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California ISO

Jobs Assessment of

Assembly Bill 825

California employment in a regional electricity market, its in-state source rule and their interaction with SB 100, 2025–2040

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Note: This document was authored by an independent consultancy and does not represent CAISO policy. Data in this assessment are drawn from publicly available federal and state sources, including the California Energy Commission, the U.S. Energy Information Administration, the U.S. Bureau of Labor Statistics, the California ISO Department of Market Monitoring and the National Renewable Energy Laboratory. Other energy supply responses to AB 825 are possible and might change the magnitude, but not the direction, of the estimated impacts.

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1 Executive Summary

Assembly Bill 825 (2025) authorizes the California Independent System Operator (CAISO) to transfer governance of the Western energy markets it operates to an independent regional organization. Section 4(f) of the statute requires CAISO to assess how such a transfer could affect the creation or retention of jobs in California, specifically including jobs constructing and maintaining power plants, and to submit the study to the Legislature by December 31, 2026. This report presents BEAR's assessment of these potential employment impacts using standard economic modeling tools for analyzing California's energy sector and workforce.

Relationship between SB 100 and AB 825

Senate Bill (SB) 100 establishes California's clean energy targets, including 90% by 2035 and 95% by 2040. Public Utilities Code §399.16.5, added by AB 825, provides that participation in a regional market does not expand which resources qualify as having a first point of interconnection in a California balancing area (known as Portfolio Content Category 1 or PCC1 within the Renewables Portfolio Standard framework) for purposes of achieving the state's clean energy targets. For purposes of this analysis, BEAR treats this provision as preserving the regulatory interpretation of which resources may count towards PCC1 eligibility. In other words, while a regional market may affect electricity prices, dispatch and trade, it does not change the requirements governing the clean energy California relies on to meet its targets. s

BEAR simulates six cases to distinguish the effects of three factors: (1) participation in a broad regional market, (2) SB 100, and (3) AB 825's "source rule". **The source rule refers to AB 825's requirement that participation in a regional market does not expand which resources qualify as having a first point of interconnection in a California balancing area (Portfolio Content Category 1) for purposes of achieving the state's clean energy targets.**

These six cases examine these factors individually and in combinations, including two cases that model the regional market without the source rule to isolate its effect. The AB 825 cases also keep the RPS requirement and its content categories in force after 2030, which the Baseline does not; that extension is treated as a fourth factor.

BEAR uses an economic modeling technique (specifically, a four-way Shapley decomposition) to separate the contribution of each factor to the overall results. This method estimates the contribution of each factor by examining the results when the four factors are introduced in every possible order and then averaging each factor's contribution across those combinations. This avoids making the results dependent on an arbitrary assumption about which factor is applied first.

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The RPS after 2030. The RPS requires renewable energy equal to 60% of retail sales by 2030, and its portfolio content categories are the rules that §399.16.5 protects; the statutory RPS schedule ends in 2030. The Baseline assumes that, absent AB 825, the RPS requirement and the content categories are not continued after 2030. The AB 825 cases assume that AB 825 keeps both in force through 2040, so the employment effect of that extension is attributed to AB 825. SB 100's targets apply in every case with SB 100, and every case is evaluated on the same 5,000 simulations.

Overall, the analysis finds that AB 825 and SB 100 together increase California energy-sector employment, while also lowering system costs and reducing emissions. AB 825 contributes to these employment gains through the benefits of a regional market, by preserving existing requirements governing which clean energy resources qualify toward California's procurement requirements, and by keeping the RPS rules in force after 2030.

Key findings

- **AB 825, when considered together with SB 100, is estimated to increase both permanent jobs and construction employment in California's power sector.** By 2040, power sector operations and maintenance (O&M) employment is about 7,836 jobs higher than the Baseline (range 6,720 to 9,126), an increase of about 31%. Construction employment rises by approximately 460,000 job-years over 2025–2040.
- **AB 825 informs where SB 100's clean energy originates.** If the regional market allowed a greater share of out-of-state clean power to qualify for RPS compliance, there would be both fewer power-sector O&M employment and construction jobs in California. Under current rules, California contracts about 22% out-of-state resources. If, for example, California were to procure 50% of its resources out-of-state (about 70 TWh), the result would be 2,510 fewer jobs than the combined estimates.
- **Within the combined employment effect, AB 825 accounts for about 1,220 to 2,230 permanent jobs and 42,000 to 107,000 construction job-years, while SB 100 accounts for about 6,100 and 385,000, respectively.** AB 825's share combines its RPS extension (about +770 O&M jobs in 2040) and its source rule (about +670), both positive in every simulation, and its regional market (about +290). AB 825's total, about 1,736 O&M jobs, is positive in 95% of the simulations for O&M jobs and in effectively every simulation for construction.
- **Keeping the RPS rules in force after 2030 is a substantial part of AB 825's contribution.** Because the Baseline has no RPS requirement or content categories after 2030, the extension accounts for about 770 O&M jobs in 2040

and about 50,000 construction job-years, positive in every simulation. Most of its effect comes through SB 100's buildout: with SB 100 in force, keeping the RPS rules adds about 2,300 O&M jobs, which the Shapley value shares between the extension and SB 100.

- **The analysis is anchored in the state's existing planning assumptions.** The resource portfolio developed through CPUC's planning processes and used as input to the 2025–26 transmission-planning portfolio plans 9.0 GW of new out-of-state wind by 2035 and 10.7 GW by 2040, about 24% and 19% of new clean energy. Every case in this study now sources the same 22% out of state, so the source rule is credited only with the shift beyond what current rules already allow, a conservative and plan-consistent measure.
- **SB 100 sets the quantity and AB 825 informs the source, so their joint effect is shared equally.** In-state jobs depend on the product of the clean energy required and the share sourced in state. About 2,280 of the 2040 O&M jobs exist only because both policies apply. That joint effect has no single cause, and the Shapley value divides it equally.

Table 1: Impact Results

Change from the RPS Baseline (mean)	AB 825: market	AB 825: source rule	AB 825: RPS extension	AB 825 total	SB 100	Combined*
O&M jobs, 2030	+203	+82	0	+285	0	+285
O&M jobs, 2035	+284	+402	+407	+1,093	+3,324	+4,417
O&M jobs, 2040	**+295**	**+669**	**+772**	**+1,736**	**+6,100**	**+7,836**
range, P10 to P90	−848 to +1,390	+342 to +998	+484 to +1,060	+516 to +2,848	+5,497 to +6,706	+6,725 to +9,134
Construction job-years, 2025–40 (thousands)	**−17.6**	**+43.0**	**+49.8**	**+75.2**	**+384.9**	**+460.1**
range, P10 to P90	−53 to +21	+22 to +64	+31 to +68	+36 to +116	+353 to +418	+409 to +519
California emissions, 2040 (Mt CO2e)	+0.5	+0.2	−1.1	−0.4	−31.6	−32.0
System cost (LCOE), 2040 ($/MWh)	−2.1	−0.3	−0.6	−3.0	−10.1	−13.1
O&M jobs, 2040, import share 25% / 75%	+888 / −276	+74 / +1,241	+263 / +1,263	+1,224 / +2,227	+6,612 / +5,609	+7,836 / +7,836
Construction 2025–40 (thousands), share 25% / 75%	+20.5 / −54.3	+4.7 / +79.8	+17.0 / +81.4	+42.2 / +106.8	+417.8 / +353.2	+460.1 / +460.1

*Combined results include the AB 825 Total + SB 100.

Notes :

Summarized from Monte Carlo reliability modeling (averages across 5,000 simulations; ranges are the 10th to 90th percentiles).

Central figures draw the import share from 25% to 75% around a 50% placeholder; the last two rows fix it at each end of that range. AB 825 total = market + source rule + RPS extension; AB 825 total + SB 100 = combined in every simulation.

SB 100 binds only after 2030. Other energy supply responses to AB 825 are possible and might change the magnitude, but not the direction, of the estimated impacts.

The Baseline and the SB 100 case have no RPS requirement and no content categories after 2030; every AB 825 case keeps both through 2040, and the effect of that extension is shown as a separate AB 825 component.

The assessment measures direct power-sector employment (O&M) and construction employment including indirect and induced jobs; investment in the model does not yet respond to export prices, so the market component of AB 825's employment is best read as a lower bound.

The source-rule estimates rest on an interpretation of §399.16.5 and on the share of compliance that out-of-state power would win without the rule; that share is a placeholder pending evidence, so the source-rule results are reported across its plausible range (Sections 2.3, 3.4 and 6.7).

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2 AB 825 and the Mandate for a Jobs Study

2.1 The legislation

CAISO operates the real-time Western Energy Imbalance Market and the Extended Day-Ahead Market with participants across the West. AB 825 (Petrie-Norris, 2025) enables CAISO to transition the governance of voluntary energy markets to an independent regional organization, with the aim of delivering more efficient market services and benefits across the broadest possible region. Proponents and market analysts have pointed to substantial potential ratepayer savings from a larger, independently governed market. However, a change in governance also raises the question of how California workers are affected. To that end, AB 825 requires the CAISO to assess impacts of this transition on California jobs.

Three provisions frame this study:

Table 2: AB 825 provisions relevant to the jobs study (bill text, chaptered 2025).

Provision	Content
345.6(f)	Requires CAISO to study the impacts of implementing the transfer of governance of the regional market on the creation or retention of jobs in California, specifically including jobs constructing and maintaining powerplants; to host public workshops on the study methodology and results; to complete the study by December 31, 2026, and provide it to the legislative committees with jurisdiction over electrical corporations; to include its results in CAISO's findings and resolution; and to comply with Government Code §9795.
345.6(g)(2)	The Independent System Operator shall not change its balancing authority area from that which existed on December 31, 2024, with three exceptions.
345.6(h)(1)(A) and PUC §399.16.5	AB 825 does not change any requirement related to the California Renewables Portfolio Standard Program as provided in Article 16 (commencing with Section 399.11). The program includes the CPUC's portfolio content categories established in Public Utilities Code § 399.16 (b), and therefore does not expand the types of transactions that meet portfolio content category 1 of the RPS (§399.16(b)(1)), compared with the transactions that qualified on December 31, 2025. Category 1 covers renewable energy connected to, or delivered hourly into, a California balancing authority.

2.2 California's clean-energy requirements

Two existing laws determine how much clean capacity California must build regardless of AB 825. The RPS requires retail sellers to procure renewable energy equal to 44% of retail sales in 2024, 52% in 2027 and 60% from 2030. SB 100 (2018), as amended by SB 1020 (2022), sets clean-energy targets of 90% of retail sales in 2035, 95% in 2040 and 100% in 2045, counting renewable energy together with large hydro, nuclear and other zero-carbon resources.

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The RPS schedule in statute ends with the 60% requirement for 2030. Whether the RPS rules, including that requirement and the portfolio content categories that §399.16.5 protects, continue to govern procurement after 2030 matters for this assessment, because SB 100's targets for 2035 and 2040 carry no content categories of their own. This assessment assumes that, absent AB 825, they do not: the Baseline has no RPS requirement and no content categories after 2030, while the AB 825 cases keep both in force through 2040 (Section 3.4).

Taken together, §399.16.5 and §345.6(h) mean that AB 825 potentially widens the market in which California's clean power is traded without loosening the rules that tie RPS compliance to California-delivered resources. AB 825 and SB 100 therefore act on the same California clean-energy buildout. Section 2.3 sets out how BEAR interprets AB 825's role in that buildout; the interpretation governs the design of the assessment (Section 3.4) and the attribution of its results (Section 6.5).

2.3 AB 825 as a source rule for SB 100 compliance

SB 100 determines how much clean energy California must secure; on its own it does not determine where that energy comes from. Under existing law at least 75% of RPS procurement must be portfolio content category 1, renewable energy connected to or delivered hourly into a California balancing authority (§399.16); the remainder may be firmed and shaped out-of-state power or unbundled certificates. In a regional market dispatched across the West, the line between in-state and out-of-state supply blurs: resources throughout the footprint are scheduled through the same market, and without a rule the transactions that qualify as category 1 could widen. Section 399.16.5 prevents that by freezing category 1 at the transactions that qualified on December 31, 2025.

BEAR interprets this provision in AB 825 as requiring that, regardless of the regional market's effects on prices, dispatch and trade, the clean energy California procures to meet its targets must continue to come from resources delivered into the state. On this reading, AB 825 has two components. The regional market changes how much in-state capacity compliance needs, mainly by letting California sell power it would otherwise curtail. The source rule determines where compliance comes from.

