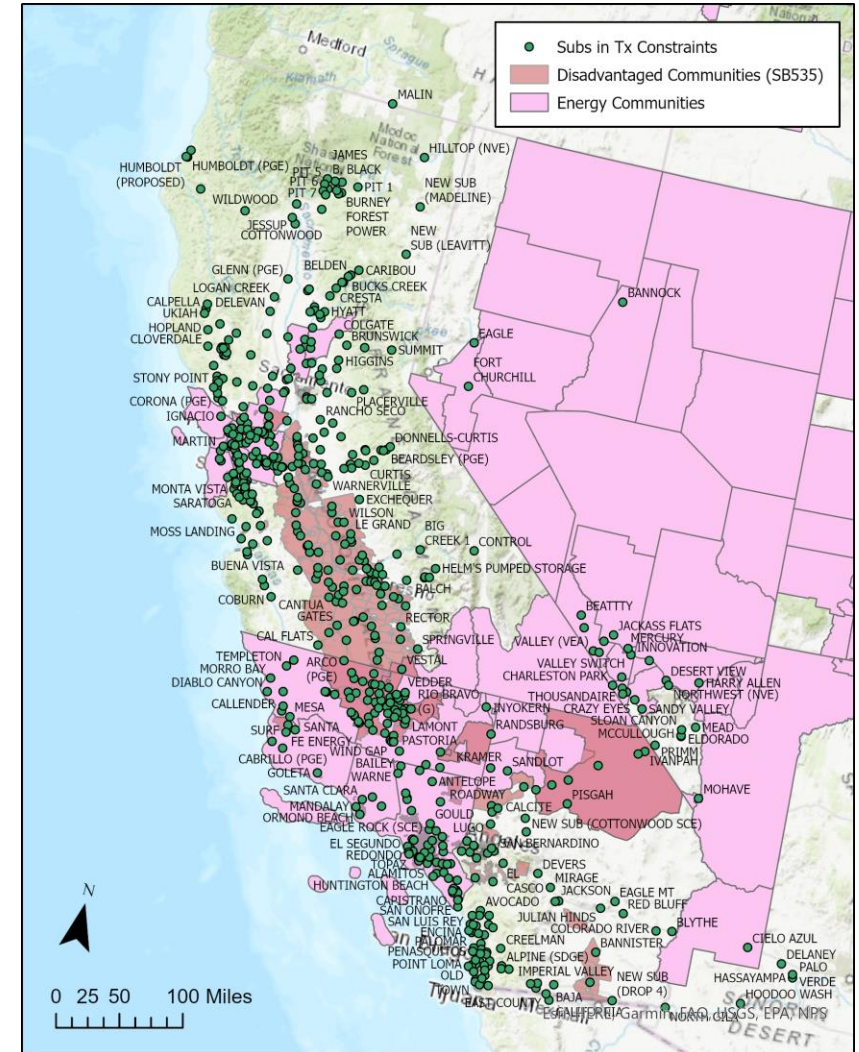


- The USFS Burn Probability dataset is a continuous raster that assigns an annual burn probability (%) to each cell
- Low, Medium, and High-Risk Levels are defined annual burn probability thresholds of <0.5%, 0.5 - 2%, and >2%, respectively.
- For the Fire Threat Criteria, alignment scores are based on the percentage of total area within the mapping radius of each substation that falls within the defined burn probability ranges
 - The higher the proportion of area exposed to elevated burn probability, the higher the risk level assigned:

Alignment Level	Low Burn Probability (<0.5%)	Mid Burn Probability (0.5 - 2%)	High Burn Probability (>2%)
Level 1	≥ 80% of area	< 20% of area	0% of area
Level 2	≥ 50% of area	< 50% of area	< 10% of area
Level 3	≤ 25% of area	< 75% of area	< 20% of area
Level 4	Minimal	< 75% of area	< 30% of area
Level 5	Majority outside Low zone	> 75% of area	> 30% of area

Criteria 5: Community and Environmental (societal) Impacts

- Mapped resources should seek to bolster and benefit pollution-burdened and disadvantaged communities where feasible, particularly with the goal of reducing reliance on fossil-fuel generators.
- Looks at datasets centered around seeking to map renewable resources and energy storage to bolster and benefit pollution-burdened and historically disadvantaged communities, particularly by seeking to reduce emissions and impacts of air-pollutant emitting fossil-fuel generators.
 - Proximity to fossil-fueled generators
 - Air Quality Standard Non-Attainment Areas – Ozone and PM2.5
 - Areas in or near disadvantaged communities (per SB 535 and CalEnviroScreen 4.0 dataset)
 - Areas in Inflation Reduction Act Energy Communities
- Also seek to limit impacts of new emitting resources (e.g. biomass) to these communities.
 - Criteria Alignment is reversed for biomass/gas mapping.



Above: Map show substation locations overlaid with identified disadvantaged communities and energy communities.

Criteria 6: Commercial Interest

- Busbar allocations should reflect the planned procurement indicated in LSE plans and the level of commercial interest in the CAISO and other relevant interconnection queues
- Resources are first mapped to align with in-development projects, which include resources contracted by LSEs or identified as under construction by PTOs, but are not in the IRP modeling baseline for the 26-27 TPP
- Next, resources are mapped to align with “higher confidence” indicators of commercial interest, which include:
 - Projects with an Executed IA
 - Projects with TPD allocations
 - Projects that have completed their Phase 2 interconnection cluster studies
- Additional projects undergoing Phase 1 Study with CAISO, or that have not completed any interconnection studies by their respective balancing area authority or transmission owner are weighted as “lower confidence” commercial interest

Criteria 6: Commercial Interest Criteria

Commercial Interest Criteria

The Commercial Interest Criteria aligns mapped resources with locations of commercial interest and identifies locations where misalignment occurs to ensure that exceedances are supported by strong rationale.

When mapped resources **exceed** the amount of commercial interest:

Level	Description
1	Mapped resources align with in-development resources and commercial interest with TPD or an executed IA
2	Mapped resources exceed the amount of commercial interest with TPD or an executed IA
3	Mapped resources exceed the amount of higher-confidence commercial interest
4	Mapped resources exceed the total amount of commercial interest
5	There is no commercial interest at the busbar where resources are mapped

When the mapped resources **are less than** the various amounts of commercial interest:

Level	Description
1	Mapped resources are significantly less than only the total commercial interest
2	Amount mapped is less than higher confidence commercial interest by 100 MW
3	Amount mapped is less than the amount of commercial interest with TPD or an executed IA by a to be specified amount
4	Amount mapped is significantly less than the amount of commercial interest with TPD or an executed IA by a to be specified amount
5	Amount mapped is less than the amount of identified in-development and contracted resources

Criteria 6: Commercial Interest Criteria

Commercial Interest Data Sources

Information Type	Data Sources	Notes
Interconnection Agreements	(Additions) Interconnection Queues	Same treatment as in previous TPPs and expanding scope to include neighboring BAA queues.
Interconnection Agreements	CAISO NRI	Same treatment as in previous TPPs.
Interconnection Agreements	TPD Allocations	Same treatment as in previous TPPs.
Offtake Agreements	LSE Plans	Same treatment as in previous TPPs.

- Due to FERC approval of CAISO's interconnection queue reform plan in 2024, Staff is looking to potentially incorporate a broader set of supplemental data into the commercial interest criteria in future cycles
- Other data sources that were presented in the August 2025 MAG Webinar for consideration in the 26-27 TPP, including land use permits and planned resources from out-of-state IRP plans, are being evaluated for inclusion in the 27-28 TPP

Out-of-State In-Development Resources

- The busbar mapping dashboard includes information on out-of-state resources requesting TPD allocations at specified delivery points in the CAISO system (see dashboard sheet "Out-of-CAISO_Summary")
- Staff encourages Stakeholders to review this information in the 2026-2027 TPP Busbar Mapping Dashboard and provide feedback on any updates or revisions that are needed

Criteria 7: Alignment with prior TPP portfolios

- Mapping should be relatively consistent with prior years.
 - The Base Case compared to base cases of prior years and similar sensitivity portfolios.
 - Sensitivity Portfolios compared to similar issue-focused portfolios of prior years.
- Goal is to avoid significantly reducing transmission impacts of prior years' mapping without clear reasons which are explicitly justified.

Criteria	Comparative Point(s)		Level 1	Level 2	Level 3	Level 4	Level 5
Consistency with prior TPP Portfolios	Previous TPP portfolios mapped resources	MW amounts mapped	Not less than in previous most similar TPP portfolio	Not less than (FCDS & Total) total in previous base case	Slightly less FCDS or total than in previous base case	Significantly less total than in previous base case	Level 4 but in area with approved/triggered Tx upgrade

Mapping Methodology for Modeled Gas Retirements

- Portfolios can include two types of gas retirements:
 - Policy identified retirements that are forced into RESOLVE and do not appear as RESOLVE selected resources
 - RESOLVE selected generation not retained due to RESOLVE's economic costs optimization.
- Portfolios identify only the aggregated amount of gas capacity not retained, but individual locations need to be identified for the TPP studies. In identifying which units to model as offline, staff implemented a scoring criteria based on the factors below to develop a prioritized ranking of plants to model as not retained.
- Environmental/Community Factors:
 1. Proximity to Disadvantaged communities (DACs): Units in or near a DAC receive higher score.
 2. Emission info and non-attainment zones: Units in Ozone and PM2.5 non-attainment areas receive higher score and units with higher per MWh NOx and SO2 emissions per available EIA data receive higher score.
- Performance-Related Factors:
 3. Age of plant: Older units receive higher score.
 4. Heat Rate: Plants with highest heat rate (by plant type) receive highest score/priority.
- Local Reliability factor:
 5. CAISO LCR study info: Units with lower effectiveness factors receive higher score.
- In these selections, the CPUC is seeking to identify transmission needs and impacts of potential plant retirements. The CPUC is not directing specific gas generators to retire via these studies. Gas retirement is addressed as part of overall transmission planning, however the CPUC cannot retire specific gas plants.

