Mid-Term Need Determination Analysis

September 30, 2025

California Public
Utilities Commission

Contents

Background

Background

- Prior Commission Mid-term Reliability (MTR) procurement orders were focused on the compliance periods from 2023-2028
- Stakeholders, in their response to the Reliable and Clean Power Procurement Program (RCPPP) staff proposal, proposed to consider a reliability need determination analysis for the post-MTR period
- Staff conducted a need determination analysis using the SERVM LOLP model to assess the system reliability gap, versus a portfolio where all MTR procurement materializes as ordered*
- This need determination analysis is intended to inform whether the Commission should initiate another procurement order to cover 2028-2032 reliability needs or whether prior orders, in conjunction with the expectation of future requirements, provide sufficient resources to allow runway for the development and potential adoption of RCPPP

* NOTE: This analysis assumes procurement of 2028 generic resources to replace any LLTs contracted for after 2028 and the amount of LLTs still needing to be contracted to meet the minimum required amounts in D.23-02-040, as modified by D.24-02-047. These as-yet uncontracted LLT resources are assumed to come online in 2031.

Previous IRP Procurement Orders

- The MTR procurement order in 2021 required 11.5 GW net qualifying capacity (NQC-ELCC) online from 2023-26[1], across various tranches, including:
  - Two long lead-time (LLT) tranches: 1 GW NQC for long duration (8-hr+) storage and 1 GW NQC for clean firm (80%+ CF) resources
  - 2.5 GW NQC of zero-emission generation by 2025 to replace Diablo Canyon (DCPP)
- In 2023, the CPUC issued a supplemental MTR procurement order (SMTR), based on the 2022 IEPR load forecast, requiring jurisdictional LSEs to procure an additional 4 GW NQC (**15.5 GW NQC in total**) of procurement for 2027-28, and changing the LLT deadline from 2026 to 2028[2]
- The deadline to procure the LLT tranches has since been updated with the option to extend to 2031[3]

MTR and SMTR Procurement Ordered (NQC MW - ELCC)

Need Type	2023	2024	2025	2026	2027	2028
General D.21-06-035 requirements[7]	2,000	6,000	1,500			
LLT resources, as defined in D.21-06-035						2,000
New in D.23-02-040				2,000	2,000	
Total	**2,000**	**6,000**	**1,500**	**2,000**	**2,000**	**2,000**
Total (cumulative)	**2,000**	**8,000**	**9,500**	**11,500**	**13,500**	**15,500**

Resources must be online by June 1 to count for a given year

Option to extend LLT procurement deadline to 2031

1 D.21-06-035 https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K603/389603637.PDF;
2 D.23-02-040 https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF;
3 D.24-02-047 https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M525/K918/525918033.PDF

2023 SERVM MTR Sufficiency Analysis

- As part of the Preferred System Plan (PSP) development in 2023, staff conducted an MTR sufficiency analysis in SERVM
  - SERVM-based perfect capacity (PCAP) shortfall calculations were performed on a modeling baseline that assumes partial compliance with MTR-ordered procurement
  - Then remaining MTR was assessed relative to the PCAP shortfall need
  - This analysis relied on the 2022 IEPR load forecast
- Staff concluded at the time that MTR provided a sufficient buffer of ~2,800 PCAP MW in 2028

MTR Sufficiency Analysis: Result

	(Units = Perfect capacity MW)	2023	2024	2025	2026	2027	2028	Notes
A	MTR Ordered Procurement (annual)	2,000	6,000	1,500	2,000	2,000	2,000	
B	MTR Ordered Procurement (cumulative)	2,000	8,000	9,500	11,500	13,500	15,500	Cumulative sum of A
C	MTR Incremental Procurement (in PSP Baseline)	2,896	4,219	4,578	4,700	4,719	4,750	Source: Staff analysis of RESOLVE-centric Generator List
D	Remaining MTR Procurement (above PSP Baseline)	(896)	3,781	4,922	6,800	8,781	10,750	B – C
E	SERVM PCAP Shortfall (using PSP Baseline)	n/a	2,200	6,000	5,800	8,000	8,000	Direct SERVM model outputs
F	MTR Gap: MTR ordered relative to SERVM shortfall	n/a	(1,581)	1,078	(1,000)	(781)	(2,750)	E – D

- Assuming full gas plant retention*:
  - 2024, 2026, 2027, and 2028 have moderate surplus capacity in the MTR order
  - 2025 has a deficit of ~1,100 MW (the MTR order is not sufficient in that year)

Full deck available here: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2023-irp-cycle-events-and-materials/psp-ruling-reliability-and-emissions-analysis-slides_20231004.pdf

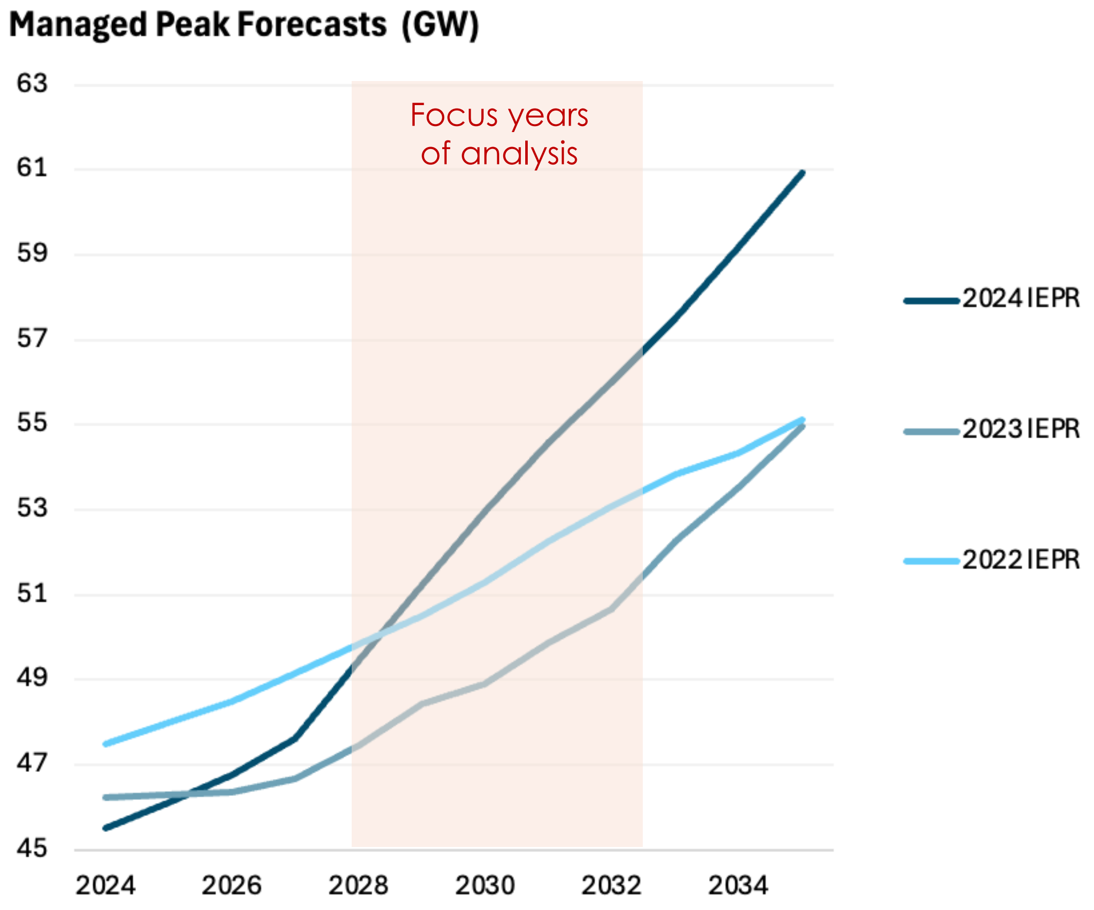
Changes since 2023 MTR Sufficiency Analysis

- The 2023 analysis examined the period of 2023 to 2028
- The Commission continues to develop a potential RCPPP framework in conjunction with parties in the IRP proceeding, but it is not yet complete
- An analysis of reliability in the 2028 to 2032 timeframe can inform whether the prior IRP procurement orders, in conjunction with the expectation of future requirements, provide sufficient resources to allow runway for the development and potential adoption of RCPPP

Current Reliability Drivers

Recent Load Forecasts Show Increasing Growth

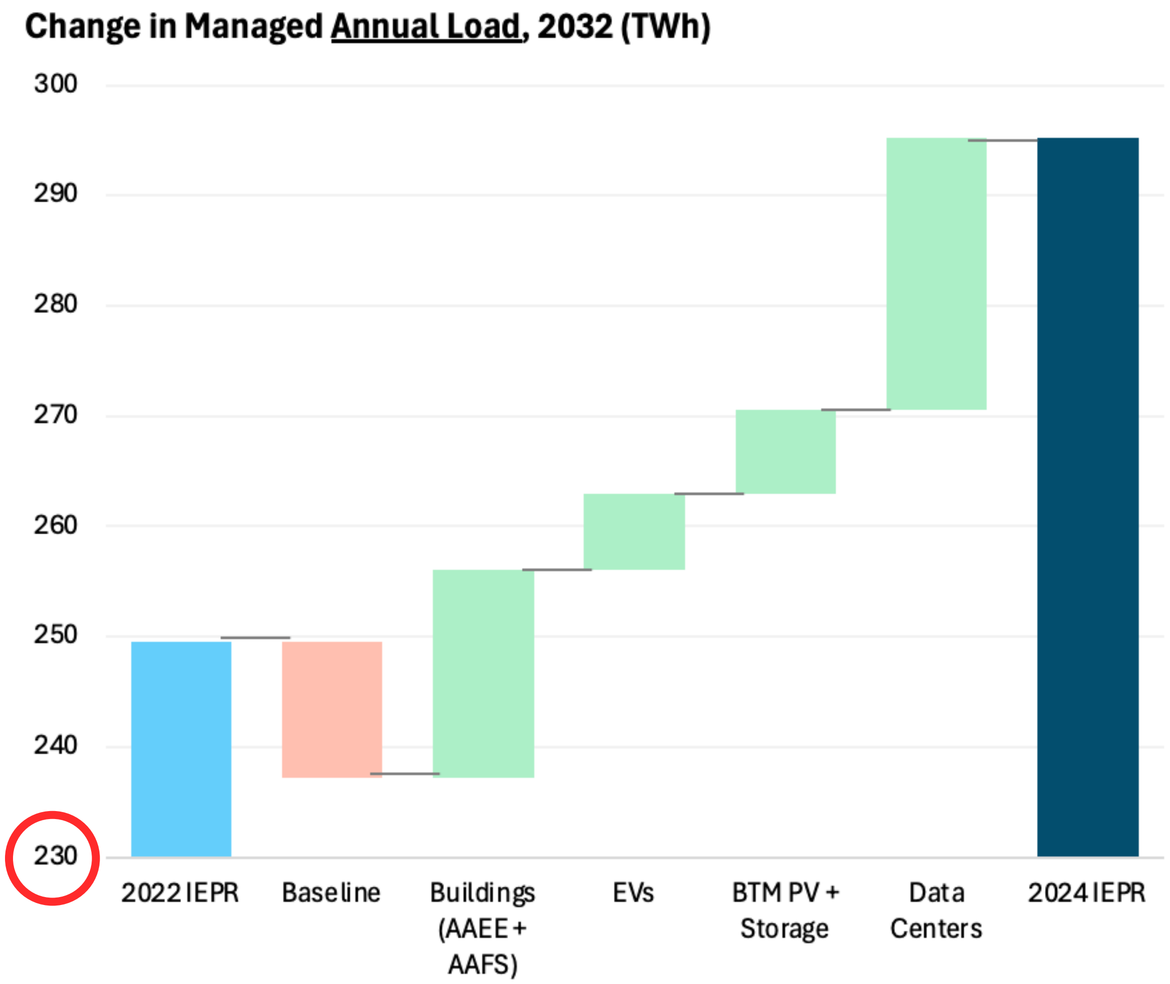
- The 2022 IEPR forecast was used for the 2023 PSP and associated SERVM study evaluating MTR sufficiency
- While the 2023 IEPR, used for the 25-26 TPP, had a lower starting peak than the 2022 IEPR, the forecasted peak grew more rapidly after 2028
- The most recent **2024 IEPR** is a significantly **more aggressive load forecast** in both the mid- and long-term
  - By 2028, the 2024 IEPR forecasted managed peak (i.e. after BTM PV)is ~2 GW higher than the 2023 IEPR.
  - By 2032, the 2024 IEPR forecasted managed peak (i.e. after BTM PV) is ~56 GW, 3 GW higher than the 2022 IEPR and >5 GW above the previous 2023 IEPR
  - Difference in near-term peaks is driven by updated assumptions of population growth (including near-term) starting in the 2023 IEPR, and updates to the IEPR hourly load model[1]