This structure governs how the joint impact should be attributed. In-state employment from compliance depends on the product of the quantity of clean energy required, set by SB 100, and the share sourced in state, protected by AB 825. A product of two factors contains a joint term that exists only when both apply: the source rule keeps many jobs in the state only because SB 100 requires clean energy procurement at a significantly large scale; and, SB 100 creates California jobs at that scale only because AB 825 keeps the requirement in the state.

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Two qualifications apply. First, read narrowly, §399.16.5 preserves an existing floor for the RPS rather than creating a new requirement, and the reading adopted here extends its principle to the zero-carbon portion of SB 100, which has no content categories of its own. Second, measuring the rule requires a counterfactual in which it does not exist, and the share of compliance that out-of-state power would then win is uncertain; it is treated as a Monte Carlo variable (Section 3.4). BEAR recommends that CAISO counsel confirm the interpretation; Section 6.5 shows how the attribution changes under alternative readings. Third, the source rule acts after 2030 only while the RPS rules it protects remain in force; the assessment treats AB 825 as keeping those rules in force to 2040, which the Baseline does not, and credits the extension to AB 825 (Section 3.4), a reading that CAISO counsel should also confirm.

2.4 Scope of the study

In line with Section 4(f), the assessment estimates California employment in the electric power sector in two forms: permanent O&M jobs at generating and storage facilities, and construction employment, measured in job-years (one job for one year), associated with new capacity. Results are reported annually for 2025–2040 for the eight generation technologies represented in CREPS: natural gas, hydro, nuclear, solar, wind, geothermal, biomass and battery storage. BEAR presented the study methodology at public workshops in June and July 2026; this report documents the methods and results as of October 2026.

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3 Baseline Trends and the Scenario Counterfactual

3.1 Historical demand

California's retail electricity sales grew about 1.5% a year in the 1990s and about 1.3% a year from 1990 to their 2008 peak, then plateaued: over 1990–2020 growth averaged only about 0.6% a year (EIA State Energy Data System). Since the pandemic, demand has begun to grow again, driven by transportation and building electrification and, increasingly, by data centers and other large new loads.

3.2 The California Energy Commission forecast

The newest adopted outlook is the California Energy Demand 2025 forecast (CED 2025, adopted January 21, 2026), incorporated in the 2025 Integrated Energy Policy Report (IEPR, adopted July 8, 2026). Under the CEC–CPUC–CAISO Single Forecast Set Agreement, its planning forecast sets 2027 resource-adequacy requirements, while CPUC integrated resource planning and CAISO bulk-system transmission studies remain on the 2024 IEPR planning forecast through the 2027–28 planning cycle.

The size of projected growth depends on what is meant by "load." Read from the CED 2025 forecast files (statewide deliveries to end users), growth from 2025 to 2040 is +41% in the mid baseline, before the CEC's additional achievable efficiency and electrification; +50% in the planning forecast (managed sales); and +71% and +78% in the local-reliability scenarios without and with known new loads. The outlook has moved up across vintages — managed sales projected for 2040 rose from 353 TWh in the 2023 IEPR to 411 TWh in the 2024 IEPR Update, driven by data centers — but the 2025 IEPR combines higher data-center demand (40–57 TWh a year by 2040) with deferred building and vehicle electrification, so its planning path initially runs below the 2024 vintage. Growth is front-loaded (2.7% a year to 2040, about 1.7% thereafter in the planning case), and CAISO coincident peak grows more slowly than energy (about +33% from 2025 to 2040).

3.3 Three load-growth paths and the choice of Baseline

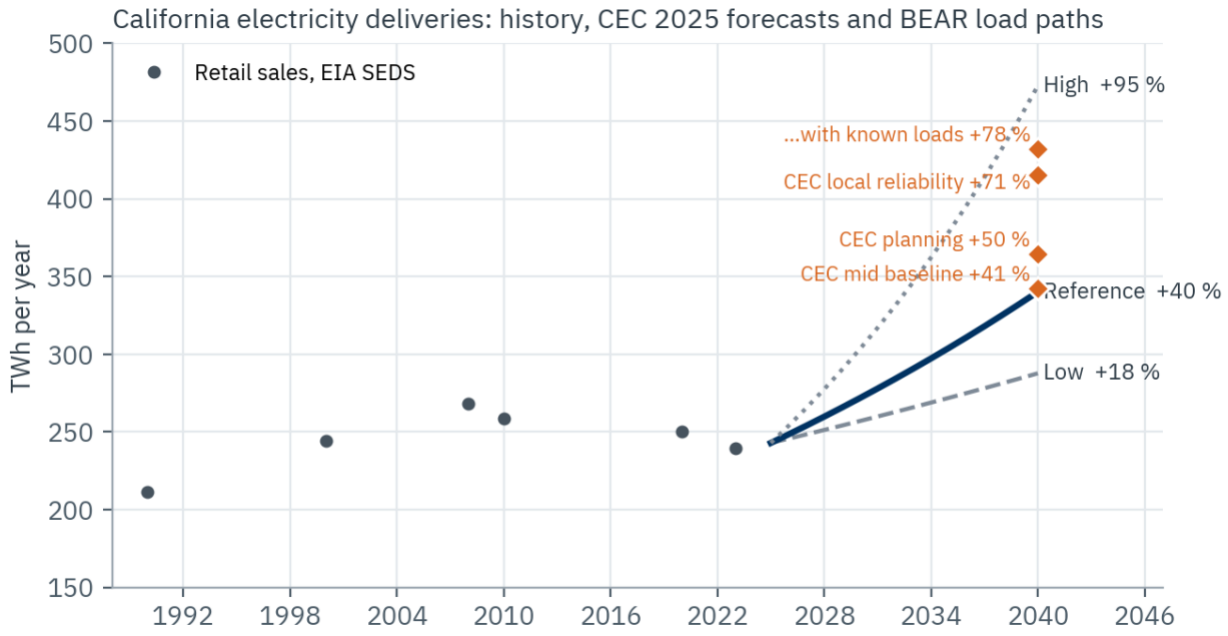
BEAR's modeling framework defines three compound load-growth paths that bracket the CEC range. The Reference path, 2.27% a year, is the compound rate that delivers +40% by 2040; the Low and High paths are half and double that rate, so the Reference is their geometric mean.

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Table 3: Load-growth paths, 2025–2040. CEC values are statewide deliveries from the CED 2025 forecast files (Form 1.1c).

Load-growth path, 2025–2040	Per year	Cumulative	Relation to the CEC forecast
Low (BEAR)	1.135%	≈ +18%	Below every CEC case, including the CED 2025 low-demand baseline (≈1.8–1.9%/yr); continuation of the pre-2008 trend
Reference (BEAR) — this study	**2.27%**	**+40%**	**Matches the CEC mid baseline: deliveries 242.8 → 342.2 TWh (+41%)**
CEC planning forecast	2.7%	+50%	Managed sales; used for resource adequacy and the CPUC IRP
CEC local reliability	3.6–3.9%	+71 to +78%	Without / with known loads; used for local transmission and distribution planning
High (BEAR)	4.54%	≈ +95%	Above every CEC case; rapid electrification and very large new loads

Figure 1: California electricity deliveries: historical retail sales (EIA), CEC 2025 forecasts for 2040 and BEAR's three load paths from the 2025 base.



Three considerations support the Reference path as the Baseline for this study. First, it is the CEC's own central demand path, and a central-to-conservative assumption: it sits below the planning forecast, mainly because that forecast adds the CEC's additional achievable electrification, and well below the local-reliability scenarios. Second, the CEC revisions have offsetting components, so the mid baseline is a stable reference while the higher cases carry the new upside risks. Third, the Low path is a floor on

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electrification that no agency advances as a forecast, and the High path represents upside risks beyond the CEC's own cases; both frame rather than replace the central case. All impacts in this report are measured against the Reference path. Faster demand growth would require more clean capacity under the RPS and SB 100, so the estimates correspond to the CEC's central outlook rather than its planning or reliability cases.

3.4 The counterfactual design

The study compares six cases, each simulated for every year from 2025 to 2040 with the same 5,000 Monte Carlo draws, so that every difference between cases is computed draw by draw. The first two rows of Table 4 are the policy cases; the third row runs the regional market without the source rule and serves only to measure that rule. For the four-way attribution (Section 6.5) every case is also simulated with the RPS rules continued and with them lapsed after 2030, on the same draws.

Table 4: The six simulated cases. The bottom row is a counterfactual used to measure the source rule, not a policy option.

	Without SB 100 (RPS only)	With SB 100
No regional market	Baseline (B)	SB 100 (S)
AB 825: regional market with source rule	**AB 825 (A)**	**AB 825 + SB 100 (J)**
Regional market without source rule	No source rule (U_A)	No source rule + SB 100 (U_J)

- **Baseline:** current policy, including the RPS through 2030 but not after it (the RPS requirement and the portfolio content categories are not continued absent AB 825); demand grows 2.27% a year; Diablo Canyon retires on the schedule set by SB 846 (2022), unit 1 in November 2029 and unit 2 in August 2030, as in every case.
- **AB 825:** the AB 825 scenario of the CREPS scenario set (somewhat faster load growth and clean-energy build rates) together with a regional market phased in over 2028–2032 that doubles California's export capability, makes imports more flexible in surplus hours and lowers renewable and storage financing costs by about 4%. Compliance shortfalls are met by procurement delivered into California, as the source rule requires. The AB 825 cases also keep the RPS requirement and the portfolio content categories in force through 2040.
- **SB 100:** the clean-energy targets are enforced from 2031 (ramping from each simulation's 2030 clean share to 90% in 2035 and 95% in 2040); any shortfall is met by procuring solar and wind with paired storage, or clean firm power where curtailment makes that cheaper. In every case about 22% of compliance

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procurement is out-of-state wind delivered into a California balancing authority, the share in the CPUC's 2025–26 transmission-planning portfolio; the rest is built in state.

- **No source rule:** the same regional market, but a share of each year's RPS or SB 100 shortfall is met by contracted out-of-state clean power instead of in-state procurement: the out-of-state share rises, as the market phases in over 2028–2032, from the 22% of current plans to a share drawn in each simulation from a triangular distribution between 25% and 75% (mode 50%). The 22% starting point is evidence-based: the CPUC's adopted 2025–26 transmission-planning portfolio plans 9.0 GW of new out-of-state wind by 2035 and 10.7 GW by 2040, about 24% and 19% of new clean energy. The 25% floor equals the share of RPS procurement that may already come from outside category 1. Contracted imports count in full toward the RPS and SB 100 and carry no emissions; the jobs they support outside California are not counted.
- **RPS after 2030:** the Baseline and the SB 100 case procure to no RPS requirement from 2031. Every AB 825 case, including the two without the source rule, keeps the 60% requirement and the content categories through 2040. SB 100 is enforced in its cases throughout.

The Baseline, and every policy case built on it, assumes that the Diablo Canyon Power Plant retires on the schedule set by SB 846 (2022): unit 1 in November 2029 and unit 2 in August 2030.[1] California therefore has no nuclear generation from 2031. Retirement removes about 2,200 MW of capacity, about 18 TWh a year of zero-carbon generation and about 1,500 permanent O&M jobs at the plant. In the Baseline, gas generation largely replaces that output: its clean share of retail sales is about 70% in 2040, gas generation reaches about 122 TWh and in-state power-sector emissions are about 59 Mt CO2e. Under SB 100, the lost nuclear output must be replaced with clean energy. Compliance then requires about 77 GW of solar and wind beyond the Baseline by 2040 and cuts gas generation by about 78 TWh. This enlarges the in-state buildout to which both policies contribute. SB 100 accounts for about 6,100 of the 7,836 additional O&M jobs in 2040 and about 385,000 construction job-years over 2025–2040. AB 825 accounts for about 1,736 O&M jobs, mostly through its source rule and its extension of the RPS rules, which keep that larger replacement buildout in California.

[1] There is active discussion of extending DCNPP's services beyond 2030, but current policy limits its service extension to 2030 and that is incorporated into the model Baseline. The present assessment is not a study and in no way reflects the ISO's positions on the state's nuclear power policy options.

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Table 5: Scenario parameters. Under pathway B (Section 4.5) the build multipliers determine the AB 825 scenario's technology tilt relative to the Baseline; the Baseline's mix follows the gravity model.

