BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Reforms and Refinements, and Establish Forward Resource Adequacy Procurement Obligations.	R.25-10-003

SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) DRAFT 2028 LOSS OF LOAD EXPECTATION STUDY REPORT

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SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) DRAFT 2028 LOSS OF LOAD EXPECTATION STUDY REPORT

Pursuant to the *Assigned Commissioner's Scoping Memo and Ruling* dated December 12, 2025 (Scoping Memo) and the *Administrative Law Judge's Ruling Modifying 2028 Loss of Load Expectation Study Schedule* dated March 30, 2026 (March 30 Ruling), Southern California Edison Company (SCE) respectfully submits its Draft 2028 Loss of Load Expectation (LOLE) Study Report.

I.
EXECUTIVE SUMMARY

Southern California Edison Company (SCE) independently evaluated the reliability of the California Independent System Operator (CAISO) system for the 2028 Resource Adequacy (RA) compliance year. SCE submits this report describing the methodology, inputs, assumptions, and results of its 2028 RA LOLE study and the translation of its calibrated reliability portfolio into a Slice-of-Day (SoD) Planning Reserve Margin (PRM) Calibration Tool for the 2028 RA compliance year. Based on that study, SCE LOLE study resulted in a PRM of 16.4%.

This report is intended to provide the Commission and parties with an independently reproducible assessment of the capacity level and resource mix needed to achieve the Commission's one-day-in-ten-years reliability standard for 2028, while maintaining as much continuity with Energy Division's published reliability framework as possible. To promote consistency and comparability with

Energy Division's analysis, SCE used the Energy Division's published modeling datasets[1] and Inputs and Assumptions,[2] to the extent possible, as the primary sources for the 2028 baseline portfolio, load, renewable generation, hydro conditions, import constraints, operating reserve requirements, and outage assumptions. SCE used the Inputs and Assumptions in the production cost model used for its LOLE analysis. Using common inputs and assumptions will allow a direct comparison of SCE's LOLE Study results to those produced by Energy Division.

Where SCE applies a different assumption than Energy Division's, this report identifies the difference and explains how it affects interpretation of the LOLE and PRM results. The reported results should therefore be evaluated as SCE's independent application of the Energy Division's published data, not as a replication of an Energy Division SERVM study.

The departures between SCE's and Energy Division's approaches are twofold. First, SCE modeled the Energy Division's published inputs in PLEXOS rather than SERVM and incorporated stochastic variations in weather-dependent load profiles, renewable shapes, hydro conditions, and forced outages for thermal and battery resources. However, SCE did not use Energy Division's additional five-point economic and demographic load-uncertainty adjustments and therefore did not further modify load profiles beyond the stochastic load profiles that the Energy Division published.

Second, SCE modeled the CAISO system rather than the WECC footprint Energy Division used in its SERVM model. To accurately account for interactions between the CAISO and neighboring regions, SCE modeled imports subject to the Energy Division-established import constraints. This treatment preserves consistency with the Energy Division's assumptions regarding the amount and timing of external supply available to support CAISO reliability.

The result of performing the LOLE study using substantially similar assumptions, including baseline resource portfolio, was that SCE did not identify any unserved load, which indicates that the

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1 System Reliability Modeling Datasets 2026

2 Energy Division's Revised Inputs and Assumptions (I&A) document for the 2028 LOLE study released via email list on June 5, 2026. Energy Division revised its I&A after consideration of party comments on the draft I&A submitted on April 24th, 2026.

baseline portfolio is more reliable than the 0.1 LOLE benchmark. SCE then calibrated the baseline portfolio by applying an approximately 19% proportional reduction across non-hydro resource types, resulting in a total nameplate capacity reduction of 20,935 MW. The calibrated portfolio produced an annual LOLE of 0.085, satisfying the one-day-in-ten-years reliability standard. All modeled loss-of-load events occurred in July, August or September, were concentrated in HE 16 through HE 24, and had an average 3-hour event duration. Using Energy Division's Slice-of-Day (SoD) tool with Unforced Capacity (UCAP), SCE calculated a realized September PRM of 16.4% for the calibrated portfolio for 2028, compared with 15.5% for 2026, which may be the result of the 2028 calibrated resource mix containing a higher share of batteries than the 2026 calibrated portfolio.