Managed Load = Total Consumption minus BTM PV generation (i.e. sales + losses)
1 https://www.energy.ca.gov/event/workshop/2023-12/iepr-commissioner-workshop-california-energy-demand-forecast-results

Drivers of Growth in 2024 IEPR

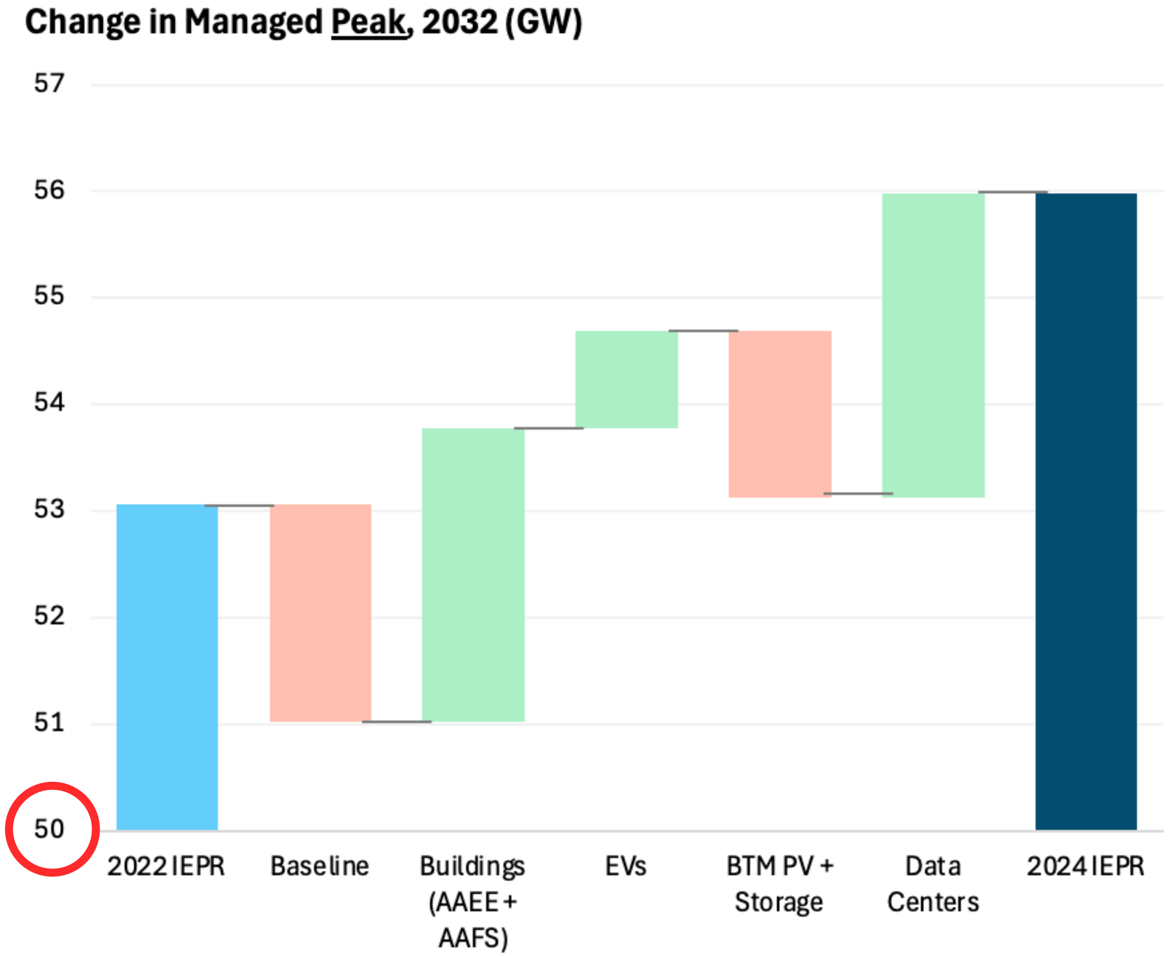
- Increases in load are driven by:
  - Significant **data center** loads in the 2024 IEPR, based on existing applications
  - Significant growth in **building electrification** assumed in 2024 IEPR forecast relative to 2022
    - Incorporates recent BAAQMD zero-Nox heating policies, and proposed CARB zero-emission heating regulation (~2030)
  - Less adoption and lower capacity factors for **BTM Solar and Storage**
  - Updates to **electric vehicles**, including higher vehicle count and vehicle miles travelled (VMT)
- On net, baseline load has decreased from the 2022 IEPR due to updated assumptions for population growth, etc., though the decrease represents only 5% of total baseline load



Managed Load = Total Consumption minus BTM PV generation (i.e. sales + losses)
TOU rates and climate change are aggregated into baseline changes

Impacts on Forecasted Peak

- In 2032, data centers and incremental building load in the 2024 IEPR add ~5.5 GW to managed peak needs, relative to 2022 IEPR
  - Though most incremental building electrification load occurs in the winter, there are also increases in building loads in summer evenings, driven by new AC adoption in mild-climate areas and electric resistance water heating
  - Data center load is relatively "flat" (i.e. consistent across the day and seasonally)
- Electric vehicles contribute an additional ~1 GW of peak growth in 2032
  - IEPR assumes managed charging, with most EV load at night or midday
- The impact of the load components noted above shift the managed peak from 7 pm to 5 pm, where BTM solar output is higher; this and reduced baseline load mitigate some of the peak growth



Managed Load = Total Consumption minus BTM PV generation (i.e. sales + losses)

Current Study Methodology

Summary of Study Methodology (1)

- The Mid-Term need determination analysis focused on **study years 2028-32**.
- **Step 1: Create the 2025 Need Determination Analysis Baseline.**
  - For the purposes of this study, the 2025 Need Determination Analysis baseline is defined as the minimum resource build that assumes full compliance with MTR-ordered procurement
  - Account for LSEs' MTR contracts coming online (by the commercial operation dates in their respective contracts) by calculating the capacity of LSE contracts (as of LSEs' June 2025 IRP Compliance filings) which are incremental to the IRP baseline used for 2025-26 TPP modeling (no RESOLVE selected resources are included)
  - Evaluate the total MTR procurement claimed by LSEs in the IRP baseline and incremental contracts shown in June 2025 IRP compliance updates
  - Calibrate to the minimum amount of MTR NQC MW required in each respective year by previous IRP orders by adding or subtracting capacity

Summary of Study Methodology (2)

- **Step 2: Analyze the 2025 baseline in SERVM to determine incremental need based on the new 2024 IEPR load forecast.**
  - Enter the base portfolio determined in the steps above into SERVM and calculate the loss of load expectation (LOLE) for each study year
  - Calibrate the system to approximately 0.1 LOLE in each study year by adding perfect capacity (PCAP)
  - The PCAP added in each study year is equivalent to the effective capacity (ELCC MW) need
- **Step 3: Incorporate the implications of long lead-time (LLT) resource delays following Decision (D.) 25-09-007.[1]**
  - Remove PCAP from the base portfolio studied in SERVM to reflect an updated assumption of minimum levels of on-time MTR compliance for LLT resources under D.25-09-007
  - The original analysis in Step 2 was based upon minimum MTR compliance under the MTR Bridge Resource Proposed Decision (PD) as originally published on August 13, 2025; the decision as ultimately adopted may result in greater delays in online dates of LLT resources, so the adjusted analysis assumes more minimal levels of on-time MTR compliance for LLT resources
- **Step 4: Analyze the impact of changes in supply or load through sensitivities.**
  - Post-processing approach by changing the PCAP MW need by the change in firm capacity (DCPP) or the change in managed peak + operating reserve margin (high/low load scenarios)
  - Sensitivities analyzed under the base portfolio (step 2) and a "Delayed LLT" portfolio (step 3)

1 D.25-09-007: https://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&docid=581576925

Step 1: Creating and Calibrating an MTR Baseline

Summary of Steps

- The current "IRP Baseline" used in 2025-26 TPP modeling was developed in spring 2024, used RDT data from the December 1, 2023 LSE filings for in-development resources, and is not sufficient to meet the existing MTR orders on its own.
- Staff used more recent (June 2025) LSE filings to develop the **2025 Need Determination Baseline**, which includes the full amount of procurement ordered and no additional resources beyond that

A. "Top-up" the IRP Baseline with latest contracts

Staff add the incremental contracts from the latest (June 2025) RDT dataset on top of the IRP baseline

→

B. Evaluate MTR compliance

Sum up the online & development MTR NQC MW from the RDT data (excluding short-term bridge contracts) and evaluate MTR position

→

C. Add (or subtract) additional capacity to calibrate to MTR need

Add/subtract additional capacity to the amount identified in (A), until any remaining MTR need identified in the (B) is filled*, and any overage is removed**

* Calibration to MTR need includes for "generic" long-term contracts in 2028 to fill any remaining LLT need that is delayed to 2031.
** "Overage is removed" refers to staff ignoring any contracting positions that are in exceedance of MTR existing order requirements.
Note: AB 1373 procurement assumptions are not relevant to the 2028-32 study period.