Updates to the Gas Capacity Not Retained Criteria

- The three impact factor categories (Environmental/Community, Performance, and Local Reliability) and their respective weights in the final scoring of existing gas plants, are consistent with the 2025-2026 TPP
- The plant age used for the Performance Factor is determined from project COD, and is not adjusted based on uprate/derate data EIA Form 860¹
- Generators located within a disadvantaged community no longer receive a blanket exemption from retirement decisions, even if they are among the youngest or most reliable units
- Generators without any local effectiveness factor data from the CAISO Local Capacity Technical Report are assigned the quartile scoring aligned with the lowest priority for non-retention
 - Generators that fall outside a local area are assigned the quartile scoring aligned with the highest priority for non-retention

Prioritizing Existing Gas Generators for Non-Retention

- For each unit type (CCGT, Peaker), scores are calculated for six impact factors across three categories
- The average score across all factors within each category is computed; a weighted sum is then taken to get the unit's total score
- Units will be identified for non-retention in descending score order, up to the total amount (MW) not retained by RESOLVE
 - Exemptions are made for the youngest quartile of generators, and the quartile of generators with the highest Local Reliability Factors
 - New for the 26-27 TPP, generators located within DACs cannot be exempted from non-retention decisions
- The volume of Li-ion batteries that could replace gas capacity on a 1-for-1 MW basis within each LCR area are taken from the 2026 CAISO Local Capacity Technical Report²



Environmental / Community Factors (50%)				
NAA	Outside			Inside
DAC	> 10 mi	< 10 mi	< 5 mi	Inside
NOx + SOx	Quartile binning – prioritize high emitters			
Performance-Related Factors (25%)				
Age	Quartile Binning – prioritize older units			
Heat Rate	Quartile binning – prioritize inefficient units			
Local Reliability Factor (25%)				
LEF ¹	Quartile Binning – prioritize low LEF units			

Gas Capacity Not Retained

Final Categorization of Gas Generators

Unit	Name	LCR Area	Capacity (MW)	Total Score	Cumulative Capacity (MW)
LAPLMA_2_UNIT_1	La Paloma Generating Plant Unit #1	CAISO System	267	3.750	267
LAPLMA_2_UNIT_2	La Paloma Generating Plant Unit #2	CAISO System	266	3.750	533
LAPLMA_2_UNIT_3	La Paloma Generating Plant Unit #3	CAISO System	266	3.750	799
LAPLMA_2_UNIT_4	La Paloma Generating Plant Unit #4	CAISO System	267	3.750	1,066
DELTA_2_PL1X4	DELTA ENERGY CENTER AGGREGATE	PGE_GBA	880	3.313	1,946
CHALK_1_UNIT	CHALK CLIFF LIMITED	CAISO System	49	3.250	1,995
GLNARM_7_UNIT_3	GLEN ARM UNIT 3	SCE_LABasin	45	3.250	2,040
...	...	...	...	...	...

- The 2026-2027 TPP RESOLVE Base Case chose not to retain 1,674 MW of gas capacity
- For the 2026-2027 TPP, La Paloma Generating Plant and Delta Energy Center will be modeled as offline for transmission system planning¹
- 880 MW of Li-ion battery will be mapped to the Greater Bay Area local area to replace gas capacity not retained

Baseline Reconciliation Methodology

- The baseline reconciliation methodology has been refined for the 2026-2027 TPP cycle to develop a robust framework for establishing a consistent, de-duplicated view of in-service resources across California
- The reconciliation process focuses on matching resources across datasets, standardizing key attributes (e.g., technology, capacity, online date), and resolving conflicts or discrepancies
- Staff crosswalk data from CAISO, E3, and CPUC sources, verifying facility-level details and addressing inconsistent naming conventions or missing fields
- The resulting dataset provides a verified baseline that supports procurement modeling, resource adequacy assessments, and identification of incremental resource need
- This clean baseline can also be re-used in downstream analyses, including cost and siting evaluations, commercial interest filters, and transmission planning input
- In collaboration with the commercial interest analysis, contracted projects are subtracted from the CAISO interconnection queue to avoid double-counting of new versus existing capacity

Data Sources for Baseline Reconciliation

Name	Description
RESOLVE/ERM Baseline	Recently calibrated across E3 and ERM, a complete list of generators and operating characteristics used in RESOLVE
RECart LSE Filings, June 2025 vintage	Utility-provided filings listing contracted capacities across generators, used for tracking LSE procurement and resource adequacy compliance
CAISO Interconnection Queue ¹	CAISO dataset mapping interconnection queue numbers to resource IDs, enabling tracking of project progression into market operations.
CAISO Master Generating Capability List ²	Official CAISO list of generating and storage resources used for resource accounting
CAISO Resource ID Mapping to Queue Number ³	CAISO dataset mapping interconnection queue numbers to resource IDs, enabling tracking of project progression into market operations
Master Resource Database Workbook (NEW) ⁴	Monthly dataset detailing generator operational status, capacities, and attributes, used for tracking resource development and commercialization, used only to identify hybrid resources

¹ <https://www.caiso.com/generation-transmission/generation/generator-interconnection>

² Accessed via CAISO Oasis site, <https://oasis.caiso.com/mrioasis/logon.do>

³ Confidential

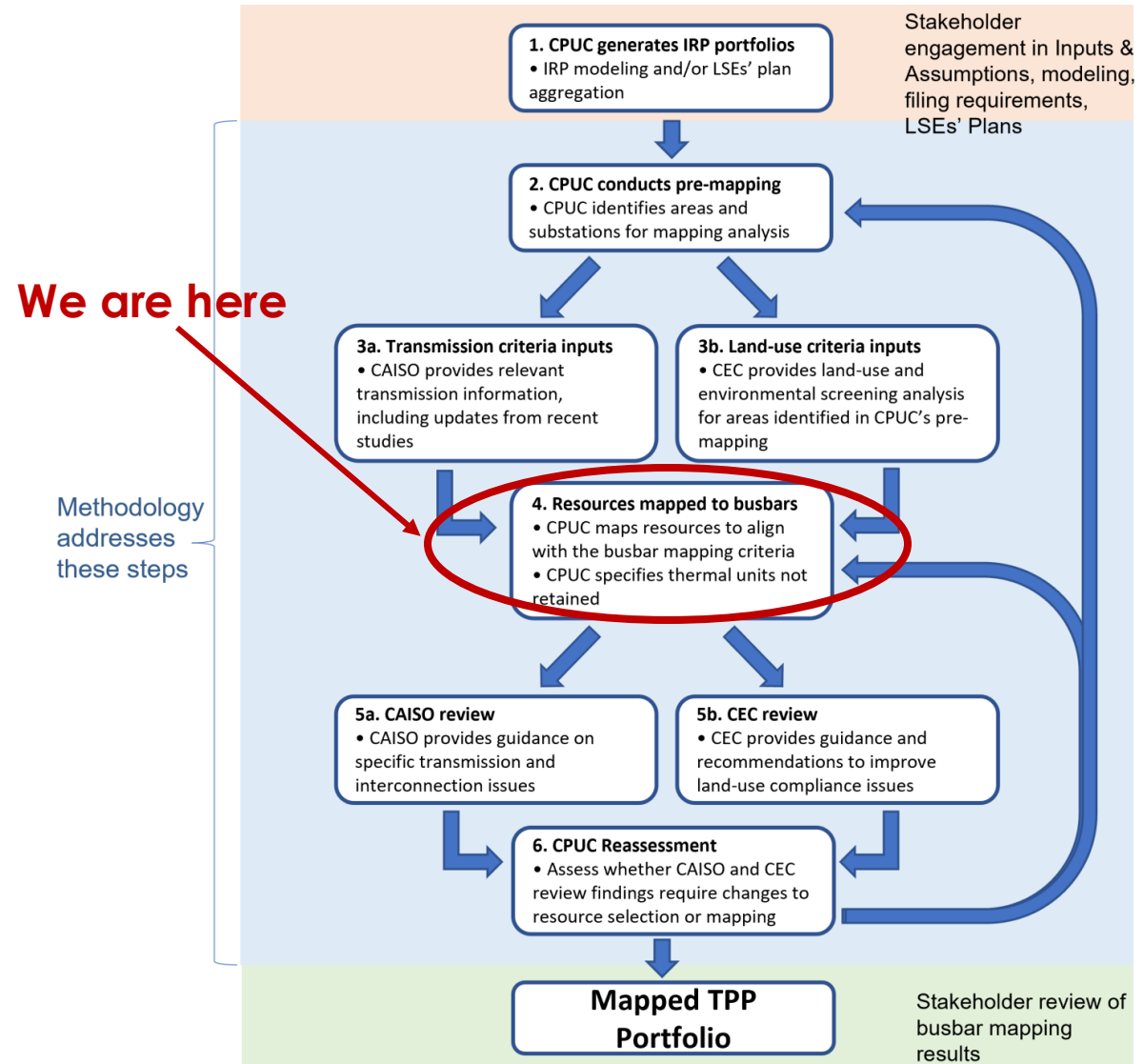
⁴ <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/resource-adequacy-homepage/resource-adequacy-compliance-materials>

In-state Land-use and Environmental Analysis (CEC Presentation)

Preliminary Mapping Results

Preliminary Mapping – Point in the mapping process

- These are first draft mapping results of the base case portfolio
 - These results are undergoing review by the busbar mapping group and typically undergo several rounds of remapping.
- During the review and additional rounds of mapping, staff will work to
 - Assess the locations with non-alignments for potential remapping,
 - Conduct further analysis for interconnection information, commercial interest, environmental impacts, and import details for out-of-state resources,
 - Optimize existing transmission and effective upgrade utilization, and
 - Incorporate stakeholder feedback.
- This section will be a high-level overview of these initial mapping results
 - Full mapping details are in the mapping dashboard at the CPUC webpage: [Assumptions for the 2026-2027 TPP](#)



Preliminary Mapping – Point in the mapping process

- The busbar mapping team has mapped so far with the goal of:
 - Faithfully mapping RESOLVE-selected resources to selected CAISO zones
 - Minimizing transmission exceedances
 - Aligning with the 25-26 TPP mapping
- Over the coming weeks, the team will focus on improving alignment across these criteria:
 - Interconnection viability
 - Land use impacts
 - Environmental (biological) impacts
 - Environmental (community) impacts
 - Commercial Interest
- Please factor this information into your comments on the most recently released dashboard.