Scenario parameter (Table 2.1 of the CREPS scenario set)	Baseline	AB 825
Load growth, mean (standard deviation), %/yr	2.27 (0.50)	2.50 (0.60)
Build multipliers on load growth: solar / wind	2.8 / 2.2	3.1 / 2.8
Build multipliers: geothermal / biomass / gas	1.0 / 0.6 / 0.3	1.4 / 0.7 / 0.2
Import scaling with load	0.60	0.55
Export capability, 2025 (calibrated) and growth	3,625 MW; +5%/yr	3,625 MW; +7%/yr, ×2 by 2032
Import floor in surplus hours	0.50	0.30 from 2028
Renewable and storage financing (LCOE factor)	1.00	0.96 from 2028
Flexible load by 2040 (share of daily load)	3%	3%

4 The CREPS Model of Generation Share Allocation

4.1 Overview

The California Regional Electric Power Supply (CREPS) model is BEAR's market-based model of competition among electricity generation technologies in California. It links four stages: (1) time-series forecasts of technology costs and installed capacity (Section 5.1); (2) a gravity model that converts relative capacity and relative cost into each technology's share of generation (this section); (3) a Monte Carlo simulation that balances supply and demand every year, enforces the RPS and SB 100, and computes emissions, costs and employment under uncertainty (Section 6); and (4) attribution of the results to the policies studied.

4.2 The gravity specification

Adapted from the trade-economics literature, the gravity approach treats each pair of technologies as competing for generation. For each pair (i, j) and quarter t, the log ratio of their generation depends on their installed capacities, their relative cost and seasonal effects:

$$\ln(G_i / G_j)t = \alpha + \beta 1 \ln Cap_{i,t} + \beta 2 \ln Cap_{j,t} + \beta 3 \ln(Cost_i / Cost_j)t + \gamma 1\, Q1 + \gamma 2\, Q2 + \gamma 3\, Q3 + \varepsilon_{ij,t}$$

The eight technologies give 28 competing pairs; with 141 quarters (1990Q1–2025Q1) the estimation sample has 3,948 pair-quarter observations. The model is estimated by pooled ordinary least squares with heteroskedasticity-robust (HC3) standard errors. Four variants test stability: the full sample (M1, the forecasting specification), M1 with pair fixed effects (M2), and samples restricted to 2000Q1 onward (M3) and to the renewable era from 2010Q1 (M4). The quarterly capacity, cost and generation series are reconstructed from published annual anchors (EIA-860 and EIA-923, CEC Energy Almanac, NREL Annual Technology Baseline) using interpolation and seasonal capacity-factor profiles.

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Table 6: Gravity model coefficient estimates. *** p < 0.01, ** p < 0.05, * p < 0.10; HC3 robust standard errors. M1 F-statistic 6,701.9.

Variable	M1 full	M2 pair FE	M3 post-2000	M4 post-2010
ln(Cap i) — own capacity	0.8911***	1.0518***	0.8403***	0.6409***
ln(Cap j) — rival capacity	−1.2582***	−1.1910***	−1.2335***	−1.0730***
ln(Cost i / Cost j) — cost ratio	−0.3252***	−0.0271	−0.2533***	−0.1291***
Q1 dummy	0.0014	0.0058	−0.0037	−0.0083
Q2 dummy	0.0986***	0.1071***	0.0990**	0.1009*
Q3 dummy	0.0764*	0.0804***	0.0789	0.0797
Constant	2.7034***	2.5776***	3.0884***	3.8362***
Observations	3,948	3,948	2,828	1,708
R^2	0.9164	0.9916	0.8818	0.7983

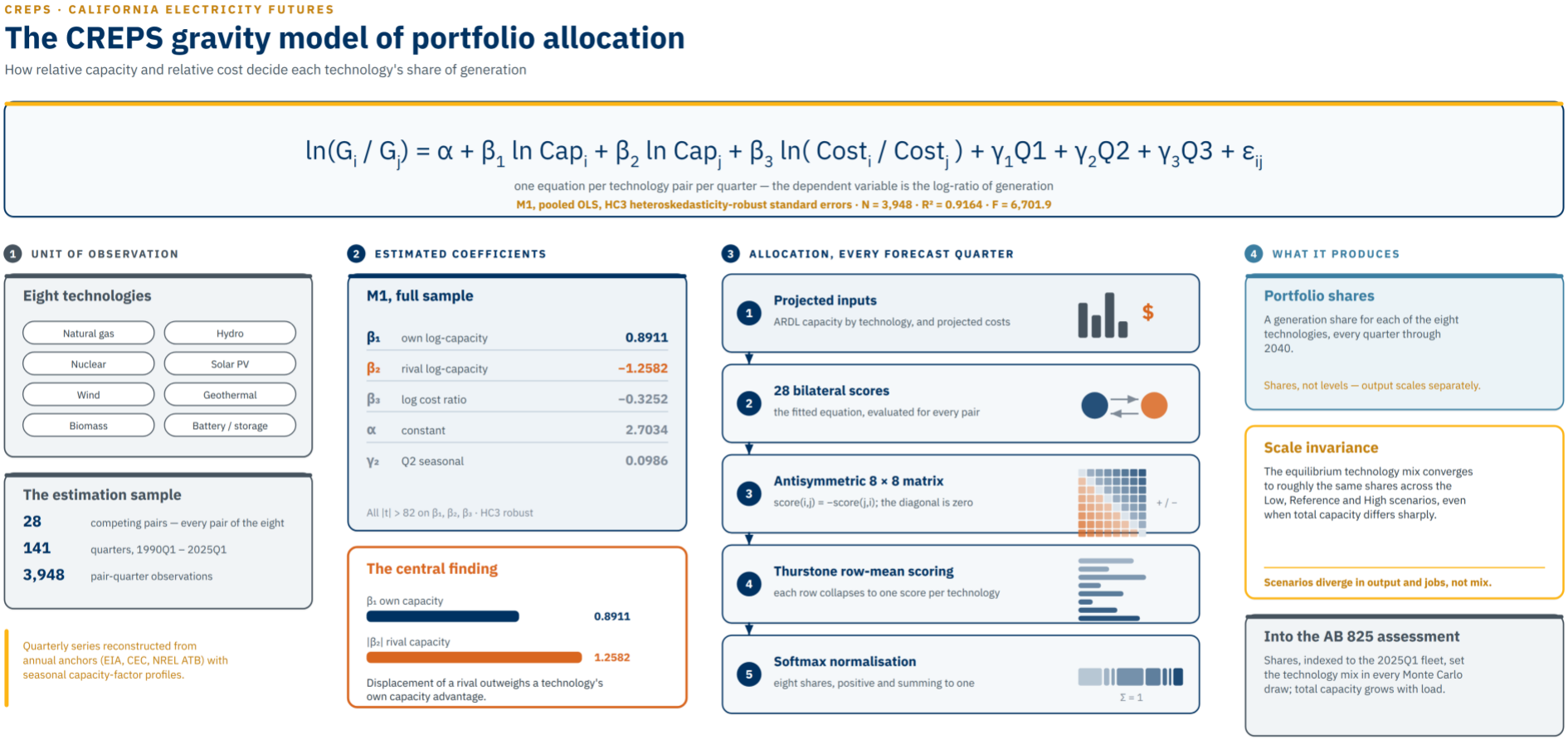
Own capacity raises a technology's share (β1 = 0.89) and rival capacity lowers it by more (β2 = −1.26): displacement outweighs own-capacity advantage, consistent with the merit-order effects and midday solar curtailment seen in California. Lower relative cost raises share (β3 = −0.33), but capacity dominates cost in the short run. In the renewable era (M4) the own-capacity elasticity falls to 0.64 and the cost coefficient to −0.13, reflecting rising curtailment and narrower cost differences within pairs; adding pair fixed effects (M2) absorbs most of the cost effect. These shifts are relevant for a forecast extending to 2040 and are one reason the Monte Carlo treats the mix and costs as uncertain.

4.3 From pairwise scores to portfolio shares

In each forecast quarter the estimated M1 equation converts projected capacity (from the ARDL models) and projected costs (from exponential smoothing) into pairwise log-generation scores for all 28 pairs. These are arranged in an antisymmetric 8 × 8 matrix (score(i, j) = −score(j, i)), reduced to one score per technology by Thurstone row-mean scoring, and normalized with a softmax so that the eight shares are positive and sum to one (Figure 2).

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Figure 2: The CREPS gravity model of portfolio allocation (flow chart).

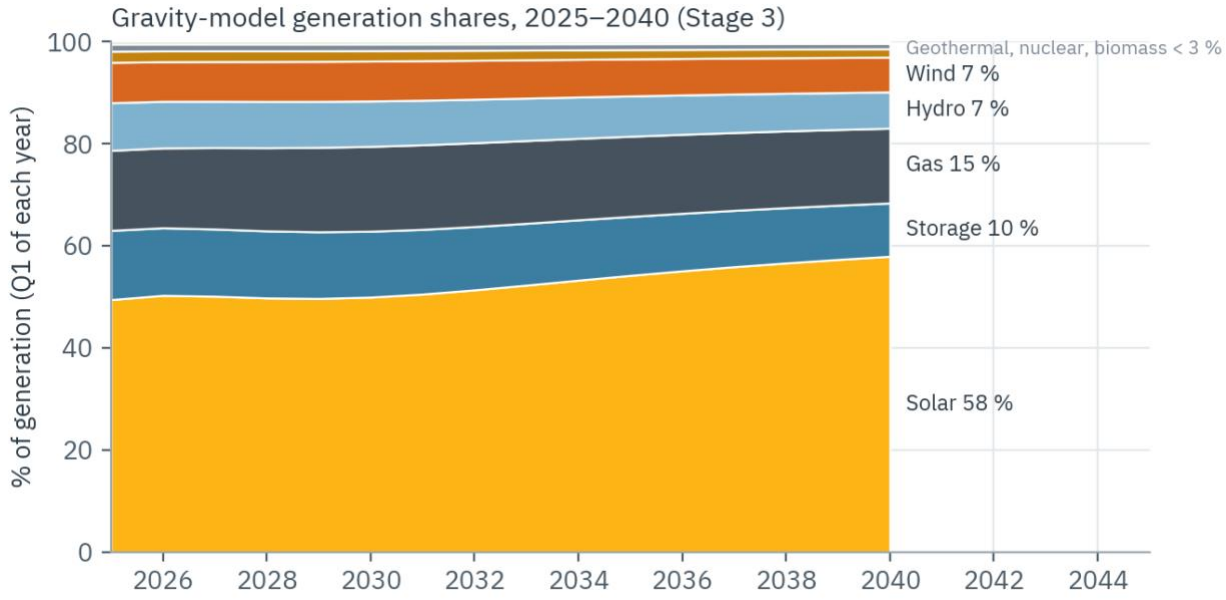


A property of this pipeline is scale invariance: the technology mix converges to similar shares across load-growth paths even when total capacity differs substantially, so differences among demand paths appear mainly in total output and employment rather than in the mix. Policy interventions such as SB 100 change the mix; in CREPS they enter through the compliance stage of the Monte Carlo (Section 6.2).

4.4 The share forecast

Figure 3 shows the gravity-model shares to 2040. Solar rises from about half of generation in 2025 to 58% in 2040; gas declines slightly to about 15%, as do storage (10%), hydro (7%) and wind (7%); geothermal, nuclear and biomass together remain below 3%.

Figure 3: Gravity-model generation shares, 2025–2040 (first quarter of each year).



4.5 How the shares enter the AB 825 assessment (pathway B)

In the assessment, total non-nuclear capacity in each simulation grows with that simulation's load growth rate, and its division among technologies follows the gravity share forecast, applied as an index relative to 2025 on the early-2025 installed fleet of 129,240 MW. Indexing on the observed fleet keeps the 2025 starting point exact while letting the gravity model

determine how the mix changes. The AB 825 scenario keeps its higher build rates relative to the Baseline: each technology's capacity is scaled by ((1 + m_AB·g)/(1 + m_Base·g))^t, where m are the scenario build multipliers in Table 5. Nuclear capacity follows the Diablo Canyon assumption, and rooftop solar grows separately at 4.06% a

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year (2025 IEPR). Compliance purchases for the RPS and SB 100 are added on top of these trend paths (Section 6.2).

BEAR also examined an alternative (pathway A) in which every technology grows at its scenario build rate times load growth. Pathway A represents a policy build-out trajectory; pathway B represents the market-trend mix estimated from history and leaves policy-driven investment to the compliance stage. BEAR adopted pathway B for this assessment because it separates the trend from the policies being studied; the comparison is reported as a structural sensitivity in Section 6.6.

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5 Time Series Analysis of Job Creation

This section describes the time-series stages of CREPS — the forecasts of technology costs and installed capacity that feed the gravity model — and then the employment methods and the resulting time series of job creation from 2025 to 2040.