A. Incremental Contracted MW Above IRP Baseline

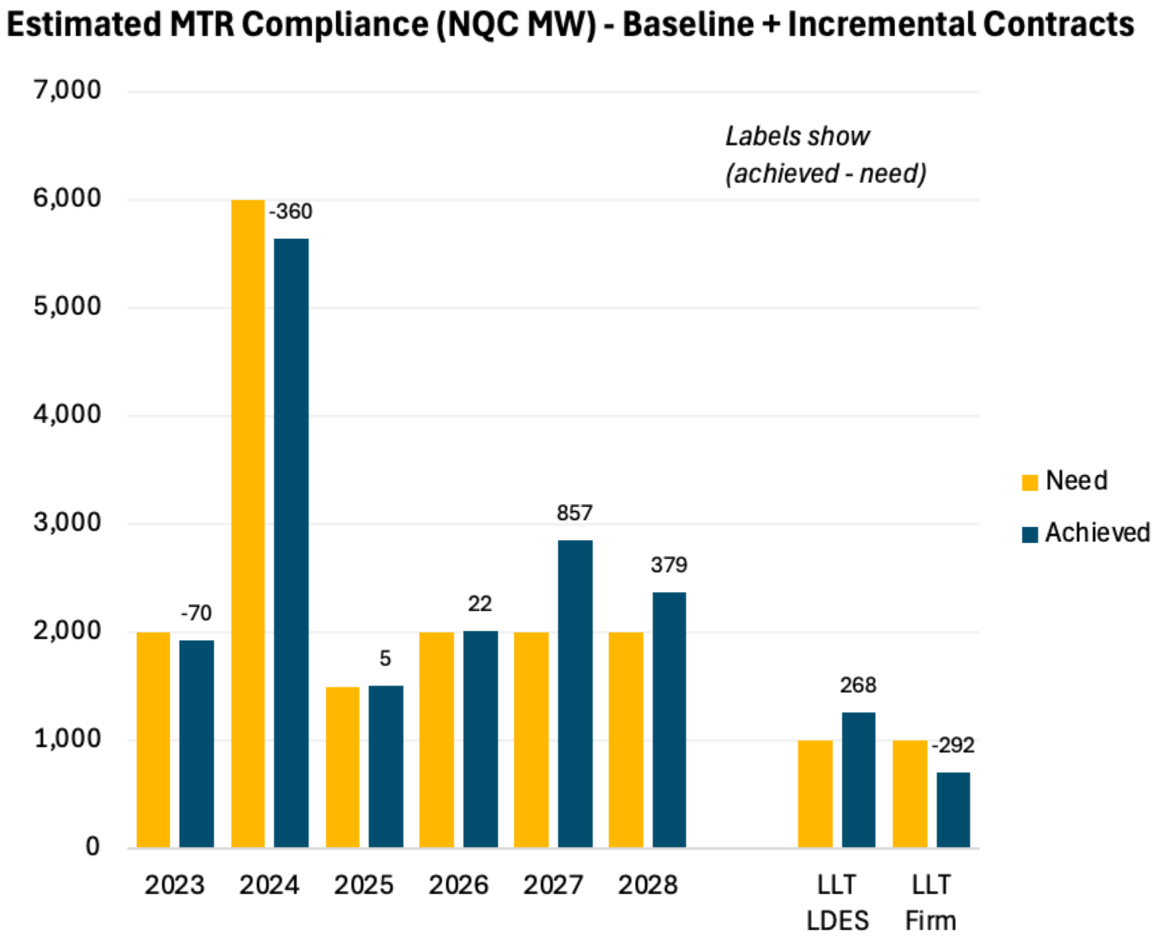
- Staff identified incremental "in-development" contracts in the June 2025 LSEs' IRP Compliance Filings data, which are not included in the IRP Baseline (for TPP) that used the December 2023 LSE Filings
  - Staff excluded short-term bridge contracts (<10 years), "planned/new", and "review" contracts, as well as any data entries judged to be duplicative

Incremental Nameplate MW above IRP Baseline (Contracted)

Resource Type	2028 Incremental Nameplate MW	2031 Incremental Nameplate MW
Geothermal	128	168
Biomass	12	12
In-State Wind	72	72
Out-of-State Wind	535	535
Solar	5,149	5,259
4-hr Battery	6,897	6,897
8-hr Battery	1,048	1,061

B. MTR Position (Baseline + Incremental Contracts)

- June 2025 RDT data, including resources already in the IRP Baseline, shows **16.3 GW (NQC) MTR** contracts online by 2028, exceeding 15.5 GW NQC requirement
  - LLT LDES was met in 2028 based on existing contracts
  - ~300 MW NQC additional LLT Firm need (by 2031) beyond LSEs' existing reported contracts
  - Based on these data, sufficient "generic" MTR procurement is under long-term contract by 2028 to fill the remaining LLT clean-firm gap
    - 2028 contracts include 1 GW of LLT LDES, 0.6 GW of LLT clean-firm, and 0.4 GW of other "generic" resources to meet the 2 GW NQC ordered in MTR
  - Contracts were modeled based on LSE-provided online dates
  - No failure rate for contracts or delays were assumed



C. Incremental Capacity, Calibrated for MTR

- Staff added additional geothermal capacity in 2031 to meet the LLT clean-firm procurement order and removed solar and battery contracts that exceeded 2028 requirements to calibrate modeled procurement with MTR requirements
- Any contracts starting after 2028 (non-LLTs) or 2031 (LLTs) were removed; enough "generic" procurement in 2028 to fill the LLT Firm gap is retained
- These incremental contracts were **added in SERVM on top on the IRP Baseline** (as the "Base Portfolio"), to determine the need in 2028-32 on top of the existing procurement orders

Incremental Nameplate MW above IRP Baseline (Final SERVM Inputs)

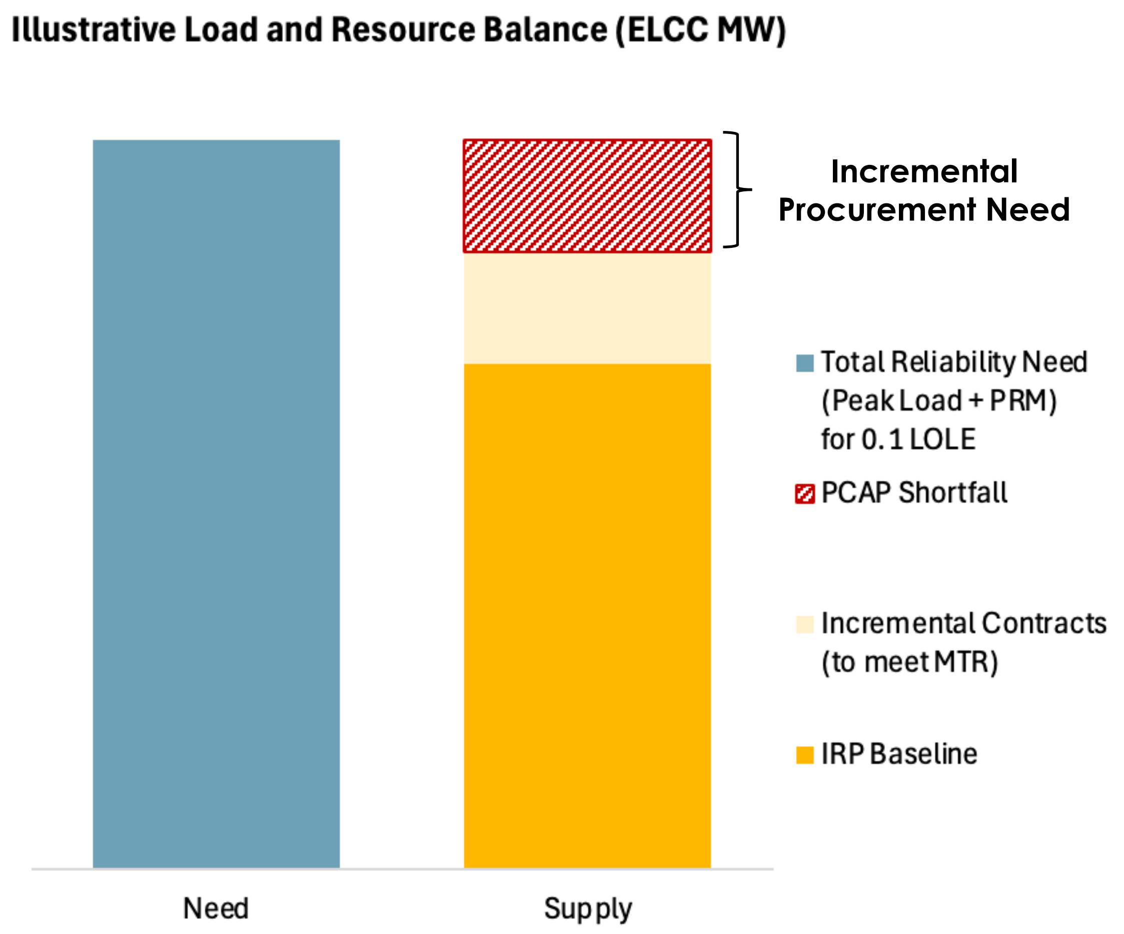
Resource Type	2028 Incremental Nameplate MW	2031 Incremental Nameplate MW
Geothermal	128	482
Biomass	12	12
In-State Wind	72	72
Out-of-State Wind	535	535
Solar	4,917	4,917
4-hr Battery	6,145	6,145
8-hr Battery	751	751

Red text indicates changes to incremental MW in this step to calibrate to MTR procurement orders

Step 2: SERVM Analysis Results – Base Portfolio

SERVM Modeling Methodology

- The SERVM loss of load probability (LOLP) model simulates 23 weather years (2000-2022) of load, hydro, wind, and solar conditions
- For each study year (2028-32), SERVM quantifies the loss of load expectation (LOLE) using the 2025 Need Determination Analysis baseline (IRP Baseline + incremental contracts) and 2024 IEPR load forecast
- Staff “tuned” SERVM to meet the reliability standard of 0.1 LOLE (1 day in 10 years) by adding perfect capacity (PCAP)
- **The amount of PCAP added is equivalent to the reliability need, measured in effective (ELCC) MW**



Base Portfolio

- Installed capacity reflects the 2025 Need Determination Analysis baseline (IRP Baseline + incremental contracts)
- The portfolio excludes additional resources to meet long-term GHG reduction goals as modeled in the IRP Planning Track; thus, the portfolio is static except for a small increase in geothermal (for MTR LLT) and the growth in BTMPV derived from the 2024 IEPR forecast
- Diablo Canyon and once-through cooling (OTC) steam units in the Strategic Reliability Reserve are modeled offline in all years
  - No additional retirements were assumed
- Simultaneous Import and Export constraints are as described in the [Draft 2025 Inputs and Assumptions]

CAISO Base Portfolio for SERVM Analysis (Nameplate MW)[1]

Resource Type	2028	2029	2030	2031	2032
Natural Gas	26,398	26,398	26,398	26,398	26,398
Cogen	2,365	2,365	2,365	2,365	2,365
Nuclear	635	635	635	635	635
Geothermal	2,240	2,240	2,240	2,594	2,594
Biomass/Biogas	837	837	837	837	837
Hydro	9,144	9,144	9,144	9,144	9,144
In-State Wind	6,605	6,605	6,605	6,605	6,605
Out-of-State Wind	3,621	3,621	3,621	3,621	3,621
Solar	28,356	28,356	28,356	28,356	28,356
BTM PV	22,638	23,589	24,593	25,620	26,561
4-hr Battery	20,662	20,662	20,662	20,662	20,662
8-hr Battery	1,043	1,043	1,043	1,043	1,043
Pumped Hydro Storage	1,643	1,643	1,643	1,643	1,643
Demand Response	3,438	3,438	3,438	3,438	3,438
Total	**129,626**	**130,577**	**131,581**	**132,961**	**133,902**

1 Nameplate shown for cogen, geothermal, biomass/biogas, hydro, and demand response per RESOLVE portfolio reporting. Note that SERVM portfolio reporting is often reported in monthly NQC (for a summer month), rather than nameplate capacity.