II.
RELIABILITY STANDARD AND MODELING FRAMEWORK

A. Reliability Standard

LOLE measures the expected number of events per year in which there is insufficient supply to meet demand and provide the required operating reserves. SCE evaluates the 2028 portfolio against an annual LOLE benchmark of 0.1 events per year, equivalent to the one-day-in-ten-years reliability standard.

B. Modeling Platform and Scope

SCE conducted its analysis using PLEXOS, a commercially available production cost simulation software provided by the Energy Exemplar. Energy Division conducts its reliability analysis in SERVM. In addition, SCE's model represents the CAISO system rather than the WECC footprint represented in Energy Division's SERVM model. This difference in geographic scope is the principal structural distinction between the two modeling frameworks. SCE does not assume that a CAISO-only production cost model and a broader WECC SERVM model will produce identical dispatch or reliability outcomes. However, the use of common resources, demand, weather, availability, reserve, and interchange

assumptions minimizes differences unrelated to the underlying reliability question and supports a meaningful comparison of results.

C. Stochastic Design

SCE simulated 625 operating-year cases. The analysis used 25 weather years -- 2000 through 2024 -- for hourly demand, wind, solar, and hydro conditions. SCE paired each weather year's demand, renewable, and hydro profiles. Weather-year pairing ensures that the demand, renewable generation, and hydroelectric generation profiles used in a modeled case are derived from the same weather year, rather than combining profiles from different weather years. For example, a 2012 weather-year case uses the 2012 demand, renewable, and hydro profiles together. The 625 cases also incorporated independent random forced outage patterns based on the Energy Division's published seasonal total Effective Forced Outage duration (EFORd) inputs for thermal and battery resources.[3] Energy Division's published design includes five probability-weighted economic and demographic load-uncertainty points. Energy Division proposed 125 probability-weighted cases, consisting of 25 paired weather/hydro years and five load-uncertainty points, with 25 outage iterations per case. SCE did not apply those five load multipliers or probability weights in the results reported here.

III.
INPUTS AND ASSUMPTIONS

A. Baseline Resource Portfolio

SCE used the Energy Division's published 2028 baseline resource assumptions as the starting portfolio. In SCE's model, the principal baseline capacities were 28,030 MW of gas and other thermal resources, 9,144 MW of hydro, 2,935 MW of nuclear, 753 MW of bioenergy, 1,592 MW of geothermal,

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3 UCAP Evaluation Workbook for January 23, 2026, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/resource-adequacy-history/ucap_normderations_2022-2025_20260120.xlsx

10,210 MW of wind, 27,699 MW of solar, 24,348 MW of lithium-ion battery storage, 1,483 MW of pumped storage hydro, and 3,350 MW of demand response.

B. Electric Demand, Weather, Renewable, and Hydro Profiles

SCE used hourly load shapes based on the 2025 IEPR Planning Scenario without Known Loads and the Energy Division's RA SERVM dataset for weather years 2000 through 2024. SCE also used the Energy Division's variable generation profiles and SERVM-specific hydro variables for the same 25-year period. [4]

C. Generator and Storage Availability

SCE applied the Energy Division's resource-type-specific seasonal total EFORd values from the January 23, 2026, UCAP Evaluation Workbook to thermal and battery resources.[5] Total EFORd reflects non-ambient forced-outage risk together with weather-normalized ambient-temperature derates for thermal resources. SCE also applied a 20% flat derate to geothermal hourly profiles and a 30% flat derate to biogas and biomass resources. While these assumptions are not identical to the Energy Division's methodology, the geothermal derate is generally consistent with the UCAP workbook, where the reported EFORd (including ambient derating effects) is approximately 20%. The basis for Energy Division's biomass and biogas derate assumptions is not clearly documented. Therefore, SCE applied a conservative derating approach to ensure these resources are not overstated in the reliability assessment.

D. Operating Reserves

Energy Division's published SERVM assumptions separately describe regulation up/down at 3% of hourly demand, spinning reserve at 3% of hourly CAISO load, 770 MW of frequency-response

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4 System Reliability Modeling Datasets 2026

5 UCAP Evaluation Workbook for January 23, 2026, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/resource-adequacy-history/ucap_normderations_2022-2025_20260120.xlsx

headroom in all hours, and load following targets equal to 6% of hourly demand. SCE modeled regulation up, regulation down, and spinning reserve requirements at 3% of hourly demand respectively, consistent with the Energy Division's assumption.