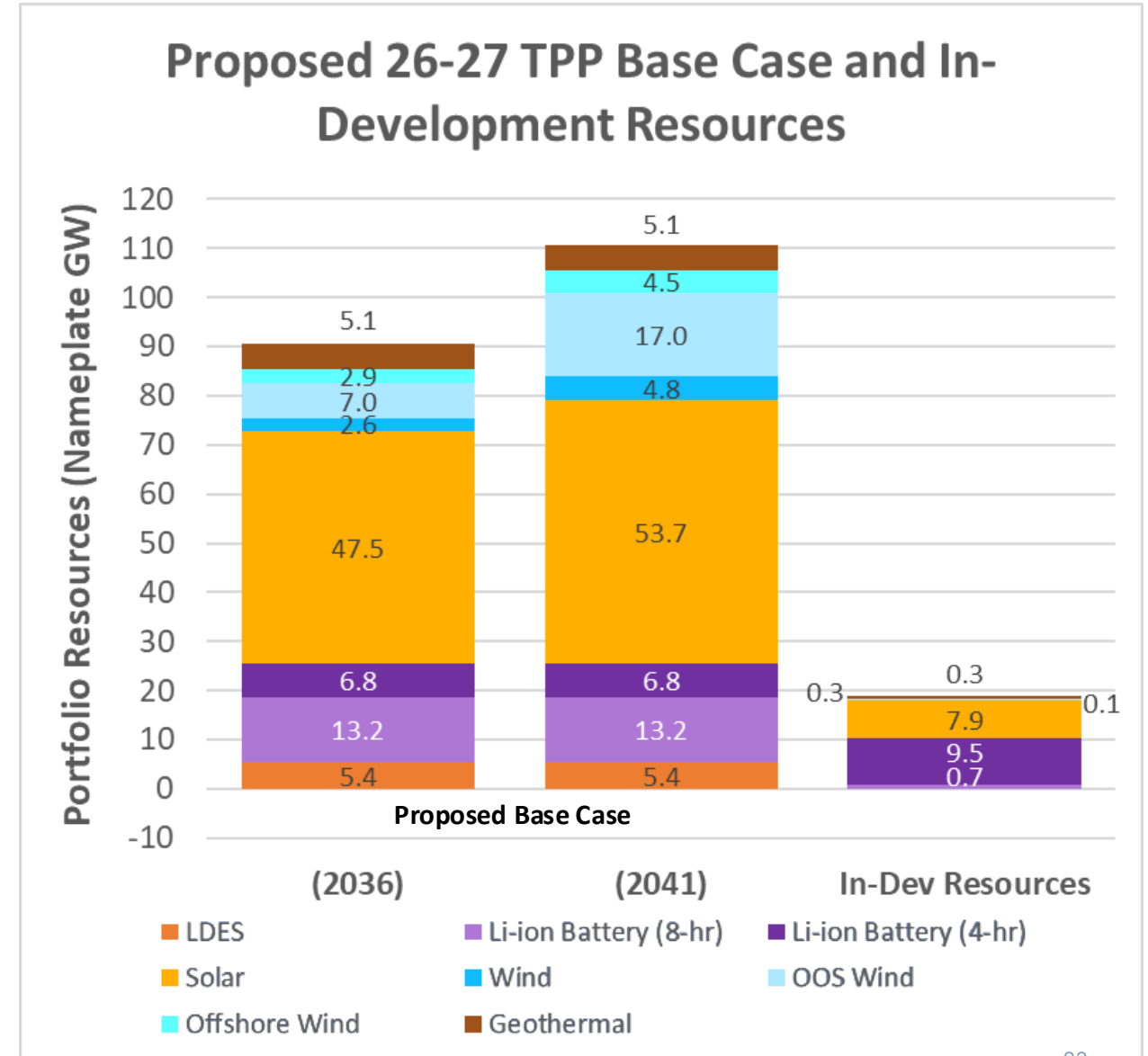
Fidelity to RESOLVE system build (amount and location)
1. System level transmission capability
7. Consistency with prior TPP portfolios
2. Substation level interconnection viability
3. Land-use implications and feasibility factors
4. Environmental (conservation and biological) impact factors
5. Environmental (societal) and community impact factors
6. Commercial & development interest

Optimized in prelim. mapping

To be optimized in coming rounds of mapping

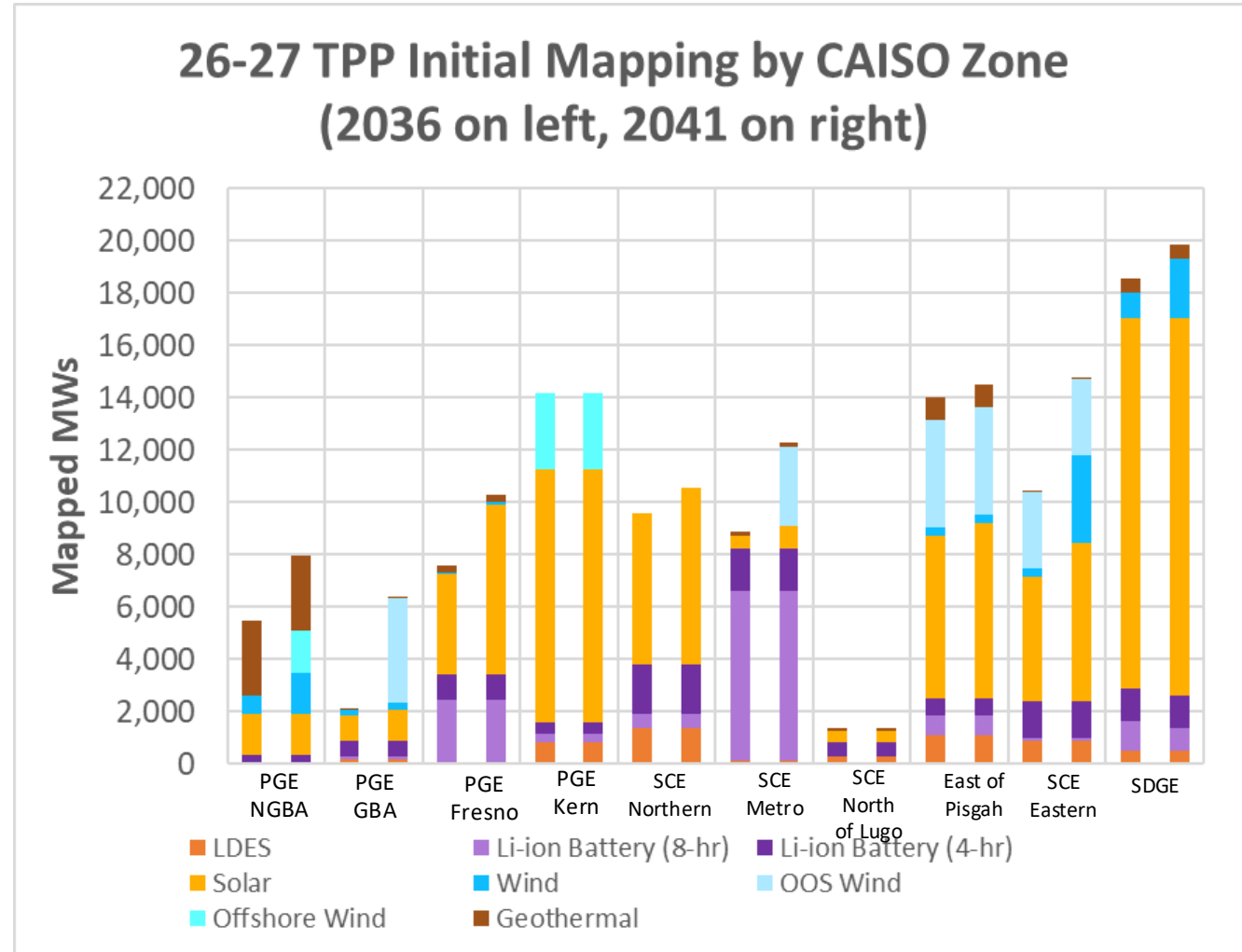
Preliminary Mapping – Baseline Reconciliation & In-development Resources

- Staff identified nearly 20 GW of “In-development resources” not in the IRP modeling baseline.
 - These resources were mapped faithfully at their interconnection points and at their reported capacities.
- Note that in this cycle there were more In-Dev 4-hr batteries than in the selected portfolio.
 - To correct this issue:
 - All in-dev 4-hr batteries were mapped
 - No selected 4-hr batteries were mapped
 - Half the delta between the in-dev 4-hr and the selected 4-hr was subtracted from selected 8-hr.
 - E.g., 100MW selected 4-hr, 120MW in-dev 4-hr, 100MW selected 8-hr --- 120MW mapped 4-hr, 90 MW mapped 8-hr.
 - This correction was consistent with what was done in the 25-26 TPP for the same issue and accounts for ~1.5 GW of the delta between the mapped and selected portfolios.