Perfect Capacity (PCAP) Tuning Results for 2028-32

- 2028 was found to be over-reliable, while all other years required PCAP addition to achieve ~0.1 LOLE
- Study years 2031 and 2032 show a jump in PCAP need, relative to 2028-2030

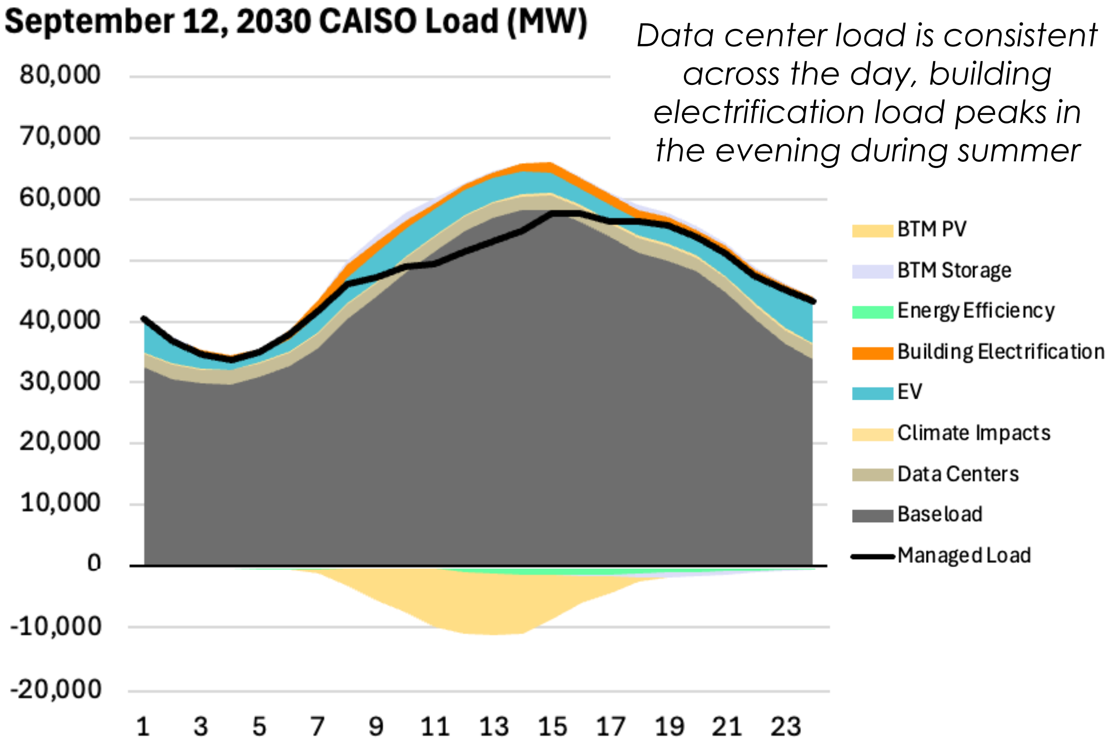
SERVM Reliability Analysis Results (Base Scenario)

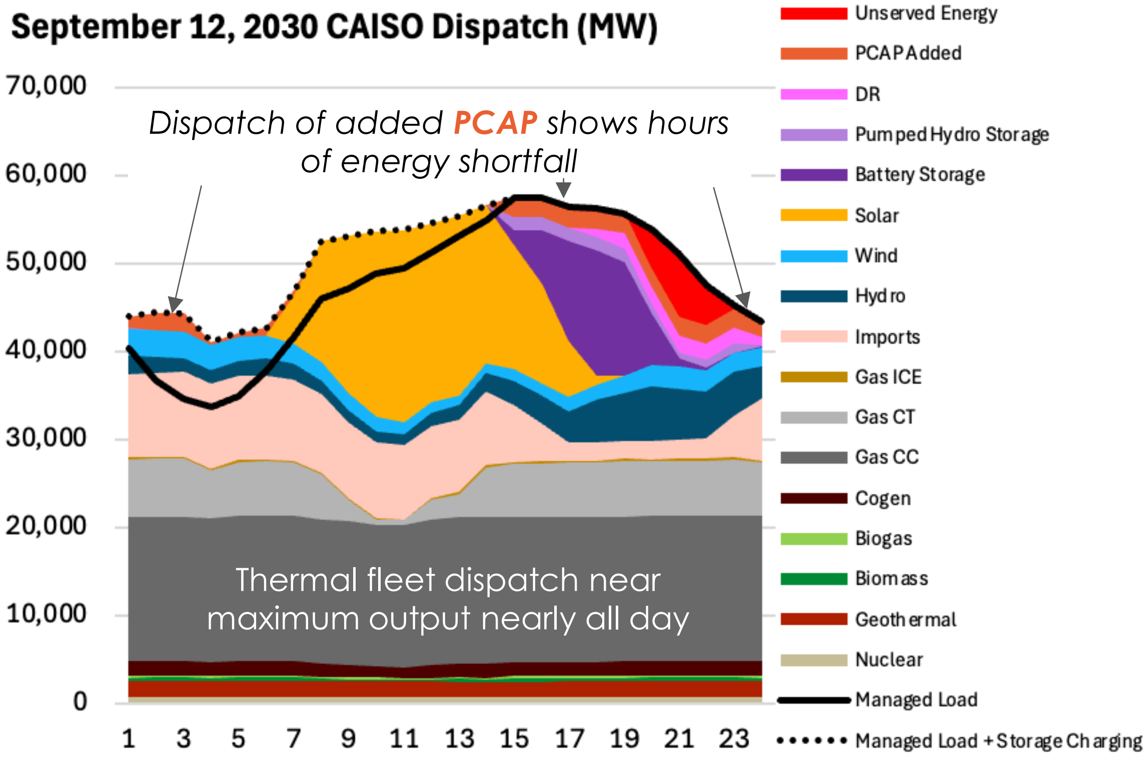
Study Year	Total LOLE after tuning (days/year)	EUE after tuning (MWh)	Cumulative PCAP added for tuning (MW)
2028	0.043	254	n/a
2029	0.115	850	**1,200**
2030	0.117	755	**2,300**
2031	0.111	619	**4,000**
2032	0.098	525	**5,900**

Cumulative PCAP (Effective Capacity) Need to reach 0.1 LOLE

Dispatch on Highest Loss of Load Day (2030)

- Unserved energy tends to occur in late summer evening hours coincident with batteries getting exhausted
- Graphics show hourly load by component and dispatch by resource type, on the day with highest expected unserved energy (EUE)