E. Simultaneous Import Constraints

SCE modeled a maximum simultaneous import limit of 11,040 MW in all hours and a 4,000 MW limit from 5:00 p.m. through 10:00 p.m. in all months, with a three-hour ramp between the off-peak and peak limits.[6] These assumptions align with Energy Division's published 2028 inputs and assumptions. During reliability calibration, SCE applied the same proportional reduction to imports as it applied to other non-hydro resource categories while preserving the Energy Division-published import shape. Consequently, the peak-hour simultaneous import limit was reduced to approximately 3,260 MW during the 5:00 p.m. to 10:00 p.m. period.

F. Battery Storage Representation

SCE modeled battery storage is subject to its available charging and discharging capability, stored-energy limitations, and applicable round-trip-efficiency assumptions. These operational constraints allow the model to represent both the capacity contribution and energy limitations of battery resources across the modeled day. The modeled operation of battery resources was reviewed during the critical reliability conditions. During the worst modeled days, available battery resources were fully utilized in SCE's production cost model. The same portfolio was also evaluated through Energy Division's SoD tool, in which batteries were likewise fully utilized during the critical hours. These results support the reasonableness of SCE's battery representation. In particular, the modeled unserved-load events were not caused by an assumption that prevented available batteries from responding during the reliability event. Instead, battery output was maximized during the critical period, subject to resource outages, charging conditions, round-trip efficiency, and stored-energy limitations.

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6 SCE alternative I&A filed on June 5, 2026, proposing the Commission adopt a 4,000 MW assumed simultaneous import constraint for summer month. For comparison purposes, SCE used the same import constraint as Energy Division in its study.

G. Demand Response

The published baseline portfolio included approximately 3,350 MW of demand response. SCE conservatively limited demand response to 1,700 MW in the calibrated portfolio, consistent with SCE's 2026 RA LOLE study.[7]

IV.

ALIGNMENT WITH ENERGY DIVISION ASSUMPTIONS

SCE adopted the Energy Division's inputs and assumptions to the greatest extent practicable. The table below summarizes how SCE's 2028 RA LOLE study assumptions align with Energy Division's published assumptions.

7 R.23-10-011, SCE opening comments on all proposal filed, March 3, 2025.

Topic	SCE 2028 Study	Energy Division Published I&A	Comparison / Interpretation
Baseline portfolio	Energy Division-published 2028 baseline as starting point.	Energy Division's 2026 baseline dataset for 2028 RA study.	Aligned
Demand forecast	2025 IEPR Planning Scenario, no Known Loads.	2025 IEPR Planning Scenario, no Known Loads.	Aligned.
Weather/renewables/hydro	25 years, 2000–2024; load, renewable, and hydro profiles paired by year.	25 years, 2000–2024; weather and same-year hydro paired.	Aligned.
Economic/demographic uncertainty	Not applied in reported 625-case results.	Five probability-weighted load forecast error points; staff also planned a narrower sensitivity.	SCE results do not include the ED probability-weighted load multipliers.
Case construction	625 stochastic operating-year cases with independent forced-outage patterns.	125 probability-weighted cases (25 weather/hydro × 5 load levels), each with 25 outage draws, or 3,125 iterations.	Different sample design, weighting, and total iterations.
Forced outages	The EFORd assumptions applied were from the ED UCAP workbook[8], which was developed using the CAISO OMS outage data that underlies the published SERVM assumptions. Weather-normalized ambient temperature derates to account for the ambient derates were also included.	Unit-level maintenance and forced-outage distributions from CAISO OMS in published SERVM assumptions; published framework also discusses ambient derates.	Aligned.
Imports	11,040 MW all hours; 4,000 MW 5–10 p.m. all months; three-hour ramp. Imports reduced pro rata in calibration.	Same published limits and ramp. ED identified lowering the import limit as one possible calibration method.	Aligned prior to calibration
Calibration to 0.1 LOLE	Pro rata reductions across non-hydro resources; hydro held constant; DR set to 1,700 MW.	Published options: add Perfect Demand, reduce capacity pro rata, or lower simultaneous imports.	SCE selected one method and applied specific exemptions/adjustments.

[8] UCAP Evaluation Workbook for January 23, 2026, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/resource-adequacy-history/ucap_normderations_2022-2025_20260120.xlsx

V.