Preliminary Mapping Results Summary by CAISO study area

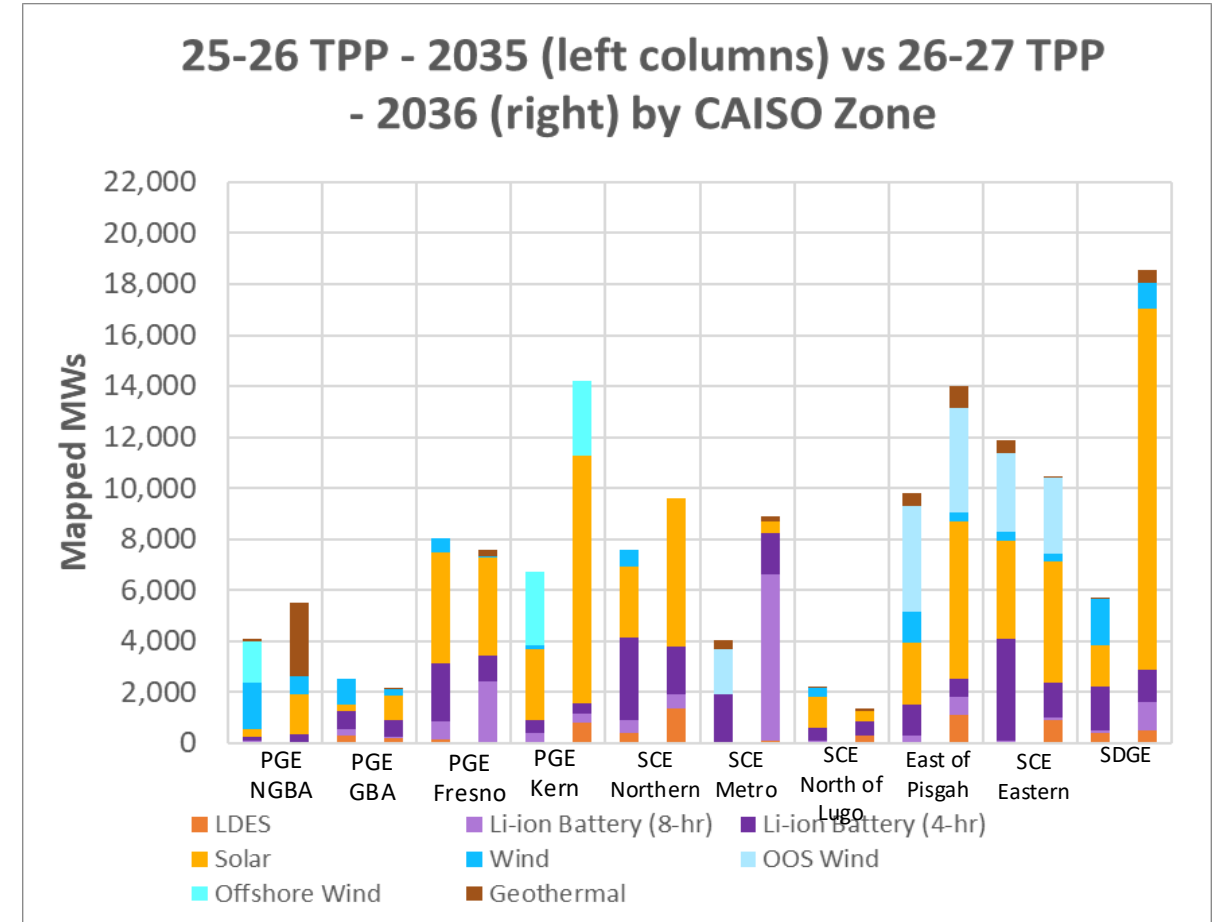
- Chart depicts the 2036 and 2041 initial mapping results by CAISO transmission study area.
- Out-of-CAISO resources are included at the substation nearest to their likely import point
 - Out-of-State wind from Wyoming and Idaho in the East of Pisgah area and in 2041 the PG&E Greater Bay area (Tesla area intertie)
 - New Mexico wind is shown in the SCE Eastern area and the SCE metro area (Lugo intertie point)
 - Imperial geothermal is shown in the SCE eastern and SD&GE areas
 - Northern Nevada and Utah geothermal are shown as interconnecting in the East of Pisgah area and SCE Metro area (reflecting potential use of IPP scheduling points down to Lugo area)
 - Additional Nevada and Oregon geothermal resources are shown as interconnecting in North of Greater Bay area



**Left Column for each area is the 2036 amounts;
Right Column is the 2041 amounts.**

Preliminary Mapping Proposed Base Case (2036): Consistency with 25-26 TPP Base Case (2035)

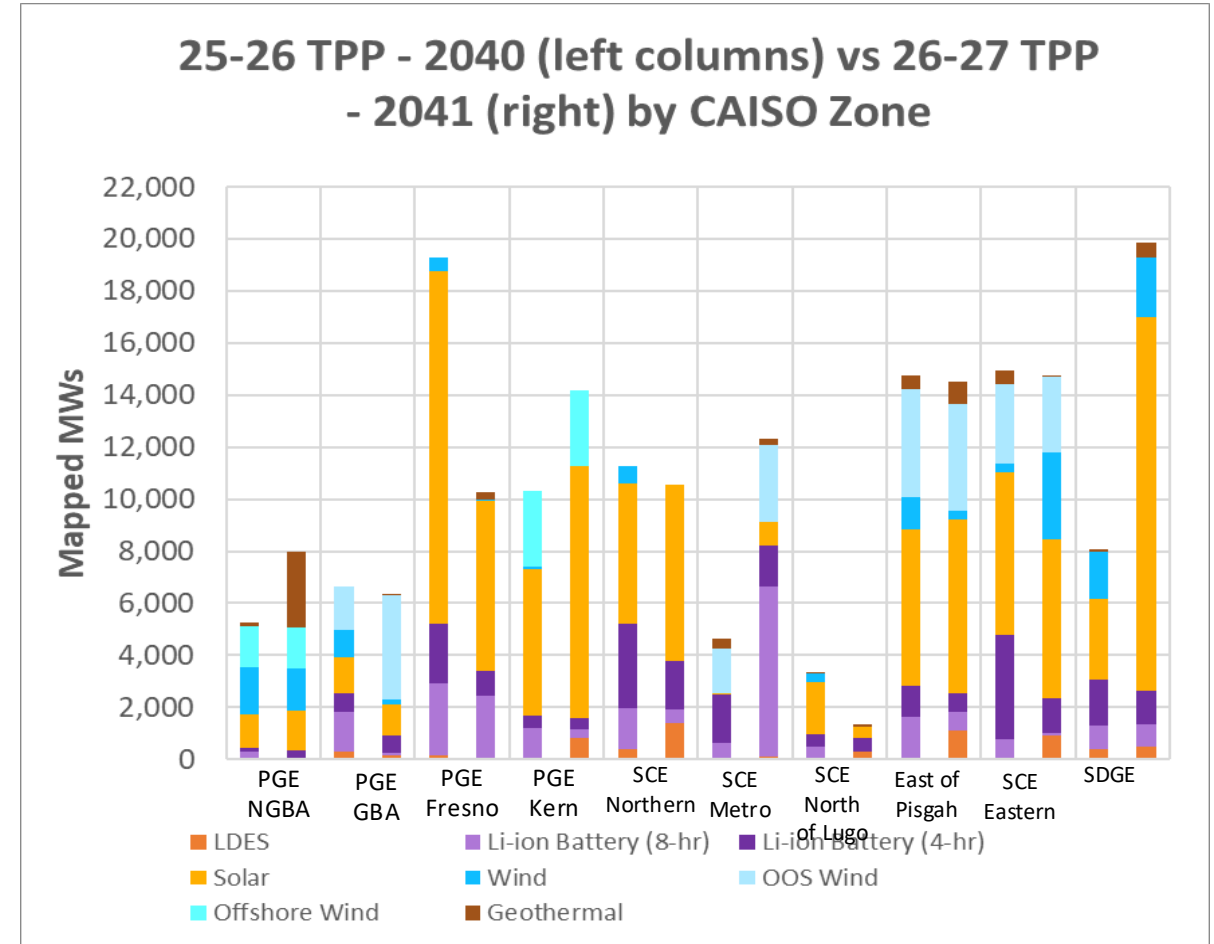
- Chart depicts the 2036 mapping results by CAISO transmission study zone compared to the 25-26 TPP (2035) mapped resources.
- 2036 portfolio size is ~92 GW, compared to ~63 GW in 25-26 TPP base case's 2035 portfolio.
- Resources mapped to certain CAISO zones between the past two cycles differ dramatically because:
 - There was a ~50% increase in mapped capacity overall.
 - Federal tax (OBBBA) and permitting policy drove different resource selection (less wind, more solar).
 - Busbar mapping staff sought to respect RESOLVE's zonal selections to a greater extent than in past cycles due to recent improvements in the model's zonal topology.



Left Column for each area is the 25-26 TPP (2035) amounts; Right Column is the initial 26-27 TPP (2036) amounts.

Preliminary Mapping Proposed Base Case (2041): Consistency with 25-26 TPP Base Case (2040)