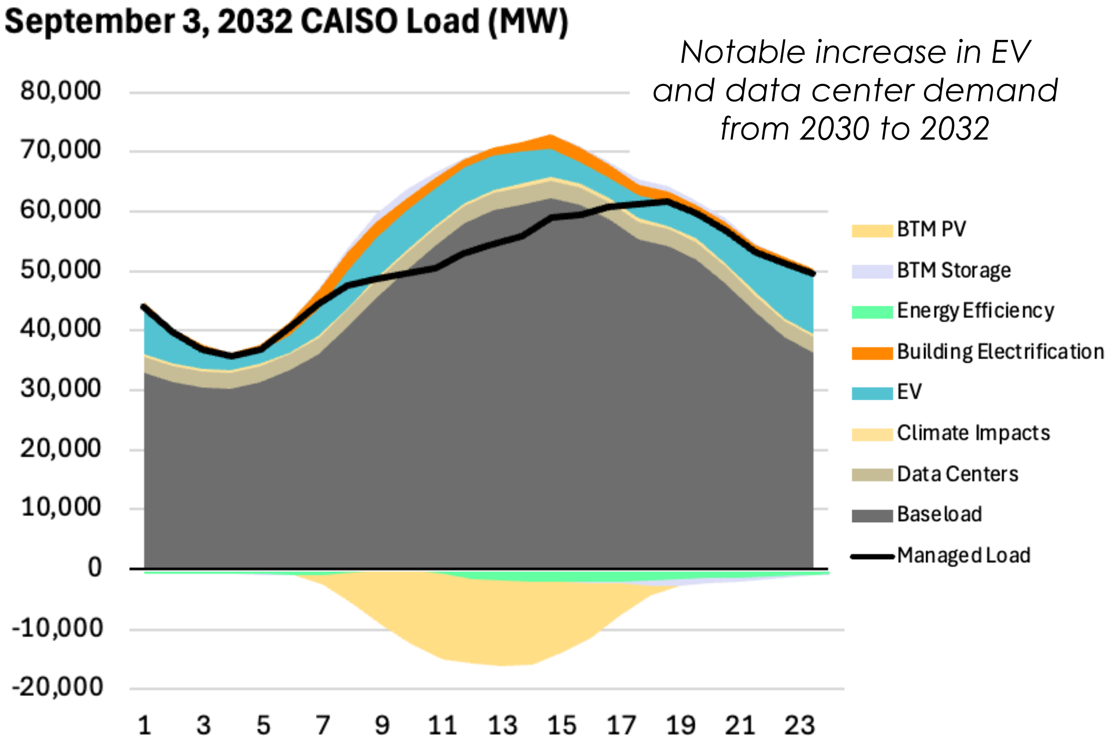


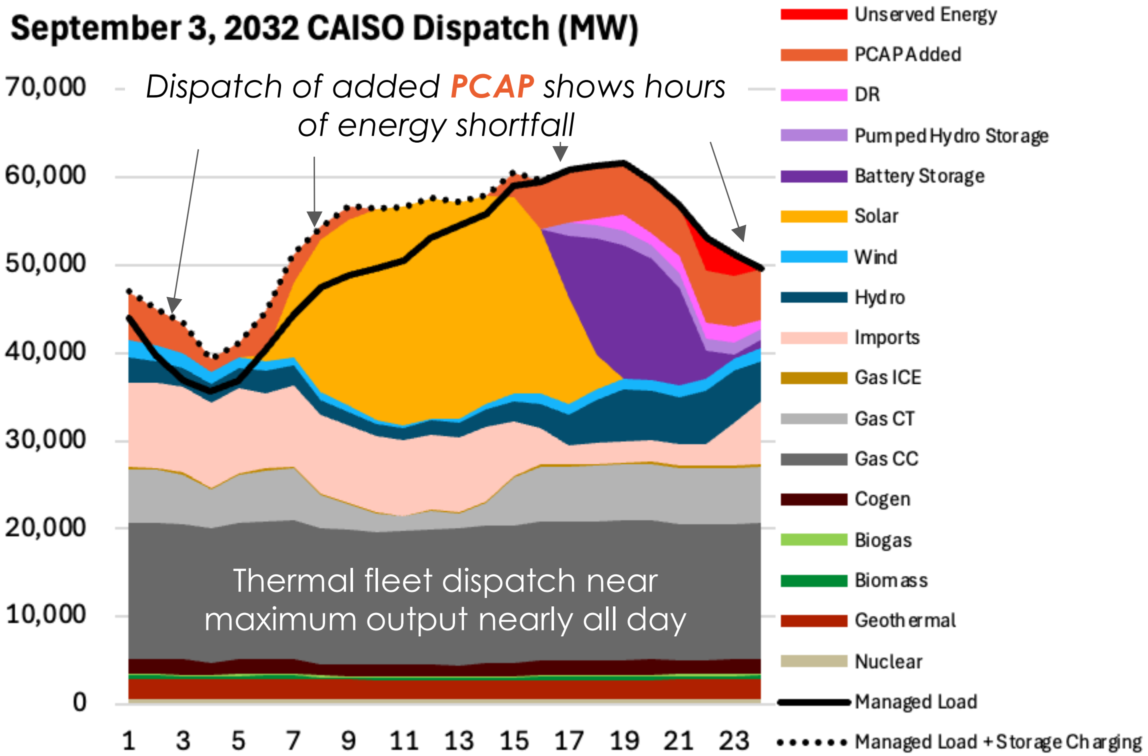


SERVM runs a combination of 23 weather years and 23 hydro years (2,645 years in total). The required PCAP is based on the weighted average of all years. Some show zero loss of load, and some higher loss of load. Highest EUE for Sept. 12, 2030 occurs in the 2015 weather year and 2015 hydro year in SERVM.

Dispatch on Highest Loss of Load Day (2032)

- Unserved energy tends to occur in late summer evening hours coincident with batteries getting exhausted
- Graphics show hourly load by component and dispatch by resource type, on the day with highest expected unserved energy (EUE)

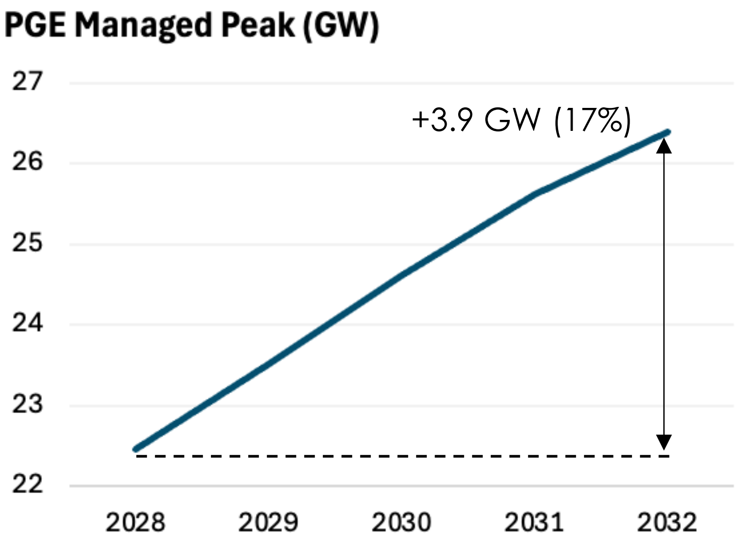


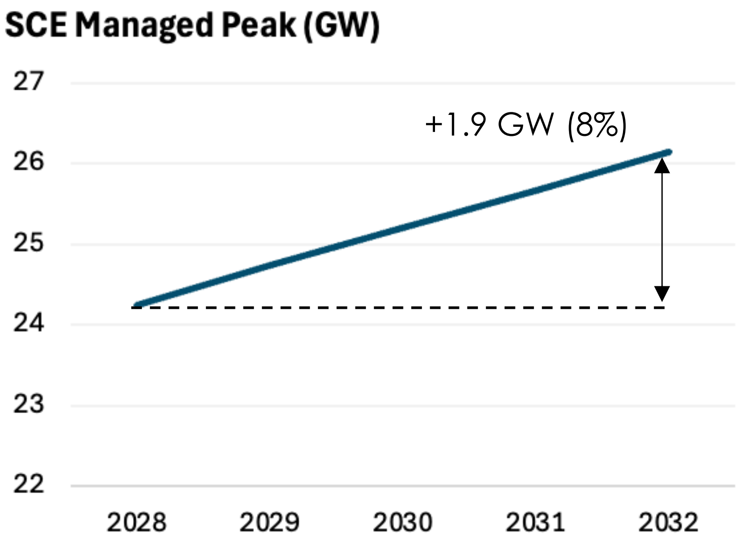


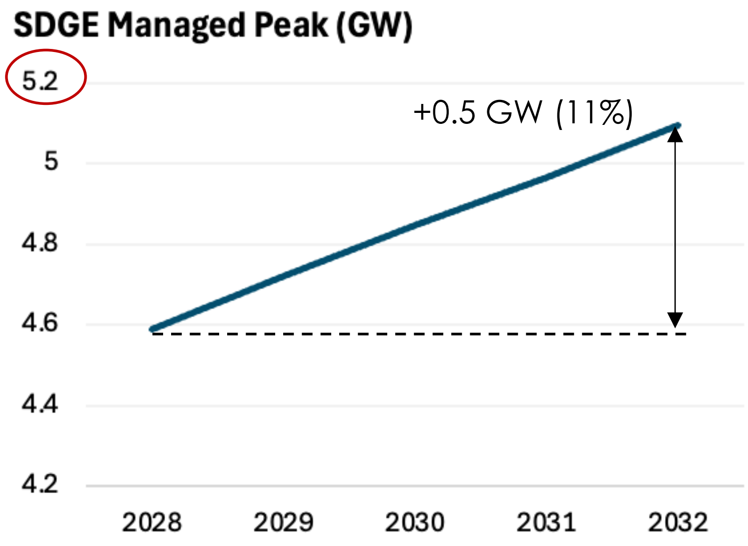
SERVM runs a combination of 23 weather years and 23 hydro years (2,645 years in total). The required PCAP is based on the weighted average of all years. Some show zero loss of load, and some higher loss of load. Highest EUE for Sept. 3, 2032 occurs in the 2022 weather year and 2001 hydro year in SERVM,

Managed Peak Growth (2028-32) by Planning Area

- As staff iterated with increasing amounts of PCAP added to tune 2032 to 0.1 LOLE, the share of PCAP allocated to PG&E was increased because the PG&E-specific LOLE increased faster relative to SCE and SDG&E
- This is consistent with PG&E seeing a much sharper growth in managed demand (e.g. higher growth in EV charging and Data Centers) than other regions (based on 2024 IEPR forecast)







Relating 2029-32 results to recent RA proceeding studies of 2026

- The final LOLP model results* used to inform RA Decision D.25-06-048 show the CAISO system to be over-reliable in 2026, with approximately 1,500 MW of surplus, assuming Diablo Canyon is online in 2026, all OTC steam units are offline, and 2026 managed peak demand is from the 2023 IEPR forecast
  - The 1,500 MW surplus is implied because the RA 2026 study configuration consistent with approximately 0.1 LOLE annually capped CAISO simultaneous imports at 2,500 MW rather than the default value of 4,000 MW.
- The need determination finding for 2029 showing a modest shortfall does not conflict with the previous RA model results for 2026 showing a modest surplus for the following reasons:
  - The studies examine different years with different capacity and load balances, all else being equal
  - The 2026 RA study accounted for the capacity of Diablo Canyon Power Plant, while the need determination analysis did not
  - The 2026 RA study used the 2023 IEPR, which forecasts lower peak loads than the 2024 IEPR, used in this analysis

* See details in this presentation "Appendix B to Loss of Load Expectation Study for 2026: Revised Slice of Day Tool Analysis": https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/resource-adequacy-history/r23-10-011/ra_workshopslides_01232025.pdf

Step 3: Incorporate Implications of D.25-09-007 – Delayed Realization of LLT Portfolio

Delayed LLT Portfolio

- Under the recent MTR Bridge Petition for Modification Decision (D.25-09-007)[1], an LSE is not out of compliance if its LLT resources' online dates are delayed from 2028 to 2031, provided the LSE has a contract for the capacity and it is otherwise meeting its month-ahead system RA obligations
  - LSEs are also offered the option to conduct long-term contracting for generic replacement resources, but it is not a requirement
- Under D.25-09-007, a scenario yielding the lowest MTR resource build would be:
  - All 2,000 NQC MW of LLT resources is delayed until 2031, with none coming online earlier
  - No generic capacity is procured in 2028 to replace the delayed LLT resources, meaning no generic MTR resources are procured above the 13,500 NQC MW required by 2027
- While the base portfolio assumed that contracted LLT resources would come online by the CODs in their respective contracts (mostly 2028),this Delayed LLT portfolio delays all 2,000 NQC MW of MTR procurement previously ordered for 2028, and removes “generic” MTR procurement in 2028 from the base portfolio, reflecting the **minimum level of compliance with MTR**

1 https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M580/K329/580329367.PDF

MTR Procurement: Base Portfolio vs. Delayed LLT Portfolio

MTR and SMTR Procurement Assumed – Base Portfolio (NQC MW)

Procurement Type	2028	2029	2030	2031	2032
Generic (Cumulative)	13,867	13,867	13,867	13,867	13,867
LLT LDES	1,000	1,000	1,000	1,000	1,000
LLT Firm	633	633	633	1,000	1,000
Total	**15,500**	**15,500**	**15,500**	**15,867**	**15,867**

MTR and SMTR Procurement Assumed – Delayed LLT Portfolio (NQC MW)

Procurement Type	2028	2029	2030	2031	2032
Generic (Cumulative)	13,500	13,500	13,500	13,500	13,500
LLT LDES	-	-	-	1,000	1,000
LLT Firm	-	-	-	1,000	1,000
Total	**13,500**	**13,500**	**13,500**	**15,500**	**15,500**
Difference from Base Portfolio	**2,000**	**2,000**	**2,000**	**367**	**367**

Delayed LLT Portfolio – PCAP Results

- Relative to the base portfolio, the Delayed LLT portfolio **increases the PCAP need** by ~2,000 MW in 2029-30 and ~367 MW in 2031-32
- 2028 not shown, as the base portfolio surplus relative to 0.1 LOLE was not quantified from SERVM

SERVM Reliability Analysis Results (Delayed LLT Scenario)

Study Year	Base Portfolio PCAP Need (MW)	Incremental Need Under Delayed LLT Portfolio (MW)	Cumulative PCAP Need, Delayed LLT Portfolio (MW)
2029	1,200	+2,000	**3,200**
2030	2,300	+2,000	**4,300**
2031	4,000	+367	**4,367**
2032	5,900	+367	**6,267**