5.1 Cost and capacity forecasts

Stage 1 projects the levelized cost of each technology ($/MWh) with damped Holt exponential smoothing, fitted separately for each technology by minimizing squared one-step errors over 1990Q1–2024Q4. The damping parameter φ lets the trend fade, so mature technologies converge to flat cost paths while solar and wind continue to decline. Stage 2 projects installed capacity with log-linear autoregressive distributed-lag (ARDL) models: each technology's log capacity is regressed on its own lags and lagged log cost, with lag orders chosen by the Akaike information criterion. Floors keep each technology above 80–85% of its 2025Q1 capacity, and the sum of autoregressive coefficients is capped at 0.98 to keep the projections stationary. The projected costs and capacities feed the gravity model every quarter (Figure 4).

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Figure 4: The CREPS time-series forecasts of cost and capacity (flow chart).

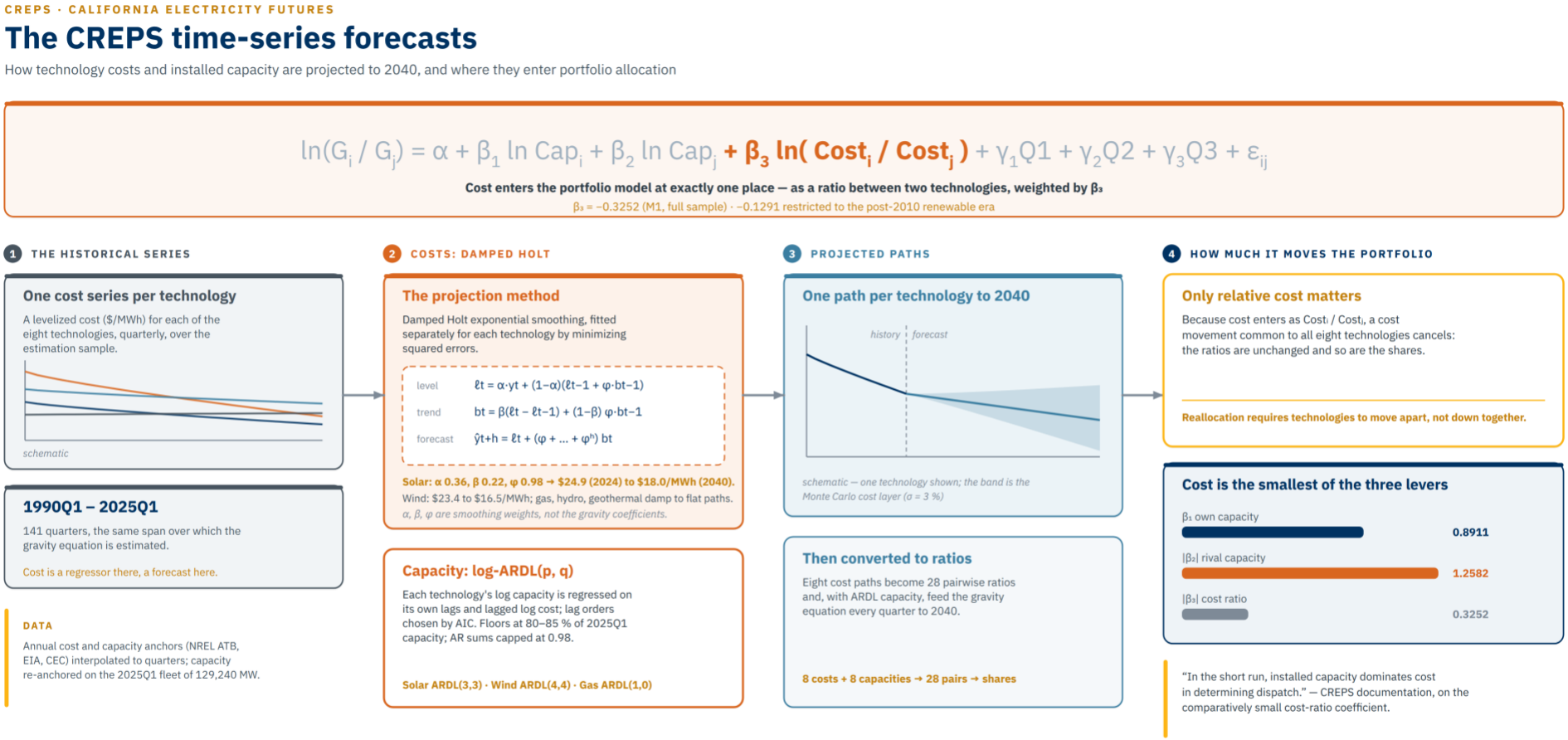


Table 7: Stage 1 exponential-smoothing parameters and cost forecasts (α level, β trend, φ damping; RMSE in $/MWh).

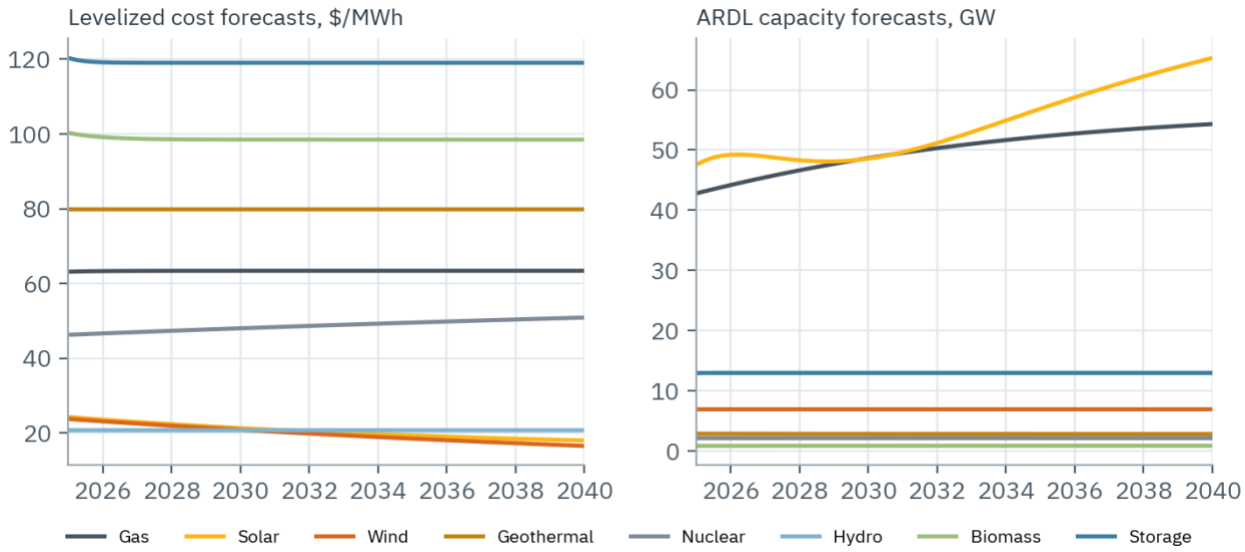
Technology	Model	α	β	φ	RMSE	Cost 2024 ($/MWh)	Cost 2040 ($/MWh)
Gas	Damped Holt	0.52	0.82	0.79	1.79	63.9	63.4
Hydro	Damped Holt	0.25	0.99	0.58	0.38	20.6	20.7
Nuclear	Holt	0.21	0.10	0.99	0.80	45.2	50.9
Solar	Damped Holt	0.36	0.22	0.98	4.49	24.9	18.0
Wind	Holt	0.18	0.29	0.99	1.33	23.4	16.5
Geothermal	Damped Holt	0.17	0.34	0.86	1.53	79.4	79.8
Biomass	Damped Holt	0.17	0.64	0.78	1.98	98.6	98.5
Battery storage	Damped Holt	0.34	0.99	0.57	9.79	118.3	119.1

Table 8: Stage 2 ARDL model selection for installed capacity (139 or fewer quarterly observations per technology).

Technology	AR lags p	Cost lags q	AIC	Adj. R^2	Sum AR	Sum DL
Gas	1	0	−775.0	0.994	0.971	0.029
Hydro	1	1	−889.3	0.907	0.337	−0.117
Nuclear	1	1	−393.6	0.970	0.924	−0.145
Solar	3	3	−576.3	1.000	0.975	−0.052
Wind	4	4	−777.9	1.000	0.980	−0.003
Geothermal	2	0	−888.0	0.961	0.914	0.008
Biomass	2	0	−869.4	0.973	0.908	−0.060
Battery storage	2	0	−528.7	1.000	0.980	−0.046

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Figure 5: Stage 1 levelized-cost forecasts and Stage 2 ARDL capacity forecasts, 2025–2040.



5.2 Employment methods

O&M employment is calibrated to BEAR's April 2026 benchmark of direct O&M employment in California's power sector, 18,650 jobs in 2025, consistent with the generation subtotal of BEAR's California employment matrix and with QCEW data for gas-fired generation (NAICS 221112). Each technology's O&M employment scales with its installed capacity relative to the early-2025 fleet (the "option 1" method adopted in September 2026), with a 5% employment-intensity shock in the Monte Carlo. Construction employment equals job-years per MW from NREL's Jobs and Economic Development Impact (JEDI) models — direct, indirect and induced — multiplied by each year's capacity additions, including compliance purchases.

Table 9: Employment coefficients. O&M benchmark: BEAR, April 2026 (direct O&M, midpoints). Construction: NREL JEDI 2024 totals.

Technology	O&M jobs, 2025 benchmark	Fleet, 2025Q1 (MW)	O&M jobs per MW	Construction job-years per MW (JEDI)
Natural gas	5,750	42,799	0.134	7.0
Hydro	2,500	12,919	0.194	10.0
Nuclear	1,500	2,200	0.682	— (no new units)
Solar (incl. rooftop)	2,250	47,568	0.047	4.4
Wind	1,150	7,000	0.164	6.5
Geothermal	2,000	2,890	0.692	10.0
Biomass	2,750	864	3.18	8.0
Battery storage	750	13,000	0.058	2.8
Total	**18,650**	**129,240**	**0.144**	

5.3 Permanent (O&M) California employment over time

O&M employment grows in every case as the fleet expands with demand. In the Baseline, it rises from about 19,300 jobs in 2025 to about 25,300 in 2040 (median); it grows more slowly after 2030 because the Baseline makes no RPS purchases after 2030. AB 825 alone adds modestly; SB 100 lifts employment sharply from 2031, when its targets begin to bind; and the two together reach about 33,000 jobs in 2040 (Figure 6, Table 10).

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Figure 6: O&M California employment in the four policy cases, 2025–2040 (median; shading shows the 10th–90th percentile range for the Baseline and the combined case).

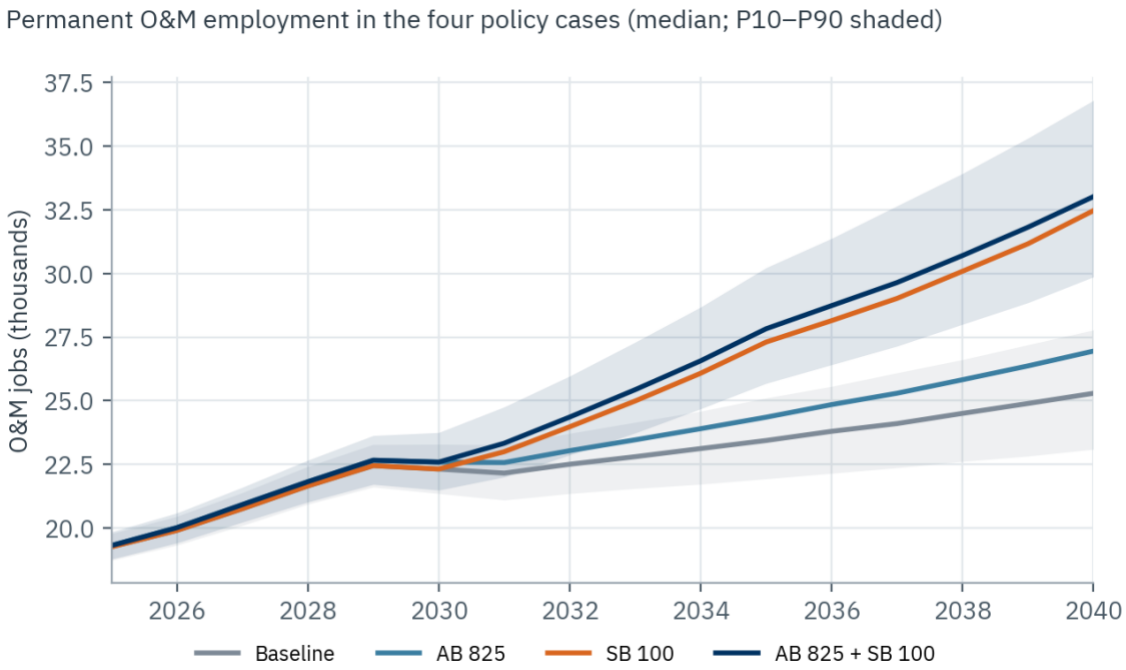


Table 10: O&M employment by policy case (medians across 5,000 simulations).