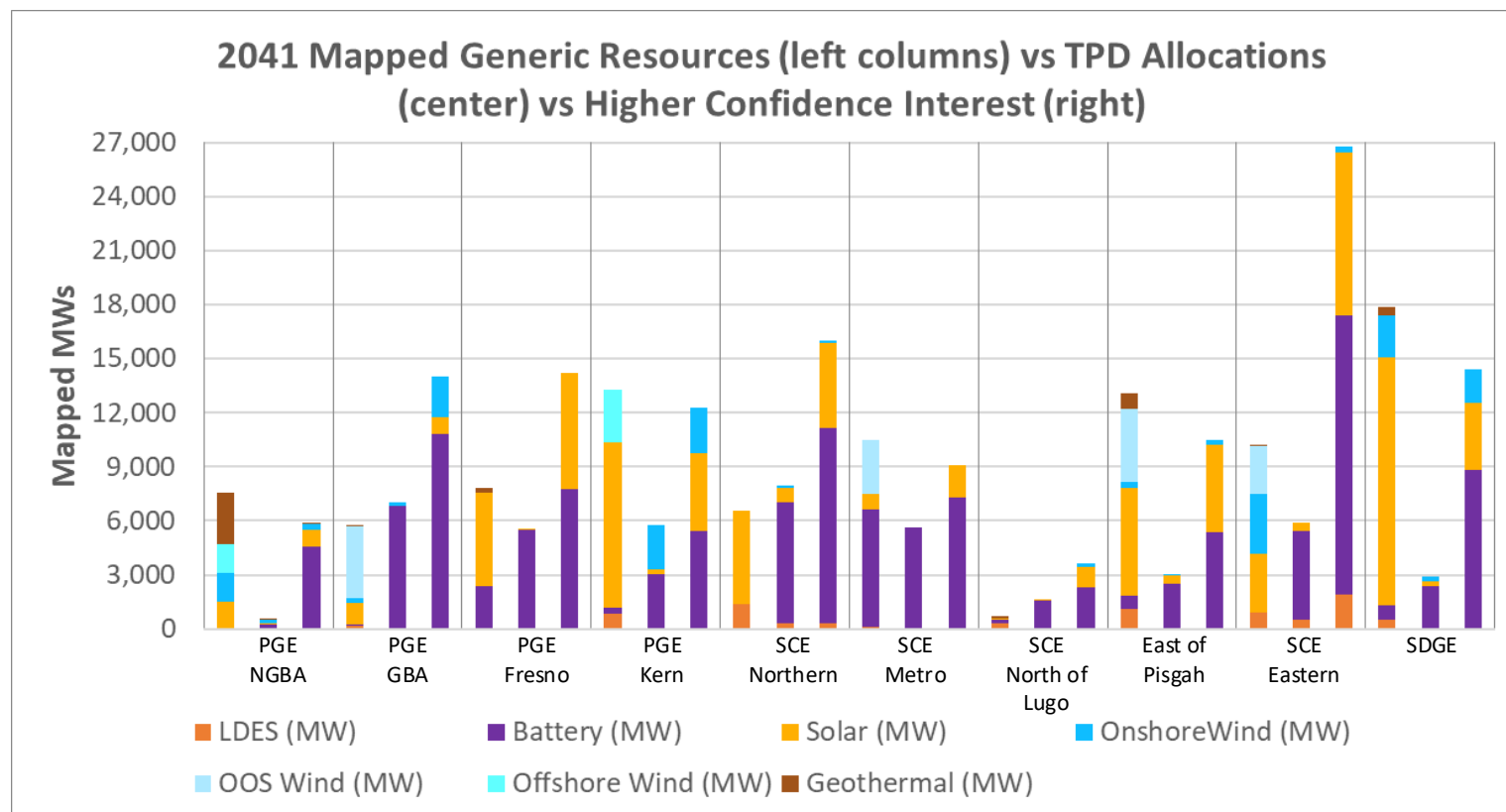
- Chart depicts the 2041 mapping results by CAISO transmission study zone compared to the 25-26 TPP (2040) mapped resources.
- 2041 portfolio size is ~112 GW, compared to ~99 GW in 25-26 TPP base case's 2039 portfolio.
- Resources mapped to certain CAISO zones between the past two cycles differ dramatically because:
 - Increase in mapped capacity overall.
 - Federal tax (OBBBA) and permitting policy drove different resource selection (less wind, more solar).
 - Busbar mapping staff sought to respect RESOLVE's zonal selections to a greater extent than in past cycles due to recent improvements in the model's zonal topology.



**Left Column for each area is the 25-26 TPP (2040) amounts;
Right Column is the initial 26-27 TPP (2041) amounts.**

Commercial Development Interest Alignment

- Chart below show the 2041 mapped generic resources by CAISO study area compared to higher confidence commercial interest (including transmission plan deliverability (TPD) allocated interest)
 - Key divergence with commercial interest in nearly all regions is large amount of storage (high confidence interest) compared to amount in the portfolio and mapped.
 - Whereas there is less wind and geothermal in the interconnection queues than in the portfolio.



3. Land-Use and Env. Impacts Alignment – Solar Resources

- Chart depicts the 2041 mapping results for utility-scale solar by CAISO transmission study zone alignment with the Core Land-use Screen and other land-use criteria.
 - For OOS resources only the Core Land-Use Screen is available using the WECC dataset rather than the Core Screen, thus total numbers in certain areas may not add up to the full amount mapped.
 - Additionally, amounts include baseline resources included in calculations.

2041 Portfolio Mapping	Core Land-use Screen Criteria Alignment				Parcelization Criteria Alignment - Highest Flag				Cropland Index Criteria Alignment - Highest Flag				Overdrafted Groundwater Basin		Fire Threat Criteria Alignment - Highest Flag			
	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	In	Out	1 or 2	3	4	5
Solar																		
PG&E North of Greater Bay Study Area	755	-	-	-	135	470	150	-	755	-	-	-	-	1,528	755	-	-	-
PG&E Greater Bay Study Area	90	130	-	-	90	-	-	130	220	-	-	-	40	1,160	50	130	-	40
PG&E Fresno Study Area	4,471	-	-	-	3,991	480	-	-	4,471	-	-	-	5,884	480	4,070	401	-	-
PG&E Kern Study Area	6,450	1,425	150	-	6,725	1,300	-	-	7,875	-	-	150	9,160	625	7,625	250	-	150
SCE Northern Area	2,690	3,810	192	-	439	362	1,256	4,635	6,500	-	192	-	312	6,520	5,465	1,035	-	192
SCE Metro Study Area	-	-	-	886	-	-	-	886	886	-	-	-	-	886	886	-	-	-
SCE North of Lugo Study Area	138	-	274	-	-	-	-	412	412	-	-	-	32	380	412	-	-	-
East of Pisgah Study Area	4,281	2,052	-	600	-	-	-	-	-	-	-	-	-	6,933	-	-	-	-
SCE Eastern Study Area	4,330	-	-	1,510	1,135	300	-	1,510	1,435	-	1,510	-	-	6,090	2,645	-	-	300
SDG&E Study Area	11,390	80	-	2,930	154	60	90	20	304	20	-	-	-	14,400	187	-	-	137
Total:	34,595	7,497	616	5,926	12,669	2,972	1,496	7,593	22,858	20	1,702	150	15,428	39,001	22,095	1,816	-	819

- Stakeholders should note a) at this stage busbar mapping has not yet been optimized for land use and environmental criteria b) CEC will be providing updated metrics for the PD ruling.*

4. Environmental Impacts Alignment – Solar Resources

- Chart depicts the 2041 mapping results by CAISO transmission study zone alignment with the various Environmental (Conservation and Biodiversity) criteria.

2041 Portfolio Mapping	ACE Connectivity Criteria Alignment - Highest Flag				ACE Biodiversity Criteria Alignment - Highest Flag				ACE Irreplaceability Criteria Alignment - Highest Flag				All ACE Criteria Alignment - Highest Flag				Intactness Criteria Alignment - Highest Flag				Wetlands Criteria Alignment - Highest Flag			
	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5
Solar																								
PG&E North of Greater Bay Stud	755	-	-	-	755	-	-	-	755	-	-	-	755	-	-	-	755	-	-	-	755	-	-	-
PG&E Greater Bay Study Area	220	-	-	-	220	-	-	-	220	-	-	-	90	130	-	-	220	-	-	-	220	-	-	-
PG&E Fresno Study Area	4,471	-	-	-	4,471	-	-	-	4,471	-	-	-	4,115	356	-	-	4,471	-	-	-	4,471	-	-	-
PG&E Kern Study Area	7,775	250	-	-	8,025	-	-	-	8,025	-	-	-	6,065	1,960	-	-	8,025	-	-	-	8,025	-	-	-
SCE Northern Area	6,692	-	-	-	6,692	-	-	-	6,692	-	-	-	6,500	192	-	-	6,692	-	-	-	6,692	-	-	-
SCE Metro Study Area	-	-	486	400	-	-	486	400	-	-	-	886	-	-	-	886	-	-	486	400	-	-	486	400
SCE North of Lugo Study Area	138	-	274	-	412	-	-	-	412	-	-	-	138	-	-	274	412	-	-	-	412	-	-	-
East of Pisgah Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCE Eastern Study Area	1,435	-	1,510	-	1,435	-	-	1,510	1,435	-	1,510	-	1,435	-	-	1,510	1,435	1,510	-	-	1,435	1,510	-	-
SDG&E Study Area	324	-	-	-	324	-	-	-	264	60	-	-	174	150	-	-	324	-	-	-	324	-	-	-
Total:	21,810	250	2,270	400	22,334	-	486	1,910	22,274	60	1,510	886	19,272	2,788	-	2,670	22,334	1,510	486	400	22,334	1,510	486	400

- Stakeholders should note a) at this stage busbar mapping has not yet been optimized for land use and environmental criteria b) CEC will be providing updated metrics for the PD ruling.*

Land-Use and Env. Impacts Alignment – Wind Resources

- Chart depicts the 2041 mapping results by CAISO transmission study zone alignment with the various Land-use and Environmental Impacts criteria.
 - For OOS resources only the Core Land-Use Screen is available (no data for wind mapped to Baja California, MX).
 - Additionally, Parcelization and Cropland criteria are not applied for wind or geothermal.