RELIABILITY CALIBRATION

A. Baseline Portfolio Result

The baseline portfolio produced no modeled unserved energy and an annual LOLE of 0.000 across SCE's 625 simulated cases. Because the baseline portfolio was more reliable than the 0.1 LOLE benchmark, SCE reduced available capacity to identify a portfolio close to the reliability threshold.

B. Calibration Method

SCE reduced capacity pro rata across non-hydro resource types. SCE held hydro capacity constant because hourly hydro availability was already constrained through the modeled hydro profiles. SCE also reduced imports pro rata and limited demand response to 1,700 MW. The resulting calibrated portfolio removed 20,935 MW relative to the below baseline category totals.

Resource Type[9]	Baseline (MW)	Calibrated (MW)	Reduction (MW)
CC/CT/ICE/Steam/Cogen	28,030	22,396	5,634
Hydro	9,144	9,144	0
Nuclear	2,935	2,328	606
Bio	753	606	147
Geothermal	1,592	1,231	361
Wind	10,210	7,430	2,780
Solar	27,699	22,790	4,908
Li-ion Battery	24,348	19,500	4,848
Pumped Storage Hydro	1,483	1,483	0
Demand Response	3,350	1,700	1,650
TOTAL REDUCTION			20,935

[9] Imports are not included in the resource-capacity table. In the calibrated case, the 4,000 MW peak-hour simultaneous import limit was reduced by approximately 19% to 3,240 MW.

VI.

LOLE RESULTS

A. Annual Results

The calibrated portfolio produced an annual LOLE of 0.085 across the 625 simulations and therefore met the 0.1 LOLE benchmark. All modeled unserved-load hours occurred during July, August, or September. Events were concentrated from HE 16 through HE 24, and the average event duration was 3 hours.

B. Most Severe Modeled Event

The most severe modeled event occurred on September 4 and 5 under 2022 weather conditions, when modeled load reached approximately 54.9 GW. The event lasted 5 hours during HE 17 through HE 22, and maximum hourly unserved load reached 9,682 MW. This event is associated with high load, low daytime wind output, constrained evening imports, and elevated thermal and storage outages.

During the worst day, battery resources were fully utilized. Battery outages increased to approximately 13% during HE 17 through HE 22. Thermal derates, including forced outages and ambient-temperature effects, reached approximately 15% in the afternoon and were approximately 12% during HE 17 through HE 22.

C. Interpretation

The results indicate that 2028 reliability risk is concentrated in summer evening and late-night hours after solar output declines. The modeled events also demonstrate the coincident impact of high load, import constraints, wind conditions, thermal availability, and battery availability on unserved events. Because the study excludes Energy Division's five-point economic and demographic load-uncertainty distribution, the reported LOLE should be interpreted as conditional on the 2025 IEPR weather-normalized demand profiles and SCE's 625-case stochastic design.

VII.

PLANNING RESERVE MARGIN RESULTS

A. Realized 2028 PRM

SCE entered the calibrated portfolio into Energy Division's SoD tool (with UCAP) and the resulting realized PRM was 16.4% in September at HE 18. This PRM corresponds to the portfolio that produced an annual LOLE of 0.085 in SCE's LOLE study.

B. Comparison with 2026

SCE's 2028 analysis produced a realized PRM of 16.4% (UCAP based), compared with the 15.5% PRM identified in SCE's prior 2026 analysis.[10] SCE attributes the increase to the change in resource mix, including an increase in the battery share from 15% in 2026 to 21% in 2028 and a decrease in gas, nuclear, and imports from 34% to 30%, measured on a nameplate-capacity basis. A portfolio with more energy-limited resources requires a higher PRM than a portfolio with a higher share of dispatchable capacity because nameplate MW does not provide uniform reliability contribution across all hours. The 16.4% result should therefore be understood as specific to the calibrated 2028 resource mix, the SoD counting framework, and the assumptions described in this report.

10 R.23-10-011, SCE opening comments on all proposal filed, March 3, 2025.

VIII.

CONCLUSION

In sum, SCE's study demonstrates that the Energy Division-published 2028 baseline portfolio was over-reliable, producing no modeled unserved energy and an annual LOLE of 0.000. A calibrated portfolio with 20,935 MW of reductions across non-hydro resource types produced an annual LOLE of 0.085 and met the 1-in-10 reliability standard. Reliability risk was limited to July through September and concentrated in HE 16 through HE 24. The calibrated portfolio translated to a 16.4% realized PRM for September using Energy Division's SoD tool with UCAP.

Respectfully submitted,

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