Cumulative PCAP Need

4. Sensitivity Results

Methodology & List of Sensitivities

- Staff analyzed potential changes to the need using a **heuristic approach**, manually adding or subtracting PCAP from the total need after the SERVM analysis was complete, corresponding to the change in forecasted peak MW or firm MW available in each sensitivity; the sensitivities were **not analyzed in SERVM**
- Staff included the following sensitivities:
  - **1. Continued DCPP Operations**: firm MW removed from PCAP shortfall
  - **2. Increased Data Center Load**: firm load (+ 6% op. reserves)[1] added to PCAP shortfall
  - **3. Reduced Load (electrification + data centers)[2]**: managed peak impact (+ 6% op. reserves)[1] removed from PCAP shortfall
- (2) increases PCAP need, (1) and (3) reduce PCAP need
- Sensitivities were analyzed under both the Base portfolio (SERVM results from step 2) and the Delayed LLT portfolio (step 3) reflecting minimum level of MTR compliance based on D.25-09-007

1 Only the operating reserve component of the PRM was added to load changes, since the data center and EV loads that make up most of the changes are not modeled as weather varying in SERVM
2 Unlike the DCPP and data center sensitivities, whereby a firm resource or flat load approximate a PCAP MW, the heuristic approach for the reduced load sensitivity is less precise due to variable electrification and BTM PV load shapes across the year and peak day

Continued DCPP Operations Sensitivity Inputs

- This sensitivity explored additional supply (reducing need) by including the proposed extension of DCPP operations as outlined in Senate Bill (SB) 846
  - **Original retirement dates that IRP planning is required to use:** Unit 1 on November 2, 2024; Unit 2 on August 26, 2025[1]
  - **Retirement dates in SB846**: Unit 1 on October 31, 2029; Unit 2 on October 31, 2030[2]
- Staff reduced the PCAP need by 1,100 MW per unit[3], based on the availability of each unit in the given study year
  - Both units available for 2028 & 2029 peak
  - Unit 2 available for 2030 peak
  - Neither for 2031-32

1 https://www.energy.ca.gov/sites/default/files/2020-03/Nuclear_Power_Reactors_in_California_ada.pdf;
2 https://legiscan.com/CA/text/SB846/id/2605677;
3 https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/what-are-nuclear-electric-cost/senate-bill-846

Increased Data Center Load Sensitivity Inputs

- For a sensitivity with increased need, staff used the 2024 IEPR "Local Reliability" scenario instead of the 2024 IEPR "Planning" scenario for data center load
  - Planning Scenario assumes existing data center applications (as of the publishing of 2024 IEPR), Local Reliability assumes further growth beyond that
- Staff increase the PCAP need by the data center MW difference between scenarios, for the peak hour of each year across the CAISO system, plus 6% operating reserve requirements
- This sensitivity represents a high end for potential need, as the 2024 IEPR Planning Scenario used in the SERVM analysis already includes aggressive transportation and building electrification loads

Data Center Managed Peak Impacts (MW)

IEPR Scenario	2028	2029	2030	2031	2032
Local Reliability	1,448	2,022	2,525	3,014	3,233
Planning Scenario	1,396	1,927	2,295	2,725	2,860
Difference	**52**	**95**	**230**	**289**	**373**
PCAP Difference (incl. operating reserves)	**55**	**101**	**244**	**306**	**395**

Data source: 2024 IEPR, CED 2024 Peak Forecast

Reduced Load Sensitivity Inputs - Load Modifiers

- Staff designed this sensitivity to test potential impacts of recent policy changes on load growth, which would reduce need on net (note that due to uncertainty, the impact of tariffs was not included)

Load Modifier	Potential Policy Impacts	Adjustment Made	Change in 2028 Load (TWh)	Change in 2032 Load (TWh)
Buildings (AAEE, AAFS)	OBBBA[1] AB306[2] Delayed CARB SIP Hearing[3]	Public AAEE/AAFS Scenario 2 (instead of Scenario 3 - Planning Scenario) as best proxy for current policy[6]	-3.0 TWh	-8.5 TWh
Baseline (Economic) Electric Vehicles	OBBBA	Updated forecast without federal tax credits provided by CEC IEPR staff	-1.7 TWh	-4.5 TWh
Policy-Driven Electric Vehicles (AATE)	EPA Waiver Repeal[4]	No incremental AATE load 2025-31[7]; same AATE growth post-2031, delayed 6 years	-3.8 TWh	-15.9 TWh
BTM Solar	OBBBA	Updated forecast without federal tax credits provided by CEC IEPR staff	+1.3 TWh	+3.0 TWh
Data Centers	N/A, though uncertain confidence level for data center applications[5]	50% haircut to total data center load	-6.0 TWh	-12.3 TWh

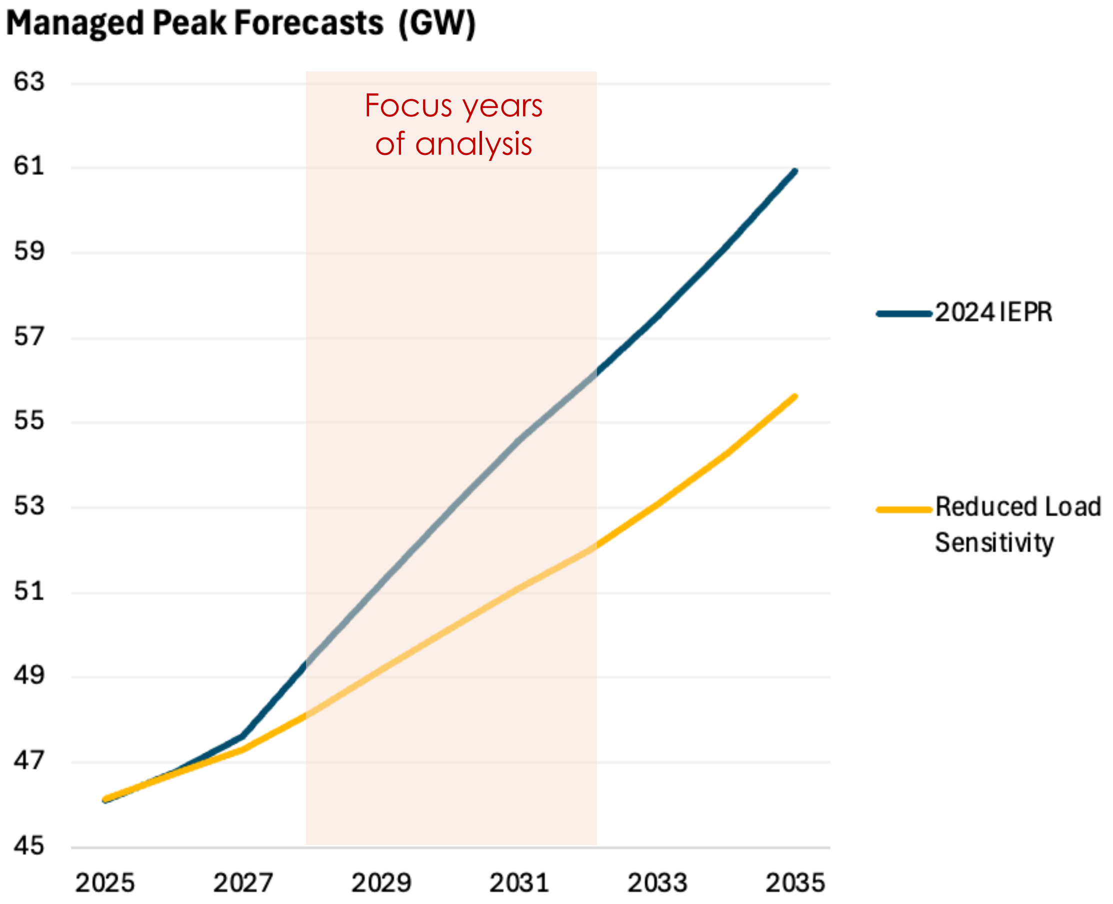
1 https://www.congress.gov/bill/119th-congress/house-bill/1/text; 2 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202520260AB306;
3 https://www.energy.ca.gov/event/workshop/2025-08/iepr-commissioner-workshop-energy-demand-forecast-load-modifier-scenario;
4 https://calmatters.org/environment/2025/05/california-electric-car-mandate-senate-revoke-waiver/;
5 CEC IEPR staff ran a sensitivity with a 50% confidence level for PG&E data center applications;
6 Scenario 2 includes existing BAAQMD and SCAQMD zero-Nox rules, but not the proposed CARB SIP zero-emission heating standard;
7 Staff used 2031 as a benchmark for modeling potential returns of pre-2025 federal policy

Reduced Load Sensitivity Inputs – Peak Impact

- Staff reduce the PCAP need by managed peak MW difference between scenarios, plus 6% operating reserve requirements
  - Managed peak difference grows to ~4 GW by 2032

CAISO Managed Peak Forecast (MW)

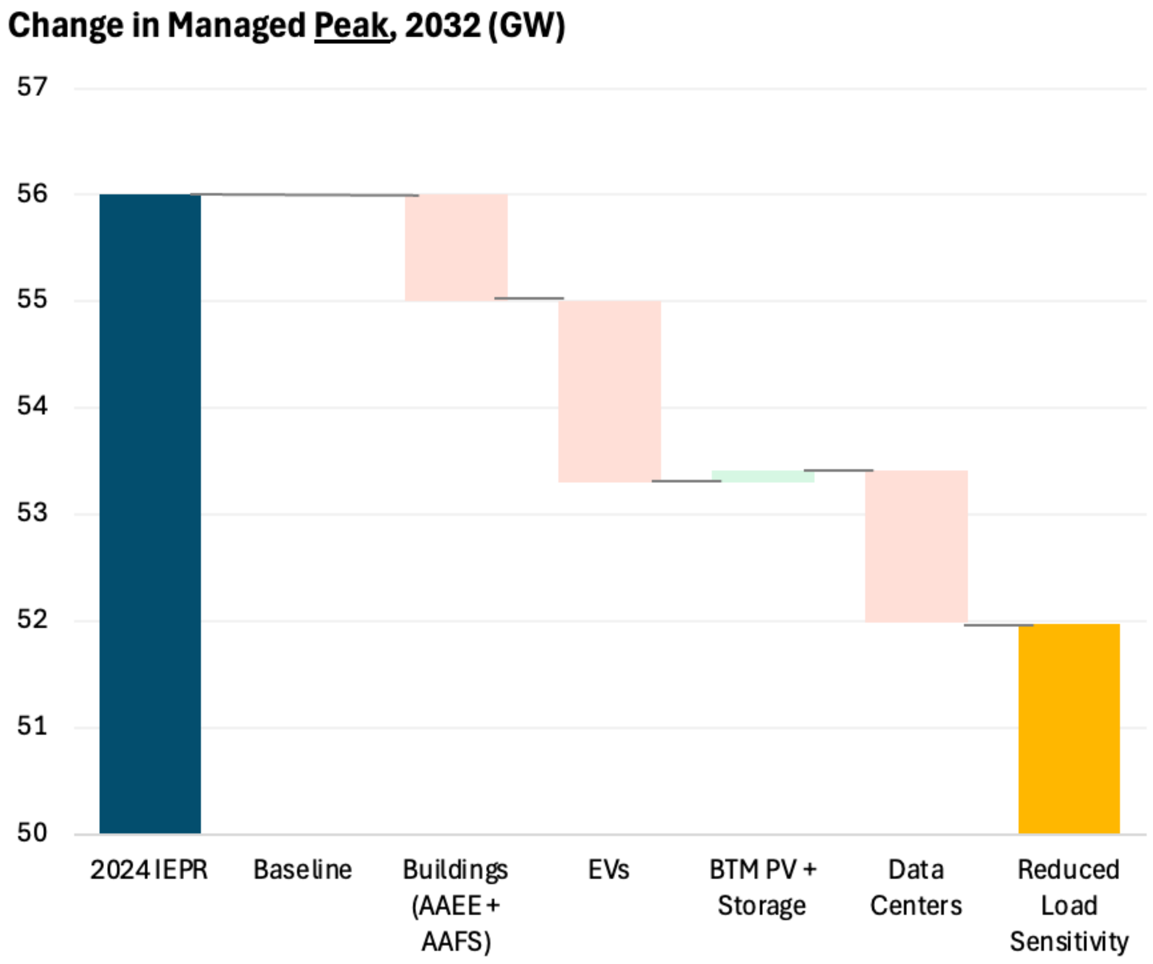
IEPR Scenario	2028	2029	2030	2031	2032
IEPR Planning Scenario	49,450	51,230	52,940	54,548	55,983
Reduced Load Sens.	48,165	49,168	50,154	51,088	51,969
Difference	**-1,285**	**-2,062**	**-2,786**	**-3,490**	**-4,014**
PCAP Difference (incl. operating reserves)	**-1,362**	**-2,186**	**-2,953**	**-3,699**	**-4,255**