- Further focus on land use/environmental impacts on for potential mapping adjustments:

- PG&E, especially in North of Greater Bay Area and Kern (Wind)
- SCE, especially SCE Metro and SCE Eastern (Solar)

- Stakeholders should note*
 - a) at this stage busbar mapping has not yet been optimized for land use and environmental criteria*
 - a b) CEC will be providing updated metrics for the PD ruling.*

2041 Portfolio Mapping Onshore Wind	Core Land-use Screen Criteria Alignment				Fire Threat Criteria Alignment - Highest Flag				Intactness Criteria Alignment - Highest Flag				Wetlands Criteria Alignment - Highest Flag			
	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5
PG&E North of Greater Bay Stud	-	110	95	270	-	-	-	475	110	95	-	270	205	-	-	270
PG&E Greater Bay Study Area	(267)	-	(86)	-	(91)	-	-	(262)	(353)	-	-	-	(353)	-	-	-
PG&E Fresno Study Area	-	-	-	9	-	-	-	9	-	-	9	-	9	-	-	-
PG&E Kern Study Area	-	-	-	95	-	-	-	95	-	-	-	95	-	95	-	-
SCE Northern Area	83	-	-	-	83	-	-	-	83	-	-	-	83	-	-	-
SCE Metro Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCE North of Lugo Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East of Pisgah Study Area	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCE Eastern Study Area	-	173	-	-	-	173	-	-	173	-	-	-	173	-	-	-
SDG&E Study Area	-	180	280	-	-	-	-	460	460	-	-	-	460	-	-	-
Total:	136	463	289	374	(8)	173	-	777	473	95	9	365	576	95	-	270

2041 Portfolio Mapping Onshore Wind	ACE Connectivity Criteria Alignment - Highest Flag				ACE Biodiversity Criteria Alignment - Highest Flag				ACE Irreplaceability Criteria Alignment - Highest Flag				All ACE Criteria Alignment - Highest Flag			
	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5	1 or 2	3	4	5
PG&E North of Greater Bay Stud	110	95	-	270	205	-	-	270	205	-	-	270	110	95	-	270
PG&E Greater Bay Study Area	(91)	(81)	(182)	-	(348)	(5)	-	-	(91)	(262)	-	-	(91)	-	-	(262)
PG&E Fresno Study Area	-	-	-	9	9	-	-	-	9	-	-	-	-	-	-	9
PG&E Kern Study Area	-	-	-	95	-	95	-	-	-	95	-	-	-	-	-	95
SCE Northern Area	83	-	-	-	83	-	-	-	83	-	-	-	83	-	-	-
SCE Metro Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCE North of Lugo Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East of Pisgah Study Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCE Eastern Study Area	173	-	-	-	173	-	-	-	173	-	-	-	173	-	-	-
SDG&E Study Area	460	-	-	-	460	-	-	-	460	-	-	-	180	280	-	-
Total:	735	14	(182)	374	581	90	-	270	839	(167)	-	270	455	375	-	112

Transmission Constraint Exceedances Impacts (2036)

- Chart depicts the CAISO Tx constraint exceedances calculated from the 2036 initial mapping.
 - 14 exceedances in total
- For comparison, RESOLVE modelling triggered 5 new partial transmission upgrades.
- Key areas of exceedances:
 - PGE Fresno
 - Key out-of-CAISO import areas: SCE Eastern area connection to IID and North of Lugo area
- Several exceedances triggered with in-development resources.
- Does not include out-of-CAISO transmission that would be needed to bring resources to existing CAISO intertie points.

Recommended Base Case (2036) Tx Constraint Exceedances		Constraint's White Paper		FCDS Resources Mapped (In-Dev & Generic)**				EODS Resources Mapped**		Calculated Largest On-peak Exceedance	Calculated Off-peak Exceedance	FCDS Upgrade Info		EODS Upgrade Info (If Different)	
CAISO Zone	Constraint Name	On-Peak Capability (MW)	Off-Peak Capability (MW)	Onshore & Offshore Wind (MW)	Solar (MW)	Storage (MW)	Biomass & Geothermal (MW)	Onshore Wind (MW)	Solar (MW)			Capacity Increase (MW)	Estimated Cost (millions)	Capacity Increase (MW)	Estimated Cost (millions)
SCE North of Lugo Area	Control to Inyokern area constraint	-	120	-	-	-	117	-	-	(117)	None	186	\$ 329	N/A	N/A
SCE North of Lugo Area	South of Kramer Area Constraint	256	1,190	-	70	435	117	-	239	(104)	None	200	N/A	N/A	N/A
SCE Eastern Area	Devers-Red Bluff Constraint	6,133	7,328	4,521	5,680	2,891	6	-	3,823	(913)	None	532	N/A	N/A	N/A
SCE Eastern Area	Constraint	-	392	-	300	460	30	60	292	(529)	None	600	\$ 1,182	N/A	N/A
East of Pisgah Area	Lugo - Victorville area constraint	10,105	12,605	8,942	10,606	6,221	868	-	10,189	(5,430)	(3,971)	6,800	\$ 2,165	N/A	N/A
PG&E North of Greater Bay Area	Collinsville-Tesla 500 kV Line	3,379	7,706	280	370	724	2,901	712	2,133	(442)	None	8,645	\$ 2,852	N/A	N/A
PG&E North of Greater Bay Area	Carberry-Round Mountain 230kV Line	15	15	-	-	-	40	-	-	(25)	(25)	26	\$ 180	N/A	N/A
PG&E Greater Bay Area	Windmaster-Delta pumps 230 kV line	546	3,673	230	-	614	54	225	595	(237)	None	6,034	\$ 417	N/A	N/A
PG&E Greater Bay Area	Birds Landing-Contra Costa 230kV Line	656	1,176	230	-	398	403	446	602	(260)	None	1,766	\$ 700	N/A	N/A
PG&E Fresno Area	Gates 500/230kV TB #12	5,406	3,581	-	6,495	4,171	21	69	5,656	(1,312)	(1,897)	14,825	\$ 35	N/A	N/A
PG&E Fresno Area	Gates 500/230kV TB #11	5,337	5,027	-	6,789	4,286	112	69	5,533	(1,738)	(563)	10,038	\$ -	N/A	N/A
PG&E Fresno Area	Chowchilla-Le grand 115kV Line	-	158	-	300	508	3	-	20	(556)	None	1,211	\$ 550	N/A	N/A
PG&E Fresno Area	Borden-Storey #1 230kV line	412	780	-	280	791	1	-	859	(421)	None	1,247	\$ 50	N/A	N/A
PG&E Fresno Area	Mustang-Henrietta 230 kV line	5,581	5,617	2,924	5,322	1,925	-	-	4,712	(476)	(3,309)	2,479	\$ -	N/A	N/A

Transmission Constraint Exceedances Impacts (2041)

- Chart depicts the Tx constraint exceedances calculated from the 2041 initial mapping.
 - 20 exceedances in total
- For comparison, RESOLVE modeling triggered 9 new full or partial transmission upgrades
- 2041 mapping increases the exceedances of the 2036 results and expands the number exceedances particularly in the PG&E Fresno area.
- Exceedances will be further assessed by working group.
 - Small exceedances may not result in upgrades or have resources that likely can be remapped.

Base Case (2041) Tx Constraint Exceedances		Constraint's White Paper		FCDS Resources Mapped (In-Dev & Generic)**				EODS Resources Mapped**		Calculated Largest On-peak Exceedance	Calculated Off-peak Exceedance	FCDS Upgrade Info	
CAISO Zone	Constraint Name	On-Peak Capability (MW)	Off-Peak Capability (MW)	Onshore & Offshore Wind (MW)	Solar (MW)	Storage (MW)	Biomass & Geothermal (MW)	Onshore Wind (MW)	Solar (MW)			Capability Increase (MW)	Estimated Cost (millions)
SCE Northern Area	Antelope-Vincent Constraint	6,149	8,920	-	5,721	4,065	-	-	1,290	(460)	None	1,500	\$ 13
	North of Magunden Constraint	876	1,527	-	754	635	-	-	68	(45)	None	500	\$ 1,253
SCE North of Lugo Area	Control to Inyokern area constraint	-	120	-	-	-	117	-	-	(117)	None	186	\$ 329
	South of Kramer Area	256	1,190	-	70	435	117	-	239	(104)	None	200	N/A
SCE Eastern Area	Devers-Red Bluff Constraint	6,133	7,328	7,521	5,680	2,891	-	-	3,823	(1,433)	(915)	532	N/A
	Eagle Mountain	-	392	-	300	460	30	60	292	(529)	None	600	\$ 1,182
	Serrano-Alberhill-Valley Constraint	6,651	10,182	7,841	1,195	4,566	37	60	5,330	(1,208)	None	1,522	N/A
East of Pisgah Area	Lugo - Victorville area constraint	10,105	12,605	11,942	11,106	6,221	868	-	10,189	(6,340)	(5,676)	6,800	\$ 2,165
PG&E North of Greater Bay Area	Collinsville-Tesla 500 kV Line	3,379	7,706	2,767	600	724	2,901	712	2,133	(2,282)	None	8,645	\$ 2,852
	Carberry-Round Mountain 230kV Line	15	15	-	-	-	40	-	-	(25)	(25)	26	\$ 180
	Bellota-Weber 230kV line	1,661	2,539	20	1,956	1,135	41	-	1,822	(340)	None	460	\$ 400
PG&E Greater Bay Area	Windmaster-Delta pumps 230 kV line	546	3,673	230	-	614	54	225	595	(237)	None	6,034	\$ 417
	Tesla-Bellota 230 kV line	3,154	4,254	4,250	46	861	96	225	1,274	(614)	None	300	\$ -
	Birds Landing- Contra Costa 230kV Line	656	1,176	230	-	398	403	446	602	(260)	None	1,766	\$ 700
PG&E Fresno Area	Gates 500/230kV TB #12	5,406	3,581	-	8,085	4,173	21	69	5,656	(2,442)	(3,151)	14,825	\$ 35
	Gates 500/230kV TB #11	5,337	5,027	-	8,819	4,288	112	69	5,533	(3,181)	(2,164)	10,038	\$ -
	Tranquility-Helm 230kV Line	2,921	2,777	-	3,146	1,917	23	-	1,345	(294)	None	2,274	\$ 1,500
	Chowchilla-Le grand 115kV Line	-	158	-	400	508	3	-	20	(571)	None	1,211	\$ 550
	Borden-Storey #1 230kV line	412	780	-	1,660	791	1	-	859	(1,163)	(419)	1,247	\$ 50
	Mustang-Henrietta 230 kV line	5,581	5,617	2,924	5,322	1,925	-	-	4,712	(476)	(3,309)	2,479	\$ -

Study area focus – North of GB and GB Areas

- Summary of initial mapping to the two Northern California study areas
 - Includes comparison of 25-26 TPP to current 26-27 TPP
- Key mapping issues working group continues to assess:
 - Transmission impacts of offshore wind to the broader study areas and multiple transmission exceedances with overlapping constraints
 - Wind resources land-use implications
 - Wyoming wind mapped as interconnecting in 2041 to the Tesla area based on CAISO's 20-year Transmission Outlook's new transmission line potential solution
 - Geothermal mapping contributing to exceedance