O&M jobs (median)	2025	2030	2035	2040	Change 2025–40
Baseline	19,270	22,320	23,440	25,290	+6,020
AB 825	19,320	22,590	24,360	26,950	+7,630
SB 100	19,270	22,320	27,300	32,460	+13,190
AB 825 + SB 100	19,320	22,590	27,830	33,010	+13,690

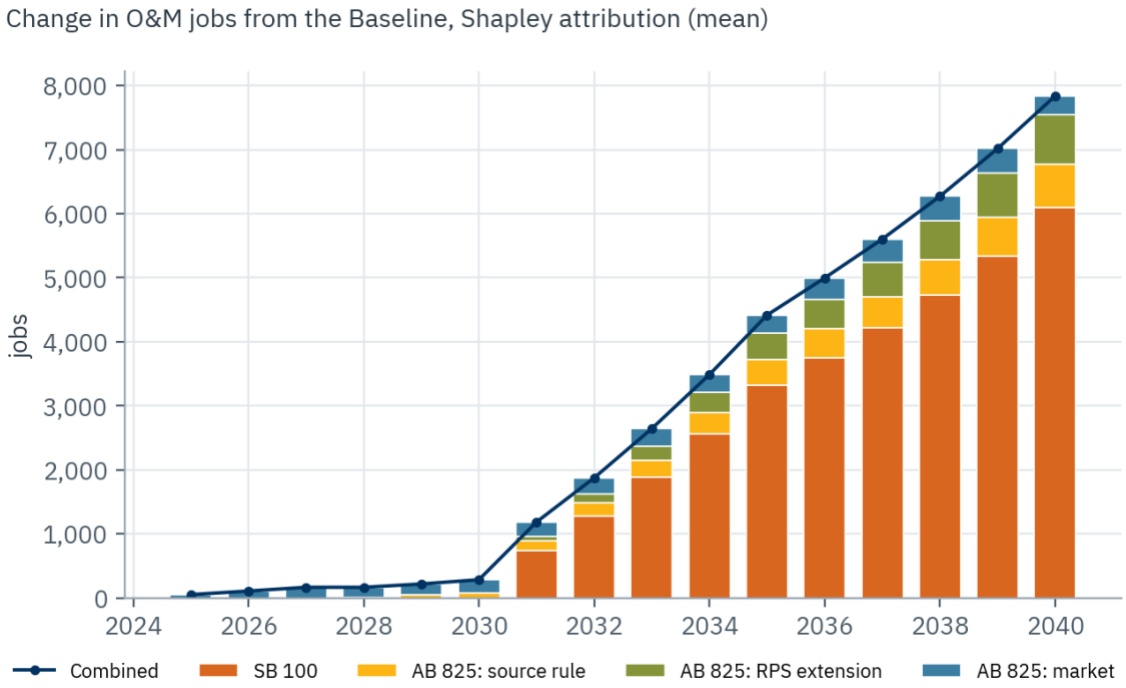
5.4 Attribution over time

Figure 7 and Table 11 attribute the change from the Baseline each year among AB 825's regional market, its source rule, its extension of the RPS rules and SB 100 (four-way Shapley values, Section 6.5). Through 2030 the entire impact is AB 825's, because SB 100's targets bind only from 2031 and the RPS applies in every case until then. The RPS extension acts from 2031 and grows to about 410 O&M jobs in 2035 and 770 in 2040. The source rule's contribution grows steadily with SB 100's requirement, to about 670 O&M jobs in 2040. The

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market component is small and positive throughout (about +290 in 2040): the AB 825 scenario builds faster, while exports of surplus power lower the capacity, and particularly the clean firm power, that SB 100 requires. SB 100's share grows to about 6,100 jobs in 2040.

Figure 7: Change in O&M jobs from the Baseline, four-way Shapley attribution (mean across simulations).



Construction employment follows procurement (Figure 8). The source rule adds construction every year from 2028, because it keeps compliance procurement in the state, and the RPS extension adds construction every year from 2031, about 50,000 job-years over 2025–2040, because the AB 825 cases keep procuring to the RPS after 2030 while the Baseline does not. The market component reduces construction in most years, because selling surplus power lets compliance be met with fewer new megawatts. AB 825's construction contribution totals about 75,000 job-years. SB 100 drives a large and sustained construction program from 2031, adding about 49,000 job-years in 2035 and 42,000 in 2040.

Figure 8: Change in construction job-years per year from the Baseline, four-way Shapley attribution (mean).

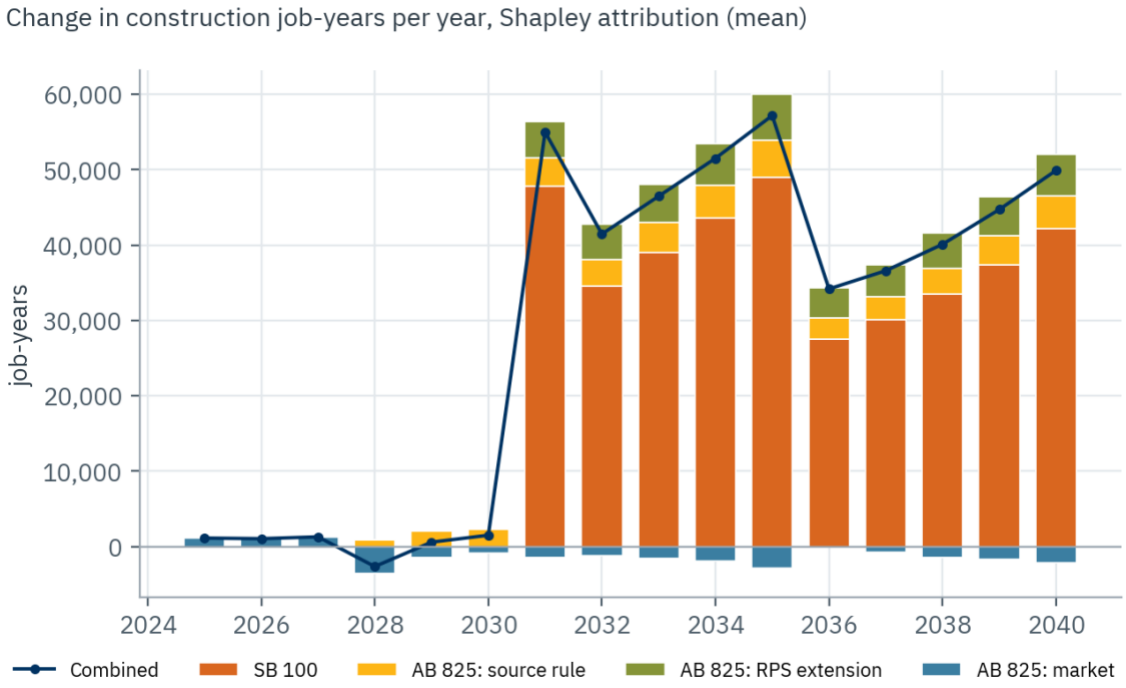


Table 11: Change from the Baseline in O&M jobs (in the year) and construction job-years (in the year), four-way Shapley attribution (means; O&M rounded to the nearest 10, construction in thousands).

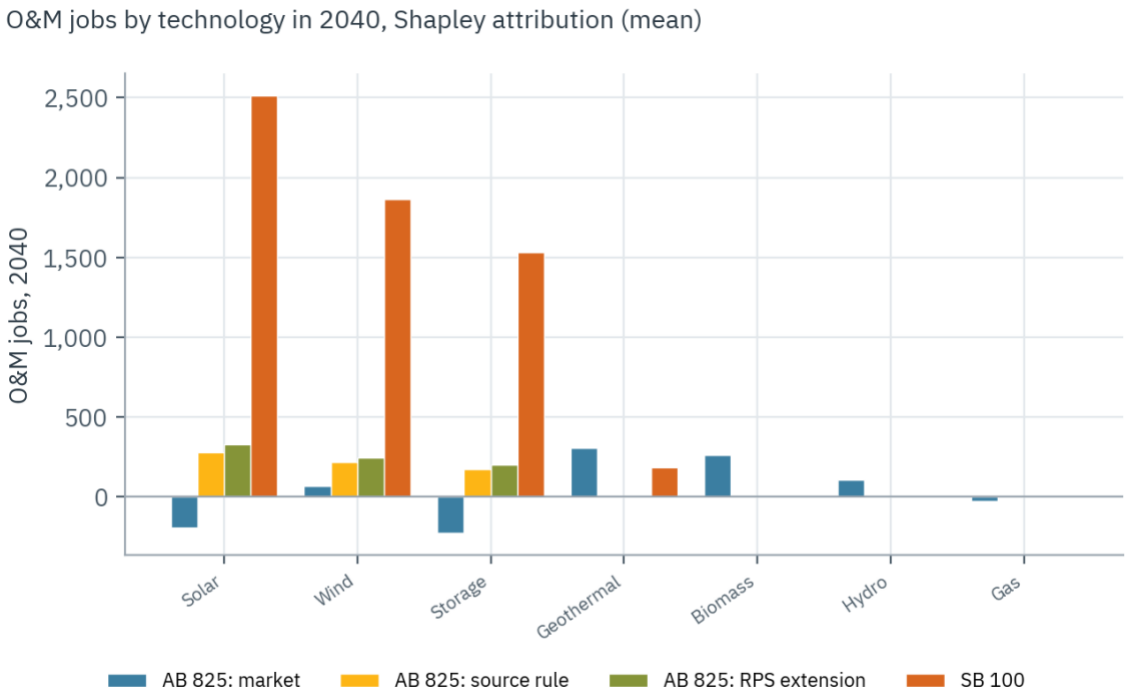
Component	Jobs	2026	2028	2030	2032	2034	2036	2038	2040
AB 825 market	O&M jobs	+110	+150	+200	+250	+280	+330	+390	+290
	Construction (thousands)	+1.0	−3.5	−0.9	−1.3	−1.9	−0.1	−1.4	−2.2
AB 825 source rule	O&M jobs	0	+10	+80	+200	+330	+450	+540	+670
	Construction (thousands)	0.0	+0.9	+2.4	+3.5	+4.3	+2.8	+3.4	+4.3
AB 825 RPS extension	O&M jobs	0	0	0	+150	+310	+470	+610	+770
	Construction (thousands)	0.0	0.0	0.0	+4.7	+5.5	+4.0	+4.6	+5.6
SB 100	O&M jobs	0	0	0	+1,280	+2,570	+3,750	+4,740	+6,100
	Construction (thousands)	0.0	0.0	0.0	+34.6	+43.6	+27.6	+33.6	+42.2
Combined	**O&M jobs**	**+110**	**+170**	**+290**	**+1,880**	**+3,490**	**+5,000**	**+6,270**	**+7,836**
	Construction (thousands)	**+1.0**	**−2.7**	**+1.5**	**+41.5**	**+51.5**	**+34.2**	**+40.1**	**+49.9**

5.5 Jobs by technology

The jobs the source rule and the RPS extension keep in the state are in solar, wind and battery storage, the resources procured for compliance (in 2040 about 280, 220 and 170 jobs from the source rule and 330, 250 and 200 from the extension). SB 100's jobs are in the same technologies, with some geothermal-type clean firm power. The market component shifts employment from solar and storage toward wind, geothermal, biomass and hydro (Figure 9, Table 12).

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Figure 9: O&M jobs by technology in 2040, four-way Shapley attribution (mean).



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Table 12: four-way Shapley attribution by technology (means). Nuclear is unchanged in all cases. Totals may differ from the sum of rows because of rounding.