Managed Load = Total Consumption minus BTM PV generation (i.e. sales + losses)

Reduced Load Sensitivity Inputs – Peak Impact by Load Modifier

- Peak reduction is driven by a mix of building, EV, and data center load reductions
  - Lower BTM PV leads to slight increase
  - No change in baseline load
- Though peak timing (late summer 5 pm) remains the same, reductions in building and EV load do not have a uniform effect on load in other hours
  - Due to these variable load shapes, the heuristic's ability to capture changes in PCAP need with precision are limited for this sensitivity



Managed Load = Total Consumption minus BTM PV generation (i.e. sales + losses)

Sensitivity Results – Base Portfolio

- Continued DCPP operations eliminates need in 2029 and reduces 2030 need by approximately half
- Increased data center load modestly increases need
- Reduced load sensitivity, modeled by staff as a proxy for recent policy changes, may eliminate 2029-30 need and significantly reduce 2031-32 need
- 2028 not shown, as Base portfolio surplus relative to 0.1 LOLE was not quantified from SERVM

Cumulative PCAP Need Results for Base Scenario and Sensitivities (MW)

Study Year	Base Portfolio (SERVM results)	Reduced Load	Increased Data Center Load	Continued DCPP Operations
2029	**1,200**	**0** (surplus) (-2,186)	**1,301** (+101)	**0** (surplus) (-2,200)
2030	**2,300**	**0** (surplus) (-2,953)	**2,544** (+244)	**1,200** (-1,100)
2031	**4,000**	**301** (-3,699)	**4,306** (+306)	**4,000**
2032	**5,900**	**1,645** (-4,255)	**6,295** (+395)	**5,900**

Reminder: Base Portfolio assumes 15.5 NQC GW of MTR procurement by 2028, with small amounts of additional LLT resources in 2031. DCPP current retirement dates are October 31, 2029 for Unit 1 and October 31, 2030 for Unit 2.

Sensitivity Results – Delayed LLT Portfolio

- Continued DCPP operations reduces need by ~70% in 2029 and ~25% in 2030
- Increased data center load modestly increases need
- Reduced load sensitivity, modeled by staff as a proxy for recent policy changes, may significantly reduce need in all years
- 2028 not shown, as Base portfolio surplus relative to 0.1 LOLE was not quantified from SERVM

Cumulative PCAP Need Results for Delayed LLT Portfolio Scenario and Sensitivities (MW)

Study Year	Delayed LLT Portfolio	Reduced Load	Increased Data Center Load	Continued DCPP Operations
2029	**3,200**	**1,014** (-2,186)	**3,301** (+101)	**1,000** (-2,200)
2030	**4,300**	**1,347** (-2,953)	**4,544** (+244)	**3,200** (-1,100)
2031	**4,367**	**668** (-3,699)	**4,673** (+306)	**4,367**
2032	**6,267**	**2,012** (-4,255)	**6,662** (+395)	**6,267**

Reminder: Delayed LLT Portfolio assumes 13.5 NQC GW of MTR procurement by 2028, plus 2 NQC GW LLT resources in 2031. DCPP current retirement dates are October 31, 2029 for Unit 1 and October 31, 2030 for Unit 2.

Storage ELCC Trends' Impact on a Future Tranche of Procurement

Reference Values of Storage ELCC for Prior MTR Orders

- For the existing tranches of MTR procurement, staff has provided ELCC values by tranche and resource type

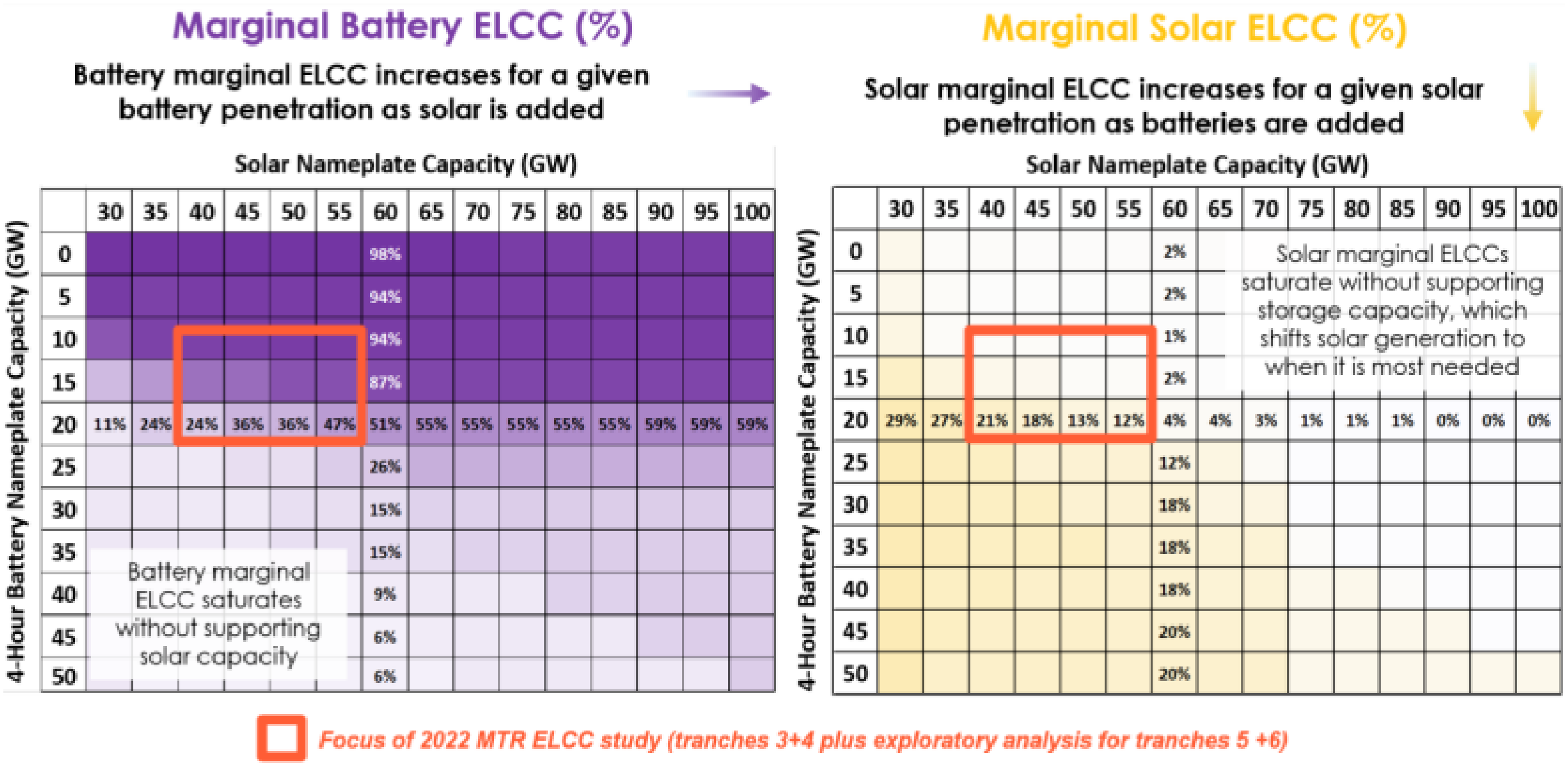
Table 1. Incremental ELCCs by MTR Tranche

	From prior study, for reference only		Updated values from this study		Additional Proposed MTR Tranches[7]	
	Tranche 1 2,000 MW 2023	Tranche 2 6,000 MW 2024	Tranche 3 1,500 MW 2025	Tranche 4 2,000 MW 2026	Tranche 5 2,000 MW 2027	Tranche 6 2,000 MW 2028
4-Hour Battery	96.3%	90.7%	75.1%	76.6%	74.0%	76.5%
6-Hour Battery	98.0%	93.4%	79.6%	80.3%	80.5%	83.3%
8-Hour Battery	98.2%	94.3%	84.0%	84.0%	87.1%	90.1%
8-Hour PSH	N/A	76.8%	82.6%	82.6%	85.7%	88.7%
12-Hour PSH	N/A	80.8%	86.6%	86.6%	89.7%	92.7%
Solar - Utility and BTM PV	7.8%	6.6%	6.6%	7.0%	7.5%	8.8%
Wind CA	13.9%	16.5%	12.0%	13.2%	14.0%	14.7%
Wind WY	28.9%	28.1%	31.0%	33.0%	31.7%	30.9%
Wind NM	31.1%	31.0%	30.0%	35.0%	33.7%	31.9%
Wind Offshore	N/A	N/A	48.0%	46.0%	44.0%	44.7%

Source: Incremental ELCC Study for Mid-Term Reliability Procurement (January 2023 Update). Available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/20230210_irp_e3_astrape_updated_incremental_elcc_study.pdf

Prior Study RESOLVE Solar and Storage Surface

Figure 13. Proposed RESOLVE Solar and Storage Surface + the Subsection Studied in this Report



Source: Incremental ELCC Study for Mid-Term Reliability Procurement (January 2023 Update). Available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/20230210_irp_e3_astrape_updated_incremental_elcc_study.pdf

Short-Duration Battery Storage ELCCs Can Be Impacted by Installed Solar Capacity

- Staff pulled data from a RESOLVE solar + storage surface for **illustrative**[1] values for the next tranche of potential procurement
- Short-duration storage marginal ELCCs **may** decline in the near-term if 4-hour storage is installed without sufficient incremental energy resources (e.g., solar) to ensure charging sufficiency.
- If a procurement order adopts the use of incremental ELCCs for capacity accreditation, Staff would produce incremental ELCCs in the first half of 2026 that would capture how storage ELCCs change, including assumptions for growth in other resources like solar and wind

Installed 2028 portfolio from the 2025 Need Determination Analysis baseline (Note: inclusive of utility-scale and BTM PV)

4hr Storage Marginal ELCC %

		Energy Storage (Nameplate GW)					
		0	0	0	0	0	8hr
		15	20	25	30	35	4hr
Solar (Name-plate GW)	50		66%	35%	24%	16%	
	55		69%				
	60		70%	40%	28%	22%	
	65		70%				
	70		71%	45%	34%	25%	
	80		71%				
	120		72%				

4-hr storage marginal ELCCs may be subject to a potentially major decline for the next tranche of reliability procurement

Due to "diversity benefits" from charging and other factors, procuring additional solar together with storage can partially mitigate against this ELCC decline

1 RESOLVE's surface is relatively coarse for its use in long-term planning. It is also based on 2035 loads and installed capacities (for wind, etc.). Therefore, values here are indicative only and should not be used for any specific comparison to any future ELCCs produced for near-term procurement or in a potential RCPPP.