Previous Base Case Comparison				
	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
PG&E North of Greater Bay				
Geothermal (MW)	2,890.0	2,890.0	98.0	98.0
Biomass (MW)	-	-	95.6	95.6
OnshoreWind (MW)	711.7	1,591.7	1,689.7	1,689.7
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	-	1,607.0	-	-
Solar (MW)	1,545.2	1,545.2	296.9	1,251.9
Battery-4hr (MW)	362.7	362.7	-	-
Battery-8hr (MW)	-	-	95.0	305.0
LDES (MW)	-	-	-	-
Zone Total (MW)	5,510	7,997	2,275	3,440
	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
PG&E Greater Bay				
Geothermal (MW)	30.0	30.0	-	-
Biomass (MW)	-	-	2.1	2.1
OnshoreWind (MW)	230.0	230.0	440.3	440.3
OOS Wind (MW)	-	4,000.0	-	-
Offshore Wind (MW)	-	-	-	-
Solar (MW)	980.5	1,210.5	168.3	920.3
Battery-4hr (MW)	628.0	628.0	-	-
Battery-8hr (MW)	90.7	95.7	236.1	1,058.3
LDES (MW)	170.0	170.0	310.0	310.0
Zone Total (MW)	2,129	6,364	1,157	2,731

Study area focus – PG&E Fresno & Kern Areas

- Summary of initial mapping to the two Central California study areas
 - Includes comparison to 25-26 TPP
- Key mapping issues working group continues to assess:
 - Multiple transmission exceedances and optimal remapping or transmission upgrade solutions
 - Transmission impacts of mapped central coast offshore wind
 - Commercial interest alignment for amount of solar

Previous Base Case Comparison				
PG&E Fresno	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
Geothermal (MW)	270.0	270.0	-	-
Biomass (MW)	-	-	6.0	6.0
Onshore Wind (MW)	69.3	69.3	300.0	300.0
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	-	-	-	-
Solar (MW)	3,881.4	6,541.4	2,180.8	10,190.8
Battery-4hr (MW)	979.6	979.6	-	-
Battery-8hr (MW)	2,436.0	2,436.0	615.0	2,375.0
LDES (MW)	-	-	140.0	140.0
Zone Total (MW)	7,636	10,296	3,242	13,012
PG&E Kern	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
Geothermal (MW)	-	-	-	-
Biomass (MW)	-	-	9.3	9.3
Onshore Wind (MW)	-	-	-	-
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	2,924.0	2,924.0	-	-
Solar (MW)	9,708.7	9,708.7	1,654.8	4,349.8
Battery-4hr (MW)	398.1	398.1	-	-
Battery-8hr (MW)	355.0	355.0	360.0	1,090.0
LDES (MW)	820.0	820.0	-	-
Zone Total (MW)	14,206	14,206	2,024	5,449

Study area focus – SCE Northern & Metro Areas

- Summary of initial mapping to the SCE Northern and Metro study areas
 - Includes comparison to 25-26 TPP.
- Key mapping considerations working group continues to assess:
 - High volume of 8-hr battery added (6.5 GW) mapped to Metro area
 - 3.4 GW of generic FCDS solar to Whirlwind substations

Previous Base Case Comparison				
	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
SCE Northern Area				
Geothermal (MW)	-	-	-	-
Biomass (MW)	-	-	-	-
Onshore Wind (MW)	-	-	200.0	200.0
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	-	-	-	-
Solar (MW)	5,840.0	6,770.0	-	150.0
Battery-4hr (MW)	1,884.0	1,884.0	-	-
Battery-8hr (MW)	523.0	523.0	-	250.0
LDES (MW)	1,380.0	1,380.0	-	-
Zone Total (MW)	9,627	10,557	200	600
SCE Metro				
Geothermal (MW)	203.0	203.0	23.0	23.0
Biomass (MW)	-	-	-	-
Onshore Wind (MW)	-	-	-	-
OOS Wind (MW)	-	3,000.0	1,750.0	1,750.0
Offshore Wind (MW)	-	-	-	-
Solar (MW)	490.6	890.6	-	-
Battery-4hr (MW)	1,589.0	1,589.0	-	-
Battery-8hr (MW)	6,526.5	6,526.5	-	600.0
LDES (MW)	100.0	100.0	-	-
Zone Total (MW)	8,909	12,309	1,773	2,373

Study area focus – North of Lugo & East of Pisgah Areas

- Summary of initial mapping to the North of Lugo and East of Pisgah areas
 - Includes comparison to 25-26 TPP
- Key mapping issues working group continues to assess:
 - Land-use implications in both areas for solar
 - Transmission exceedances in both areas
 - Mapping CAISO intertie locations for Central and Northern Nevada geothermal
 - 3 GW of Wyoming wind mapped as interconnecting to the Eldorado or Harry Allen
 - 1.1 GW of Idaho wind mapped to Harry Allen
 - Increase in solar and storage in EOP

Previous Base Case Comparison				
	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
SCE North of Lugo				
Geothermal (MW)	116.8	116.8	-	-
Biomass (MW)	-	-	1.5	1.5
Onshore Wind (MW)	-	-	362.2	362.2
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	-	-	-	-
Solar (MW)	421.8	421.8	618.0	1,322.0
Battery-4hr (MW)	542.0	542.0	-	-
Battery-8hr (MW)	6.0	6.0	97.0	427.0
LDES (MW)	286.0	286.0	-	-
Zone Total (MW)	1,373	1,373	1,079	2,113
East of Pisgah				
Geothermal (MW)	868.0	868.0	517.3	517.3
Biomass (MW)	-	-	-	-
Onshore Wind (MW)	321.0	321.0	918.5	918.5
OOS Wind (MW)	4,100.0	4,100.0	4,100.0	4,100.0
Offshore Wind (MW)	-	-	-	-
Solar (MW)	6,198.0	6,698.0	1,087.0	3,887.0
Battery-4hr (MW)	685.0	685.0	-	-
Battery-8hr (MW)	734.5	734.5	260.0	1,295.0
LDES (MW)	1,100.0	1,100.0	-	-
Zone Total (MW)	14,007	14,507	6,883	10,718

Study area focus – SCE Eastern

- Summary of initial mapping to the SCE Eastern area
 - Includes comparison to 25-26 TPP.
- Key mapping issues working group continues to assess:
 - Land-use implications in SCE Eastern area for solar
 - Commercial interest alignment for large amount of higher confidence storage and solar
 - Transmission exceedances in both areas
 - 3 GW of New Mexico wind mapped to the Palo Verde intertie

Previous Base Case Comparison				
SCE Eastern	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
Geothermal (MW)	30.0	37.0	500.0	500.0
Biomass (MW)	-	-	-	-
Onshore Wind (MW)	323.0	3,323.0	267.5	267.5
OOS Wind (MW)	2,936.0	2,936.0	1,414.0	1,414.0
Offshore Wind (MW)	-	-	-	-
Solar (MW)	4,760.0	6,090.0	-	2,380.0
Battery-4hr (MW)	1,370.0	1,370.0	-	-
Battery-8hr (MW)	100.0	100.0	-	580.0
LDES (MW)	900.0	900.0	-	-
Zone Total (MW)	10,419	14,756	2,182	5,142

Study area focus – SDG&E

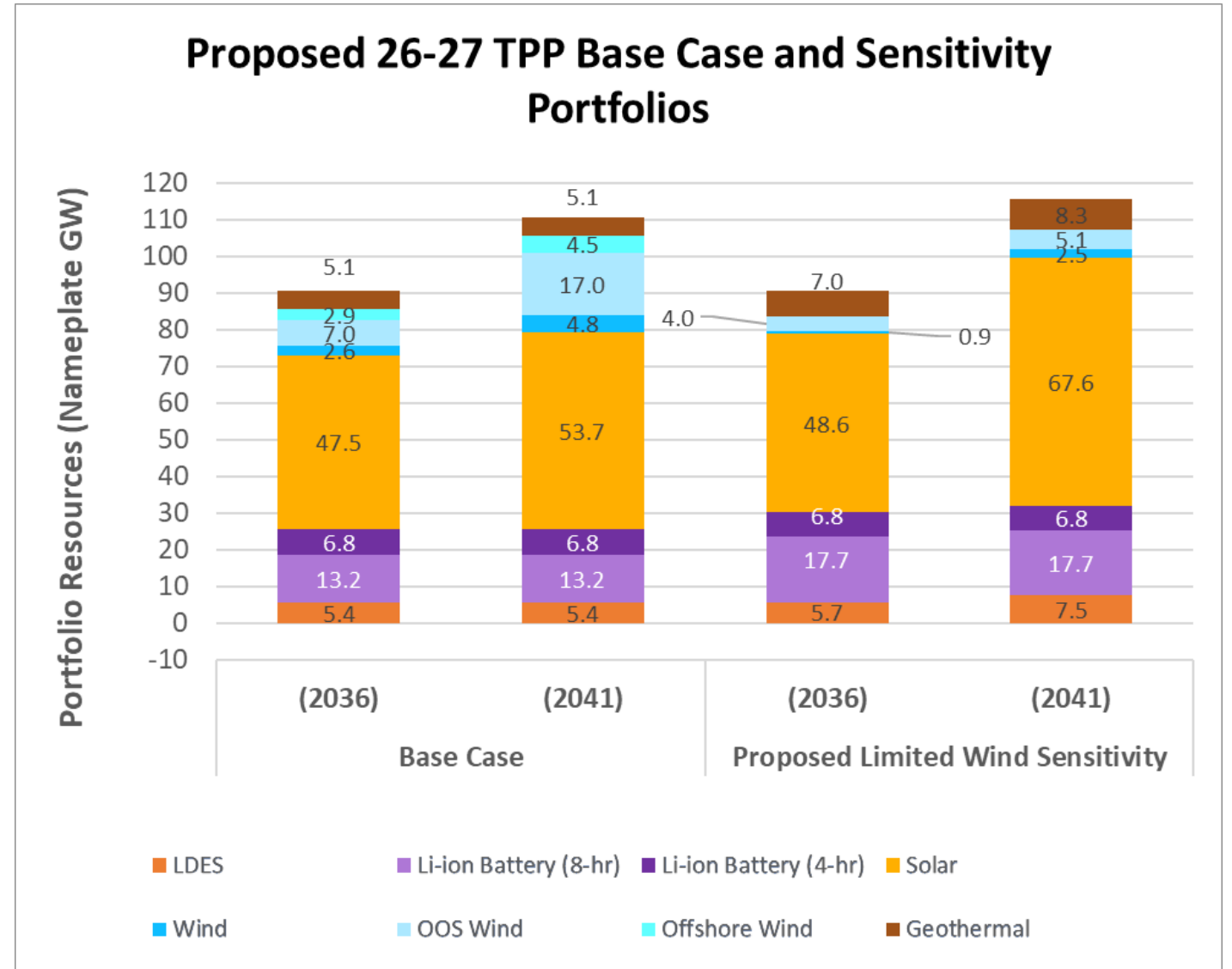
- Summary of initial mapping to SDG&E area
 - Includes comparison to 25-26 TPP.
- Key mapping issues working group continues to assess:
 - Land-use implications of newly selected > 13.5 GW of solar to SDG&E Arizona (Hassayampa, Hoodoo Wash, North Gila)
 - Interconnection implications of newly selected > 13.5 GW of solar to SDG&E Arizona