Technology	O&M 2040, AB 825 market	O&M 2040, AB 825 source rule	O&M 2040, AB 825 RPS extension	O&M 2040, SB 100	Construction 2025–40, AB 825 total (thousands)	Construction 2025–40, SB 100 (thousands)
Solar	−194	+281	+327	+2,515	+38.4	+233.9
Wind	+67	+218	+246	+1,867	+21.0	+73.8
Battery storage	−227	+171	+199	+1,533	+6.9	+74.4
Geothermal	+306	0	0	+185	+4.2	+2.7
Biomass	+264	0	0	0	+0.7	0.0
Hydro	+108	0	0	0	+5.5	0.0
Natural gas	−28	0	0	0	−1.5	0.0
Total	**+295**	**+669**	**+772**	**+6,100**	**+75.2**	**+384.9**

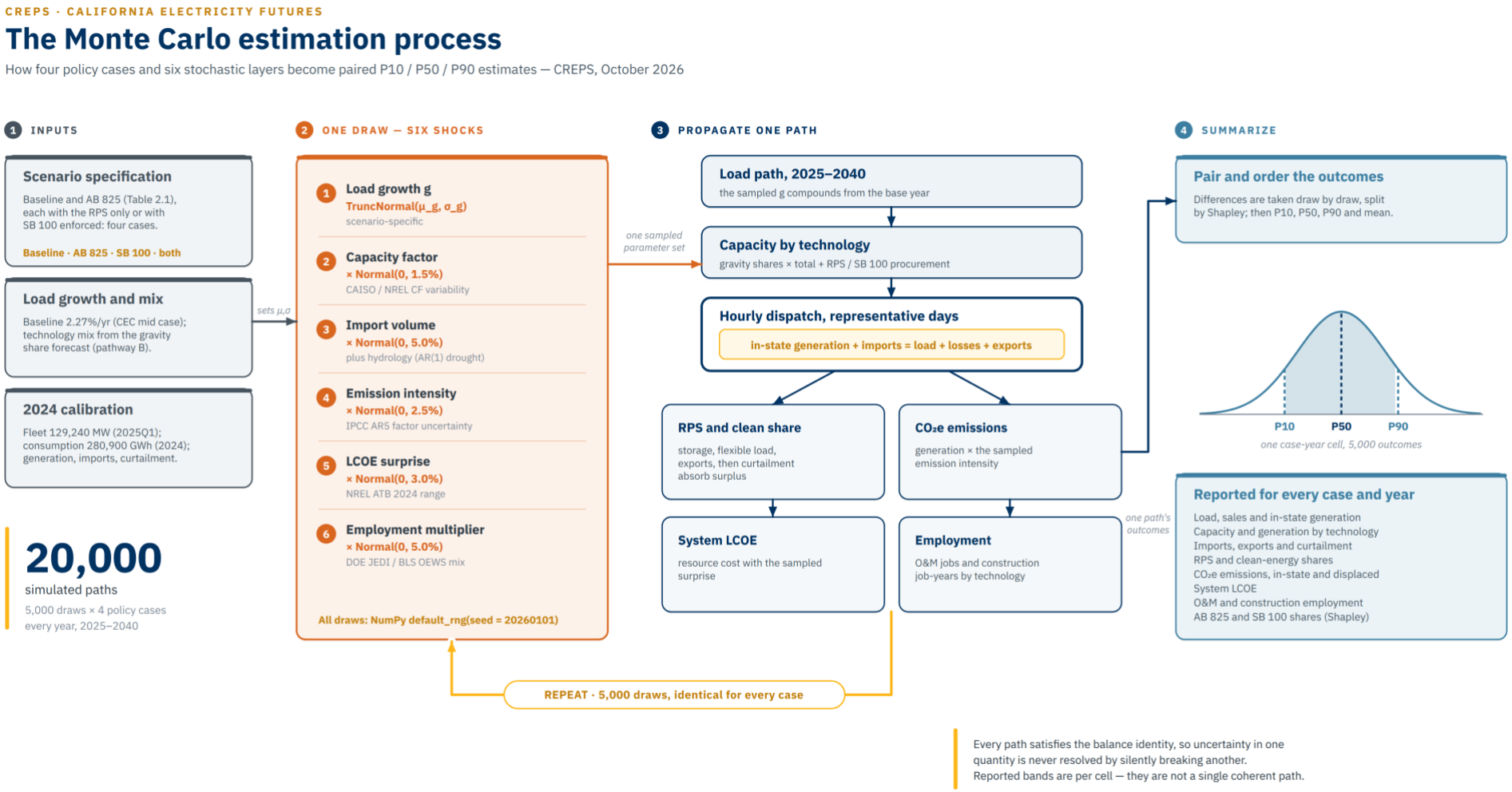
6 Monte Carlo Sensitivity Analysis

Long-run forecasts of power-sector employment are uncertain. Rather than reporting point forecasts, CREPS propagates uncertainty through a Monte Carlo simulation in which every policy case is evaluated on the same 5,000 random draws (common random numbers), so differences between cases are computed draw by draw and are far more precise than the levels themselves.

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6.1 Design

Figure 10: The CREPS Monte Carlo estimation process (flow chart).



For each draw and each year 2025–2040, the simulation: (1) compounds the drawn load growth from the 2024 calibration; (2) sets capacity by technology from the gravity share paths (Section 4.5) and adds any compliance purchases; (3) dispatches supply against demand hour by hour on eight representative days (four seasons, clear and cloudy), in which surplus energy is absorbed in order by flexible load, battery storage, reduced imports and exports up to the transfer limit, with the remainder curtailed, while gas fills residual demand between a must-run floor and its hourly availability; (4) checks the RPS and, where enforced, SB 100, procuring solar, wind, paired storage or clean firm power to close any gap; and (5) computes emissions, system cost and employment. The identity in-state generation + imports = load + losses + exports holds in every draw and year.

Table 13: Stochastic layers. All draws use NumPy default_rng with seed 20260101; the same draws are used in every policy case.

Stochastic layer	Distribution	Basis
1. Load growth g	Truncated normal, scenario mean and σ	Table 5; Baseline centered on 2.27%/yr
2. Capacity factors	× Normal(0, 1.5%)	CAISO and NREL capacity-factor variability
Hydrology	Lognormal, σ 0.20, AR(1) 0.6	California hydro output 2021–2024; drought persistence
3. Import volume	× Normal(0, 5.0%)	Variation in Western supply
4. Emission intensity	× Normal(0, 2.5%)	Emission-factor uncertainty
5. Levelized cost	× Normal(0, 3.0%)	NREL ATB 2024 cost ranges
6. Employment intensity	× Normal(0, 5.0%)	JEDI and BLS staffing variation

Table 14: Calibration anchors. Losses and unaccounted energy (8.6% of consumption) close the 2024 balance.

Calibration anchor (2024)	Value	Source
Statewide electricity consumption	280,900 GWh	CEC, 2025 IEPR
Retail sales	245,717 GWh	EIA, California Electricity Profile 2024
In-state generation (utility scale)	216,181 GWh	CEC, 2024 Total System Electric Generation
Rooftop solar	17,400 MW; 26,765 GWh	CEC, 2024 Total System Electric Generation
Imports	62,157 GWh	CEC, 2024 Total System Electric Generation
Wind and solar curtailment	4,276 GWh	CAISO Department of Market Monitoring, 2024
Electric-sector CO2	39,594 kt (gas 0.455 t/MWh)	EIA, California Electricity Profile 2024
Installed capacity, 2025Q1	129,240 MW	CREPS ARDL base (EIA-860, CEC)
Battery storage	≈13,000 MW	CAISO DMM; CREPS fleet
Export capability (calibrated)	3,625 MW	Reproduces 2024 curtailment in the dispatch

6.2 Policy compliance and the clean firm option

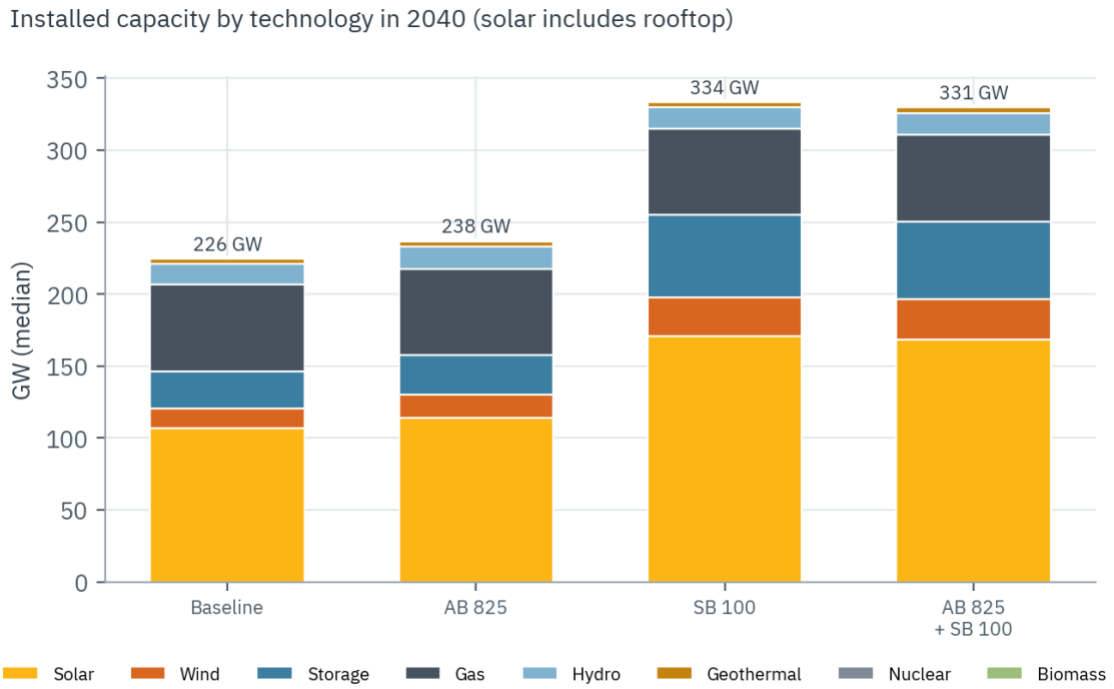
When eligible renewable energy falls short of the RPS (44% of retail sales in 2024, 52% in 2027, 60% from 2030), the model procures utility solar and wind in proportion to the existing mix, with 0.5 MW of storage per MW of solar. When SB 100 is enforced, the same mechanism closes any shortfall against the clean-energy targets. Because extra solar and wind are increasingly curtailed as their share rises, the model compares the cost per delivered MWh of new solar and wind with that of clean firm power (a geothermal proxy, capped at 15 GW and 1.5 GW a year) and buys the cheaper option; once clean firm is capped, solar is paired with 1.5 MW of storage per MW. Procured capacity remains in service in later years and counts toward construction and O&M employment.

6.3 Results for the four cases

Table 15: The four policy cases in 2040 (medians across simulations).

2040 (median)	Baseline	AB 825	SB 100	AB 825 + SB 100
Solar + wind capacity (GW)	121	130	198	196
Gas capacity (GW)	60	60	60	60
Battery storage (GW)	26	27	57	54
Procured solar + wind, cumulative (GW)	26	24	103	91
Gas generation (TWh)	122	120	44	49
Curtailment (TWh)	19	11	87	54
Exports (TWh)	9	19	18	38
RPS share of retail sales (%)	58	61	83	84
Clean share of retail sales (%)	70	73	95	95
California emissions (Mt CO2e)	58.5	56.9	25.4	26.7
O&M jobs (thousands)	25.3	26.9	32.5	33.0
Construction job-years, 2025–40 (thousands)	486	550	941	940
System cost (LCOE, $/MWh)	46.0	43.0	35.1	32.9

Figure 11: Installed capacity by technology in 2040 in the four cases (medians; solar includes rooftop).



On a trend-based mix the Baseline makes no RPS purchases after 2030: its RPS share falls to about 58% by 2040 and its clean share is about 70%, Diablo Canyon having retired in 2030, while it keeps about 60 GW of gas capacity. The AB 825 case, which keeps the RPS rules, holds an RPS share of about 61%. Enforcing SB 100 requires about 77 GW of solar and wind beyond the Baseline by 2040, more than quadruples curtailment and cuts gas generation by about 78 TWh. Adding the AB 825 regional market lets California export more of that surplus: curtailment falls from about 87 to 54 TWh, exports rise from about 18 to 38 TWh, and SB 100 is met with about 12 GW less procurement.

6.4 Decomposition of the four policy cases

Writing B, A, S and J for the Baseline, AB 825, SB 100 and combined cases, the combined impact J − B decomposes exactly, draw by draw, into AB 825 alone (A − B), SB 100 alone (S − B) and their interaction (J − A − S + B). The interaction measures how each policy changes the effect of the other. In the four policy cases the source rule is always in force, so this decomposition treats AB 825 as its market together with its extension of the RPS rules: AB 825 alone (A − B, about 1,720 O&M jobs in 2040) includes the RPS purchases the Baseline does not make, and the interaction with SB 100 (about −1,250) is negative because SB 100 would require much of that procurement anyway and needs a smaller in-state buildout once California can export its surplus. A two-factor Shapley split of these four cases, shown for comparison, credits each policy with its own effect plus half of the interaction. Section 6.5 adds the source rule and the RPS extension as separate players.

Table 16: Decomposition of the four policy cases. Means add exactly across components; the two-factor Shapley columns add half of the interaction to each separate effect.