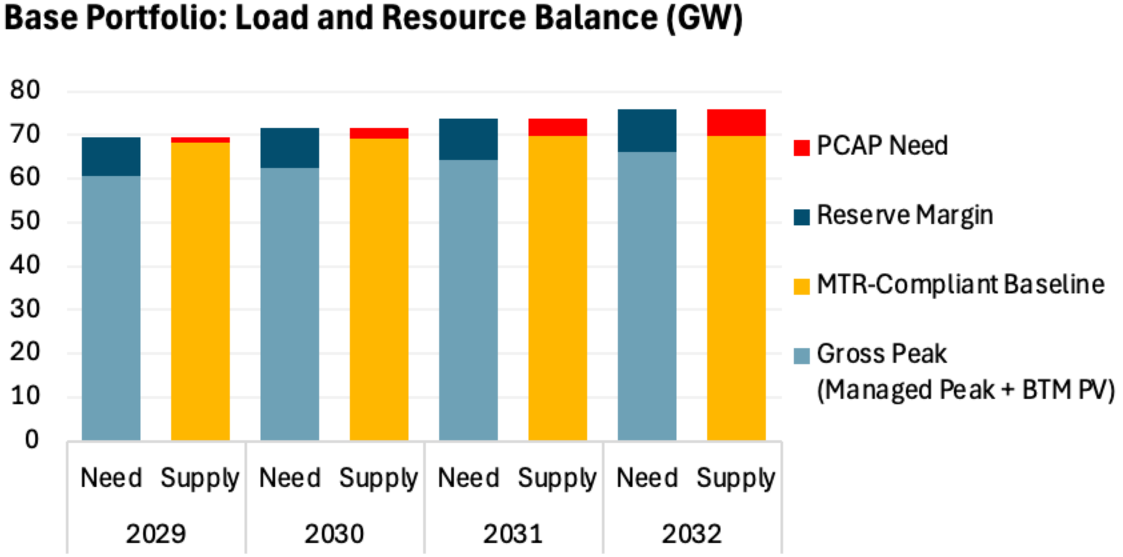
Appendix

Appendix

- The following tables provide more detailed evaluation of perfect capacity that CPUC staff estimated as necessary in conducting the need determination.
- They include values for managed peak (from IEPR) and the estimated Total Reliability Need for the proximate-to-0.1-LOLE system reliability estimates derived by Commission staff.

Peak Load, Total Need, and Shortfall: Base Portfolio

- Managed Peak = sales + losses
- Total Reliability Need (TRN) = Gross Peak (managed + BTM PV) + Planning Reserve Margin[1]
- Shortfall = TRN – total PCAP of the 2025 Need Determination Analysis Baseline (including BTM PV)



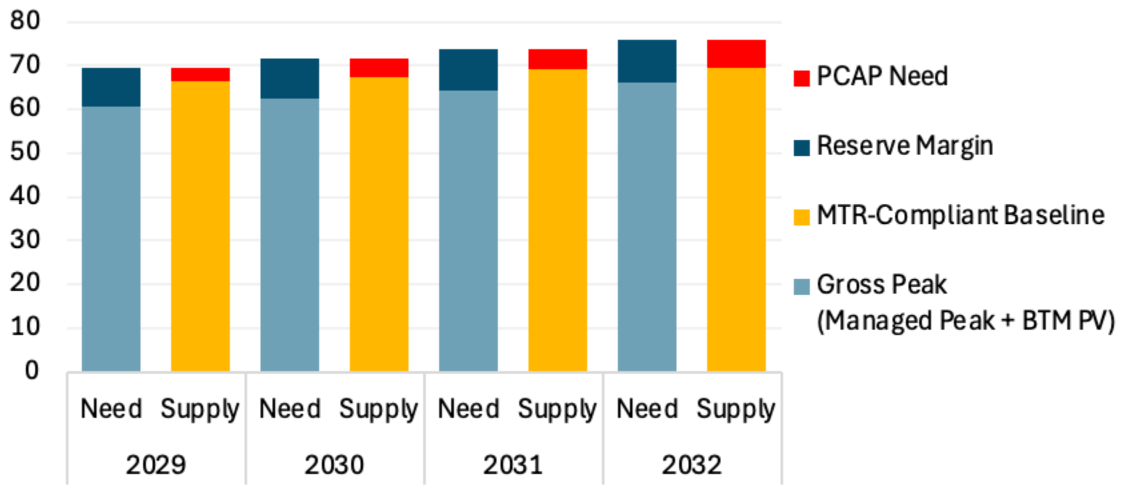
Year	Managed Peak Load (MW)	Total Reliability Need (PCAP MW)	Base Portfolio (PCAP MW)	Cumulative Shortfall (PCAP MW)
2029	51,230 (+0)	69,522 (+0)	68,322 (+0)	**1,200**
2030	52,940 (+1,710)	71,597 (+2,075)	69,297 (+975)	**2,300**
2031	54,578 (+1,638)	73,685 (+2,088)	69,685 (+388)	**4,000**
2032	55,983 (+1,405)	75,771 (+2,086)	69,871 (+186)	**5,900**

1 Planning Reserve Margin calculated from SERVM for the IRP Draft Inputs & Assumptions: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/2025_draft_inputs_and_assumptions_public_slides.pdf

Peak Load, Total Need, and Shortfall: Delayed LLT Portfolio

- Managed Peak = sales + losses
- Total Reliability Need (TRN) = Gross Peak (managed + BTM PV) + Planning Reserve Margin[1]
- Shortfall = TRN – total PCAP of the 2025 Need Determination Analysis Baseline (including BTM PV)

PFM-Adjusted Portfolio: Load and Resource Balance (GW)



Year	Managed Peak Load (MW)	Total Reliability Need (PCAP MW)	Delayed LLT Portfolio (PCAP MW)	Cumulative Shortfall (PCAP MW)
2029	51,230 (+0)	69,522 (+0)	66,322 (+0)	**3,200**
2030	52,940 (+1,710)	71,597 (+2,075)	67,297 (+975)	**4,300**
2031	54,578 (+1,638)	73,685 (+2,088)	69,318 (+2,021)	**4,367**
2032	55,983 (+1,405)	75,771 (+2,086)	69,504 (+186)	**6,267**

1 Planning Reserve Margin calculated from SERVM for the IRP Draft Inputs & Assumptions: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/2025_draft_inputs_and_assumptions_public_slides.pdf

Peak Load, Total Need, and Shortfall: Continued DCPP Operations Sensitivity

- Managed Peak = sales + losses
- Total Reliability Need (TRN) = Gross Peak (managed + BTM PV) + Planning Reserve Margin[1]
- Cumulative Shortfall = TRN – total PCAP of the 2025 Need Determination Analysis Baseline (including BTM PV)

Year	Managed Peak Load (MW)	Total Reliability Need (PCAP MW)	Base Portfolio (PCAP MW)	Cumulative Shortfall: Base Portfolio (PCAP MW)	Delayed LLT Portfolio (PCAP MW)	Cumulative Shortfall: Delayed LLT Portfolio (PCAP MW)
2029	51,230	69,522	68,322	**0**	66,322	**1,000**
2030	52,940	71,597	69,297	**1,200**	67,297	**3,200**
2031	54,578	73,685	69,685	**4,000**	69,318	**4,367**
2032	55,983	75,771	69,871	**5,900**	69,504	**6,267**

1 Planning Reserve Margin calculated from SERVM for the IRP Draft Inputs & Assumptions: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/2025_draft_inputs_and_assumptions_public_slides.pdf

Peak Load, Total Need, and Shortfall: Increased Data Center Load Sensitivity

- Managed Peak = sales + losses
- Total Reliability Need (TRN) = Gross Peak (managed + BTM PV) + Planning Reserve Margin[1]
- Cumulative Shortfall = TRN – total PCAP of the 2025 Need Determination Analysis Baseline (including BTM PV)

Year	Managed Peak Load (MW)	Total Reliability Need (PCAP MW)	Base Portfolio (PCAP MW)	Cumulative Shortfall: Base Portfolio (PCAP MW)	Delayed LLT Portfolio (PCAP MW)	Cumulative Shortfall: Delayed LLT Portfolio (PCAP MW)
2029	51,325	69,623	68,322	**1,301**	66,322	**3,301**
2030	53,170	71,841	69,297	**2,544**	67,297	**4,544**
2031	54,867	73,991	69,685	**4,306**	69,318	**4,673**
2032	56,356	76,166	69,871	**6,295**	69,504	**6,662**

1 Planning Reserve Margin calculated from SERVM for the IRP Draft Inputs & Assumptions: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/2025_draft_inputs_and_assumptions_public_slides.pdf

Peak Load, Total Need, and Shortfall: Reduced Load Sensitivity

- Managed Peak = sales + losses
- Total Reliability Need (TRN) = Gross Peak (managed + BTM PV) + Planning Reserve Margin[1]
- Cumulative Shortfall = TRN – total PCAP of the 2025 Need Determination Analysis Baseline (including BTM PV)

Year	Managed Peak Load (MW)	Total Reliability Need (PCAP MW)	Base Portfolio (PCAP MW)	Cumulative Shortfall: Base Portfolio (PCAP MW)	Delayed LLT Portfolio (PCAP MW)	Cumulative Shortfall: Delayed LLT Portfolio (PCAP MW)
2029	49,168	67,336	68,322	**0**	66,322	**1,014**
2030	50,154	68,644	69,297	**0**	67,297	**1,347**
2031	51,088	69,986	69,685	**301**	69,318	**668**
2032	51,969	71,516	69,871	**1,645**	69,504	**2,012**

1 Planning Reserve Margin calculated from SERVM for the IRP Draft Inputs & Assumptions: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/2025_draft_inputs_and_assumptions_public_slides.pdf