Previous Base Case Comparison				
SDG&E	Total Res (2036)	Total Res (2041)	25-26 TPP (2035)	25-26 TPP (2040)
Geothermal (MW)	530.0	530.0	100.0	100.0
Biomass (MW)	-	-	-	-
Onshore Wind (MW)	990.0	2,290.0	1,515.8	1,515.8
OOS Wind (MW)	-	-	-	-
Offshore Wind (MW)	-	-	-	-
Solar (MW)	14,170.0	14,400.0	393.6	1,931.6
Battery-4hr (MW)	1,251.2	1,251.2	-	-
Battery-8hr (MW)	1,114.4	868.7	50.0	780.0
LDES (MW)	500.0	500.0	-	-
Zone Total (MW)	18,556	19,840	2,059	4,327

More than 13.5 additional GW of solar were selected in SDG&E in the 26-27 portfolio

Mapping of the Proposed Sensitivity Portfolio

- Released mapping results are only for the base case portfolio
- Staff will also be working to map the proposed sensitivity portfolio, which includes additional offshore wind, geothermal, and long-duration storage resources.
 - Mapping is guided by base case mapping where resources align.
 - Same datasets and analysis will be applied.
 - Further analysis will be needed to identify additional locations for the additional long-duration energy storage and geothermal resources.



Next Steps

- Busbar working group staff will continue to conduct mapping:
 - Use additional rounds of mapping to improve mapping alignment and incorporate additional data and feedback.
 - Conduct full mapping of the proposed sensitivity case.
- Comment review from the September 30th Ruling is still in progress and may affect the portfolios
- IRP staff are still in process of incorporating stakeholder feedback into the mapping efforts.
- Stakeholders have the opportunity to provide written comments on the initial mapping results by November 21st, 2025 in response to the November 3rd, 2025 Ruling.
- Webinar slides will be available at the [Assumptions for the 2026-2027 TPP](#) webpage.
- The webinar is being recorded; the recording and the webinar's Q&A will be posted online to the same webpage.

Thank You!

Appendix

Criteria 2: Estimation of Substation Upgrade Costs

- For each PTO, voltage, and upgrade scope, the per-unit cost guides are used to estimate the cost of interconnection
- Upgrades increase in complexity and cost, depending on the upgrade feasibility indicated in PTO feedback

Upgrade Scope	Transformer	Breaker	Switches	Infrastructure	Line Stringing	Miles of Line
Minimal	n/a	Breaker and a half	Disconnect switch	n/a	n/a	n/a
Moderate	Single step-down transformer	Breaker and a half	Disconnect switch	n/a	New line, single-circuit, lattice tower	2
High	Single step-down transformer	Breaker and a half	Disconnect switch	Bus expansion within fence	New line, single-circuit, lattice tower	5
New Substation	Single step-down transformer	n/a	Disconnect switch	New loop-in substation	New line, single-circuit, lattice tower	5
Short-Circuit Duty Limit	6x step-down transformers	6x breakers	6x disconnect switches	New loop-in substation	New line, single-circuit, lattice tower	5

Baseline Reconciliation and In-development Resources

- Staff need to conduct a reconciliation process to account for resources that are not in both the modeling baseline and the transmission constraints baseline to ensure both resources amounts and transmission utilization are properly accounted for.
- Staff utilize this process to also identify the in-development resources to align with in mapping.

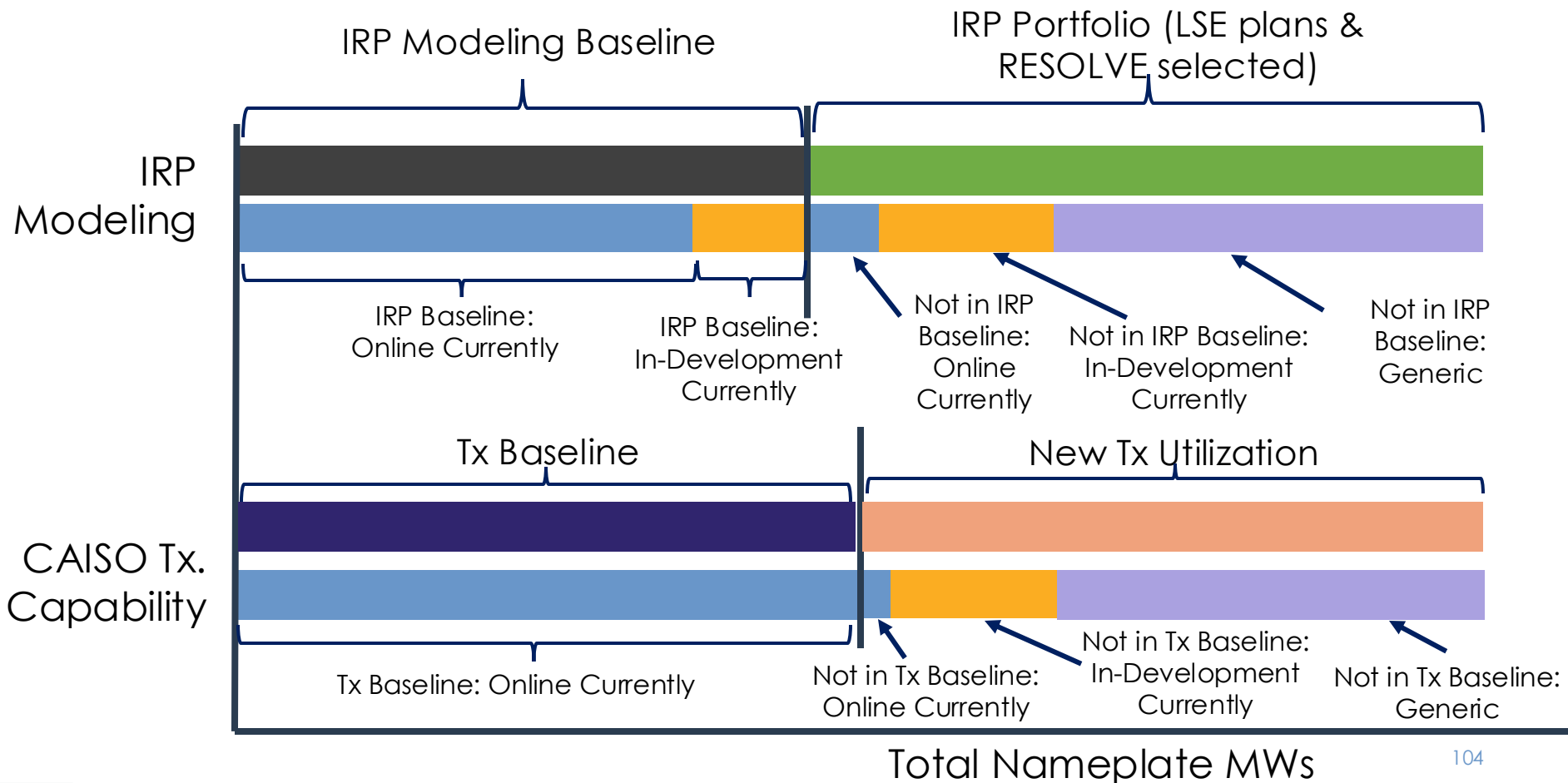
Busbar Mapping Resources

Categories:

Online: Resources identified in the CAISO Master Generating List at time of mapping.

In-Development: Resources contracted, under construction, or already progress through the interconnection process that have very high confidence of development to online.

Generic: Resources in the portfolio (either from LSE plans or RESOLVE selected) that are not tied to a specific project.



Baseline Reconciliation Results

In-Development Capacity (MW)										
	PG&E FRESNO	PG&E GBA	PG&E KERN	PG&E NGBA	SCE Eastern	SCE EOP	SCE Metro	SCE NOL	SCE Northern	SDGE
Geothermal (FCDS)	-	-	-	11	30	45	40	-	-	25
Biomass (FCDS)	-	-	-	-	-	-	-	-	-	-
Wind (FCDS)	-	-	-	-	-	-	-	-	-	-
Wind (EODS)	69	-	-	-	-	-	-	-	-	-
OOS Wind (FCDS)	-	-	-	-	285	-	-	-	-	-
Distributed Solar (EODS)	34	10	19	18	-	-	5	10	21	-
Solar (FCDS)	166	-	60	-	175	65	-	70	197	238
Solar (EODS)	988	-	440	25	2,685	650	-	236	1,363	388
Battery, 4-hr (FCDS)	980	628	398	363	1,762	685	1,547	339	1,884	1,251
Battery, 8-hr (FCDS)	35	-	-	-	100	-	52	6	523	50
LDSE (FCDS)	-	-	-	-	-	-	-	-	-	-