Change from the Baseline (mean)	AB 825 alone	SB 100 alone	Interaction	Combined	AB 825 (four-way Shapley)	SB 100 (four-way Shapley)
O&M jobs, 2040	**+1,718**	**+7,367**	**−1,249**	**+7,836**	**+1,093**	**+6,743**
Construction job-years, 2025–40 (thousands)	**+66.2**	**+458.7**	**−64.8**	**+460.1**	**+33.8**	**+426.3**
Procured solar + wind, 2040 (GW)	−1.4	+76.6	−10.1	+65.0	−6.5	+71.5
Procured clean firm, 2040 (GW)	0.0	+0.5	−0.5	0.0	−0.3	+0.3
Curtailment, 2040 (TWh)	−8	+69	−25	+35	−21	+56
Exports, 2040 (TWh)	+10	+9	+10	+29	+15	+14
California emissions, 2040 (Mt)	−1.6	−33.3	+3.0	−32.0	−0.2	−31.9
Displaced in the West, 2040 (Mt)	+4.3	+3.8	+4.4	+12.4	+6.5	+6.0
System cost, 2040 ($/MWh)	−3.0	−10.9	+0.8	−13.1	−2.6	−10.5

6.5 The source rule, the RPS extension and four-way Shapley attribution

To measure the source rule, the model reruns the regional market without it (U_A without SB 100, U_J with SB 100). Table 17 compares the six cases in 2040. Every case meets its targets; what differs is where the clean energy comes from. Without SB 100 the rule matters little, because the AB 825 case has only small RPS shortfalls to fill. With SB 100 it matters a great deal: the AB 825 case procures about 91 GW of new solar and wind in state by 2040, while without the source rule the same target is met with about 63 GW in state and about 70 TWh of contracted clean imports, against about 35 TWh with the rule. O&M employment is then about 2,510 jobs lower.

Table 17: The six cases in 2040 (medians across simulations).

2040 (median)	Baseline	AB 825	No source rule	SB 100	AB 825 + SB 100	No source rule + SB 100
Solar + wind capacity in California (GW)	121	130	128	198	196	170
Battery storage (GW)	26	27	26	57	54	43
Procured in state for compliance (GW, cum.)	26	24	22	103	91	63
Contracted out-of-state clean imports (TWh)	10	10	14	34	35	70
Curtailment (TWh)	19	11	11	87	54	39
Exports (TWh)	9	19	18	18	38	32
Clean share of retail sales (%)	70	73	73	95	95	95
O&M jobs (thousands)	25.3	26.9	26.7	32.5	33.0	30.5
Construction job-years, 2025–40 (thousands)	486	550	535	941	940	780

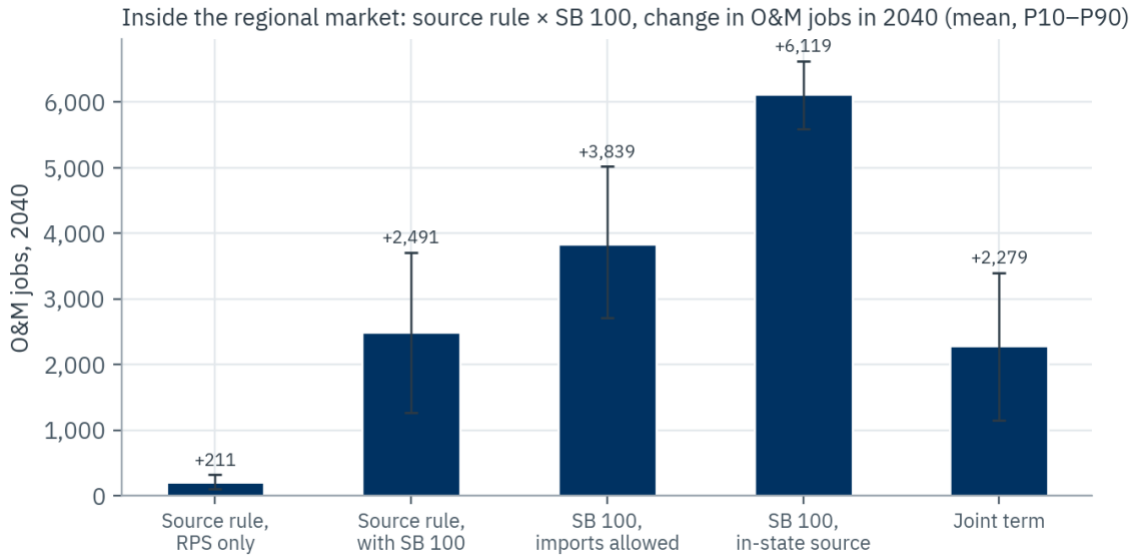
Quantity and source

Inside the regional market, the four cases U_A, A, U_J and J form a second two-by-two design in which SB 100 sets the quantity of clean energy and the source rule sets where it comes from (Table 18, Figure 12). The source rule adds about 210 O&M jobs when only the RPS applies and about 2,490 when SB 100 also applies; SB 100 adds about 3,840 jobs if imports may be used and about 6,120 if they may not. The joint term, about 2,280 O&M jobs and 147,000 construction job-years, is positive in every simulation. It is the gain that exists only because both policies apply.

Table 18: Quantity × source decomposition inside the regional market. Source rule = A − U_A (RPS only) and J − U_J (with SB 100); SB 100 = U_J − U_A (imports allowed) and J − A (in-state source); joint term = J − A − U_J + U_A.

Change inside the regional market (mean)	Source rule, RPS only	Source rule, with SB 100	SB 100, imports allowed	SB 100, in-state source	Joint term
O&M jobs, 2040	**+211**	**+2,491**	**+3,839**	**+6,119**	**+2,279**
Construction job-years, 2025–40 (thousands)	**+13.5**	**+160.2**	**+247.3**	**+393.9**	**+146.6**
In-state procurement, 2040 (GW)	+2	+27	+42	+66	+25
Contracted clean imports, 2040 (TWh)	−3	−34	+56	+25	−31

Figure 12: Inside the regional market: the source rule and SB 100, change in O&M jobs in 2040 (mean, with 10th–90th percentile range).



Three-way Shapley values

The players are the regional market (M), the source rule (G) and SB 100 (Q), and each combination of players is a simulated case: none = B, M = U_A, M + G = A, Q = S, M + Q = U_J and M + G + Q = J. The source rule has nothing to act on without the market, so G alone equals B and G + Q equals S. Each player's Shapley value is its average added effect over the six orders in which the three could be introduced:

- Regional market: (U_A – B)/3 + (A – B)/6 + (U_J – S)/6 + (J – S)/3
- Source rule: (A – U_A)/6 + (J – U_J)/3
- SB 100: (S – B)/2 + (U_J – U_A)/6 + (J – A)/3

The three values sum exactly to J – B in every simulation, and AB 825's attribution is the sum of the market and source-rule values. The rule satisfies the Shapley axioms: it allocates the whole combined effect, treats players with identical contributions identically, gives nothing to a player that never changes the outcome and is additive across outcomes, so the attribution of construction, O&M and emissions is internally consistent. In this design the AB 825 cases also keep the RPS rules after 2030 while the Baseline does not, so the three-way market value also contains the effect of that extension; the four-way values below separate it and are the headline attribution in this report.

Four-way Shapley values

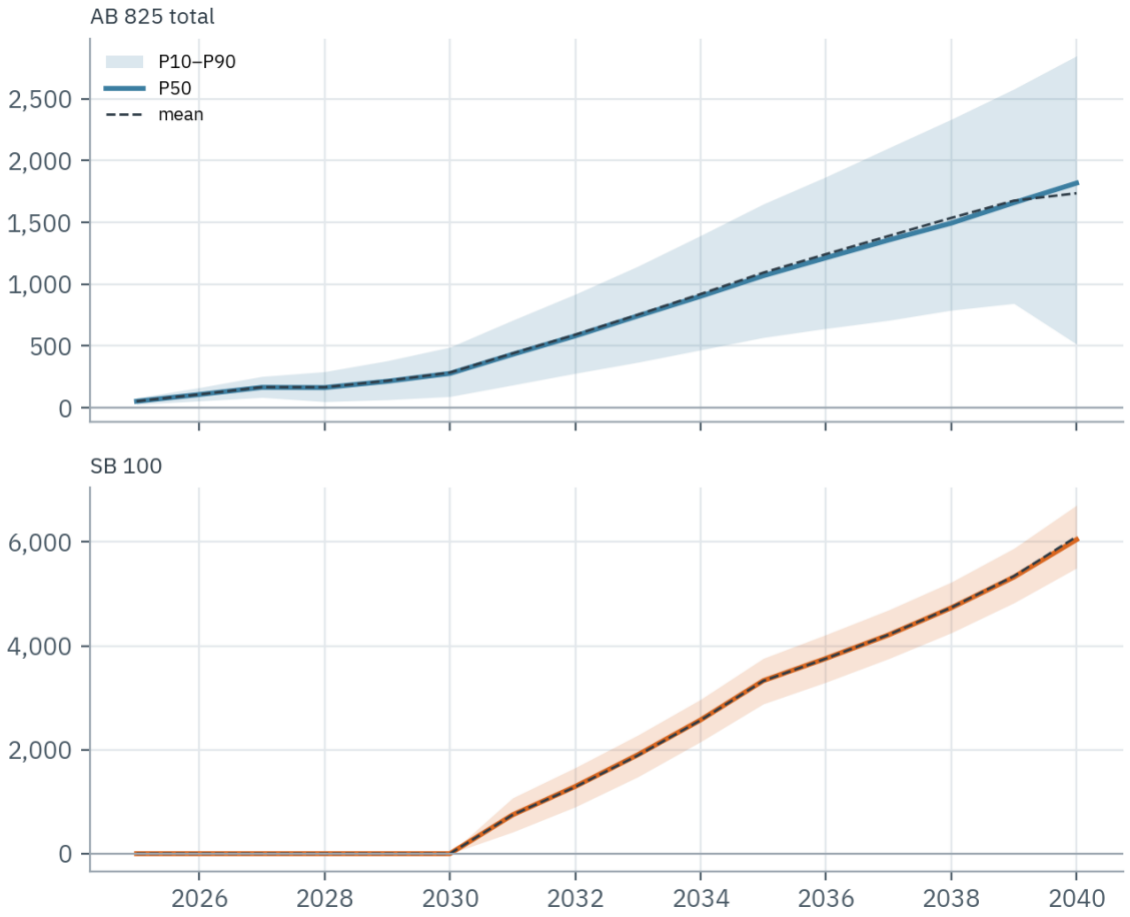
AB 825's extension of the RPS rules to 2040 (R) is the fourth player. Each combination of the four players is again a simulated case: the cases without R are those in which the

RPS rules lapse after 2030 and the cases with R those in which they continue, both run on the same 5,000 draws; the source rule still has nothing to act on without the market. Each player's Shapley value is its average added effect over the 24 orders in which the four could be introduced. The four values sum exactly to the combined impact in every simulation, and AB 825's attribution is the sum of the market, source-rule and RPS-extension values. Without SB 100 the extension adds about 530 O&M jobs to the Baseline in 2040 and about 130 to the AB 825 case; with SB 100 it adds about 2,300, because it keeps more of SB 100's procurement in the state, and the Shapley value shares that joint effect between the extension and SB 100.

Table 19: four-way Shapley attribution with uncertainty ranges (10th to 90th percentiles across simulations), with the RPS extension as a separate AB 825 component.

Change from the Baseline	AB 825: market	AB 825: source rule	AB 825: RPS extension	AB 825 total	SB 100	Combined
O&M jobs, 2030 (mean)	+203	+82	0	+285	0	+285
O&M jobs, 2035 (mean)	+284	+402	+407	+1,093	+3,324	+4,417
O&M jobs, 2040 (mean)	**+295**	**+669**	**+772**	**+1,736**	**+6,100**	**+7,836**
P10 to P90	−848 to +1,390	+342 to +998	+484 to +1,060	+516 to +2,848	+5,497 to +6,706	+6,725 to +9,134
share of simulations above zero	69%	100%	100%	95%	100%	100%
Construction job-years, 2025–40 (thousands, mean)	**−17.6**	**+43.0**	**+49.8**	**+75.2**	**+384.9**	**+460.1**
P10 to P90	−53 to +21	+22 to +64	+31 to +68	+36 to +116	+353 to +418	+409 to +519
share of simulations above zero	25%	100%	100%	100%	100%	100%
California emissions, 2040 (Mt, mean)	+0.5	+0.2	−1.1	−0.4	−31.6	−32.0
Displaced in the West, 2040 (Mt, mean)	+5.7	+0.6	+0.7	+7.0	+5.4	+12.4
System cost, 2040 ($/MWh, mean)	−2.1	−0.3	−0.6	−3.0	−10.1	−13.1

Figure 13: Distribution over time of the Shapley change (four-way) in O&M jobs: median, mean and 10th–90th percentile range.



SB 100's contribution is large and certain: positive in every simulation. AB 825's source rule and its RPS extension are also positive in every simulation, with narrow ranges. AB 825's total, about 1,736 O&M jobs in 2040 (P10 to P90 +516 to +2,848), is positive in 95% of simulations for O&M jobs and in effectively every simulation for construction; its spread comes from the market component (Figure 13). In a minority of simulations, the regional market lowers curtailment enough that the combined case avoids clean firm purchases the SB 100 case makes; because clean firm power (a geothermal proxy) has high staffing per megawatt, those simulations show a loss in O&M jobs for the market component.

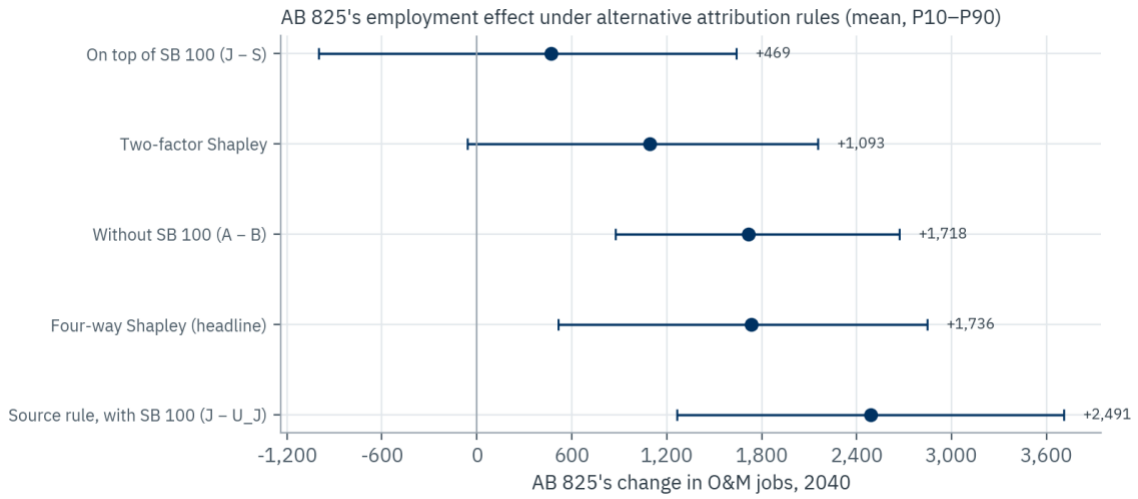
Alternative attribution rules

Any division of a joint effect is a convention, and the choice matters here. Table 20 and Figure 14 show AB 825's 2040 employment effect under five rules.

Table 20: AB 825's employment effect under alternative attribution rules.

Measure of AB 825's effect	What it assumes	O&M jobs, 2040: mean (P10 to P90)	Construction 2025–40 (thousands)
On top of SB 100 (J – S)	AB 825 measured where SB 100 already binds; its market owns the whole negative quantity interaction; source rule taken as given	+469 (–1,002 to +1,638)	+1.4
Two-factor Shapley (Section 6.4)	Averages A – B and J – S; source rule not modeled	+1,093 (–60 to +2,155)	+33.8
Without SB 100 (A – B)	AB 825 measured where SB 100 does not bind	+1,718 (+878 to +2,670)	+66.2
Four-way Shapley (this report)	**Market, source rule and RPS extension as separate AB 825 players, SB 100 as the fourth; joint terms shared equally**	**+1,736 (+516 to +2,848)**	**+75.2**
Source rule with SB 100 (J – U_J)	Source rule credited with the whole quantity × source joint term; market not counted	+2,491 (+1,265 to +3,710)	+160.2

Figure 14: AB 825's change in O&M jobs in 2040 under alternative attribution rules (mean, with 10th–90th percentile range).



The rules span a wide range. Measuring AB 825 on top of SB 100 with the source rule taken as given credits it with only about 470 jobs, because its market lowers the capacity SB 100 needs. Crediting the source rule with the whole joint term gives AB 825 about 2,500 jobs. The four-way Shapley value, about 1,736, lies between these, close to A – B (about 1,720). Under the reading that AB 825 sets the source and SB 100 sets the quantity (Section 2.3), it is the most defensible single estimate, because it treats the four components symmetrically and recognizes that the source rule acts only through the market. The bounds should be reported with it.

6.6 California and regional emissions

SB 100 drives the reduction in California's own power-sector emissions (about 31.6 Mt in 2040 on the four-way attribution). AB 825 lowers them slightly (about 0.4 Mt): its RPS extension displaces about 1.1 Mt of gas-fired generation, while its market and source rule raise emissions by about 0.5 and 0.2 Mt, mainly because the AB 825 scenario carries faster load growth and because in-state sourcing replaces zero-emission contracted imports with in-state supply that runs alongside gas. AB 825 also lowers emissions elsewhere in the West by about 7.0 Mt as exports displace gas-fired power. Displaced emissions assume each exported MWh replaces power at CARB's default rate for unspecified power (0.428 t/MWh), an upper-bound estimate reported separately from California's inventory.

6.7 Structural sensitivities and limitations

Three structural choices matter more for the attribution than the stochastic layers. Table 21 reports them.

Table 21: Structural sensitivities (four-way Shapley). The import share is the fraction of each compliance shortfall met by contracted out-of-state clean power when the source rule is absent (assumption N12, a placeholder pending evidence).

2040 O&M jobs / construction 2025–40 (thousands), mean	AB 825 (four-way Shapley)	of which source rule	of which RPS extension	SB 100 (four-way Shapley)
Import share triangular 0.25–0.75 (this report)	**+1,736 / +75.2**	**+669 / +43.0**	**+772 / +49.8**	**+6,100 / +384.9**
Import share fixed at 25%	+1,224 / +42.2	+74 / +4.7	+263 / +17.0	+6,612 / +417.8
Import share fixed at 50%	+1,741 / +75.5	+675 / +43.4	+776 / +50.1	+6,095 / +384.6
Import share fixed at 75%	+2,227 / +106.8	+1,241 / +79.8	+1,263 / +81.4	+5,609 / +353.2
Pathway A build-out paths (four-way Shapley)	+2,298 / +102.2	+333 / +21.5	+292 / +18.8	+3,608 / +231.9

- **Import share without the source rule.** The source rule's value scales with the share of compliance that out-of-state power would win without it: at a fixed 25% the source rule keeps about 270 O&M jobs in the SB 100 world and contributes +70 to AB 825's Shapley value; at 75%, about 4,620 and +1,240. AB 825's total moves less, from about 1,220 to 2,230, because a larger import share also lowers the market component. The 22% share under current rules is taken from the CPUC's adopted 2025–26 transmission-planning portfolio, so at a no-rule share of 25% the source rule has almost nothing to act on. The 50% mode and 75% ceiling remain placeholders, to be replaced with values drawn from the regional-market scenarios of the 2016 SB 350 regionalization study and a comparison of

the delivered cost of out-of-state wind, including transmission, with in-state solar and storage. Until then, the source-rule results should be cited as a range.

- **Import share and the RPS extension.** The extension's contribution also rises with the import share, from about 260 O&M jobs in 2040 at a fixed 25% to about 1,260 at 75%, because without the RPS rules more of SB 100's procurement would then be contracted out of state.
- **Calibration to the CPUC portfolio.** Before every case was given the CPUC's 22% out-of-state share, the combined impact was about 9,850 O&M jobs in 2040 and AB 825's four-way attribution about 2,090. With the calibration the combined impact is about 7,836, because part of SB 100's buildout is planned outside California, while AB 825's attribution is about 1,730, somewhat lower. The source rule's own contribution falls, because it is now credited only with the shift beyond current plans, and the market component rises.
- **Technology path.** Under the scenario build-out paths (pathway A) the Baseline builds far more solar, wind and storage on its own, so SB 100 has less to add (about 3,610 O&M jobs in 2040) and AB 825's faster build counts for more (about 2,300, mostly through the market component).
- **Legal reading.** If §399.16.5 is read narrowly, as preserving the RPS floor without fixing the source of SB 100 compliance, the source rule would not be credited and AB 825's effect would fall to the two-factor value (about +1,090 O&M jobs, which still includes the RPS extension) or, measured on top of SB 100, to about +470. Whether AB 825 can be read as extending the RPS rules beyond 2030 is a separate legal question; without that extension AB 825's four-way value would lose about 770 jobs.

Several limitations apply to all results:

- Investment does not respond to export prices. Exports absorb surplus that would otherwise be curtailed but do not draw new capacity into California, and storage is not built to sell power into the West's evening peak. Because these channels would add in-state jobs, the market component of AB 825's attributed employment is best read as a lower bound.
- The AB 825 case is the AB 825 scenario of the CREPS scenario set, including its faster load growth and build rates; its effect should be described as that of the scenario rather than of the market alone.
- The representative-day load and renewable shapes are stylized; the calibration reproduces 2024 curtailment exactly but overstates 2024 gas generation by about 9%. Technology costs reflect NREL ATB 2024 and EIA AEO 2024 vintages.

- The gravity model and time-series stages are estimated on quarterly series reconstructed from annual anchors; re-estimation on monthly EIA-923 generation and EIA-860M capacity data is recommended before the final report.
- Contracted out-of-state clean power is counted in full toward compliance and carries no emissions; the employment it supports outside California is not counted, and transmission constraints on such imports are not modeled.
- The Baseline and the SB 100 case lose both the 60% requirement and the content categories from 2031, and the AB 825 cases keep both. Intermediate cases, in which one lapses and the other continues, are not modeled.
- Several parameters are BEAR judgments listed with sensitivity results in the model's assumptions register, including the size and timing of the regional-market effects, the import share without the source rule (N12, a placeholder whose 50% mode and 75% ceiling are not yet evidence-based), flexible demand, and the clean firm option and its staffing intensity.

7 Data Sources

Table 22: Data sources. Publication vintage and retrieval dates are recorded in the project source register (docs/sources.md).

Source	Publisher, vintage	Use in the assessment
2025 Integrated Energy Policy Report (TN 271454)	California Energy Commission, adopted July 8, 2026	2024 consumption (280,900 GWh); rooftop solar growth; data-center demand; forecast vintages
California Energy Demand 2025 forecast, LSE and BAA tables (TN 268722, 268725, 268726, 268727)	CEC, adopted January 21, 2026	Statewide deliveries 2025–2040 by case (Form 1.1c); CAISO peak (Form 1.5b)
Single Forecast Set Agreement (TN 269506)	CEC, CPUC and CAISO, April 15, 2026	Which forecast case is used for which planning purpose
2024 Total System Electric Generation	CEC Energy Almanac, 2024 data	In-state generation, imports and import mix, rooftc solar
California Electricity Profile 2024	U.S. EIA	Retail sales; electric-sector CO2; gas emission rate
State Energy Data System (retail sales, 1990–2023)	U.S. EIA	Historical demand growth
Forms EIA-860 / 860M and EIA-923	U.S. EIA	Installed capacity and generation by technology (anchors for the quarterly series)
2024 Annual Report on Market Issues and Performance	CAISO Department of Market Monitoring, August 2025	Wind and solar curtailment; battery capacity
Annual Technology Baseline 2024	NREL	Technology cost levels and trends; cost uncertainty
Annual Energy Outlook 2024	U.S. EIA	Cost trends
Jobs and Economic Development Impact (JEDI) models, 2024	NREL	Construction job-years per MW by technology
Quarterly Census of Employment and Wages (NAICS 221112, 23713, 238210)	U.S. BLS	Check on gas-fired O&M employment; construction workforce
California power-generation employment briefing and employment matrix	BEAR, April 2026	O&M employment benchmark (18,650 jobs, 2025)
AB 32 Greenhouse Gas Inventory, 2000–2023 (2025 edition)	California Air Resources Board	Unspecified-power emission factor (0.428 t/MWh); cross-check
Diablo Canyon licence renewal; SB 846	U.S. NRC; California Legislature	Nuclear operating assumption (through 2045)
SB 100 (2018), SB 1020 (2022), AB 825 (2025); Public Utilities Code §§345.6, 399.16, 399.16.5, 454.53	California Legislature	RPS and clean-energy targets; portfolio content categories; regional-market provisions and source rule
Decision adopting electricity resource portfolios for the 2025–2026 transmission planning process (R.20-05-003)	California Public Utilities Commission, February 2025	Out-of-state share of planned new clean energy (Table 1)

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