Standard LSE Plan

Sonoma Clean Power Authority

2022 INTEGRATED RESOURCE PLAN

November 1, 2022

(PUBLIC VERSION)

Table of Contents

I. Executive Summary

Sonoma Clean Power Authority's (SCPA's) 2022 Integrated Resource Plan (IRP) Preferred Conforming Portfolio (also referred to as "preferred portfolio") is the result of a rigorous two-year effort that leverages advanced analytic capabilities, public stakeholder engagement, and serious thought on solutions for the challenges of decarbonizing the electric power sector. SCPA developed its preferred portfolio by defining compliance requirements and internal objectives, characterizing potential resource opportunities, and utilizing sophisticated software for co-optimizing a portfolio for cost, risk, reliability, and environmental performance.

The 2022 preferred portfolio was approved by the SCPA Board of Directors in their October 6, 2022 meeting. The preferred portfolio outperforms SCPA's emissions target by a fair margin—emitting 0.035 million metric tonnes (MMT) per year relative to a 25 MMT statewide load-share target of 0.203 MMT. The preferred portfolio delivers its required contribution of reliability with a reduction in reliance on capacity from fossil-fueled resources. SCPA's preferred portfolio relies on significant growth in geothermal power, development of new wind resources, new standalone and paired solar and storage. The 2022 preferred portfolio also decreases SCPA's dependence on hydropower.

In selecting a preferred portfolio for its 2022 IRP, SCPA established two new internal objectives. First, SCPA is developing a supply portfolio that provides hourly marginal emissions reductions equivalent to the hourly marginal emissions of its load by 2026. Second, SCPA's portfolio aims to supply 80% of its load with clean resources in winter evenings by 2030. SCPA believes that there is efficiency in building resources that are not only useful for addressing the summer reliability problem today but are also highly capable of providing year-round and around-the-clock energy— two issues which will likely be the next challenges California faces as the grid reaches high levels of decarbonization and the penetration of building electrification grows. Both internal metrics are discussed in more detail in the description of SCPA's modeling approach for its preferred portfolio.

SCPA is already well situated to fulfill the two outstanding procurement orders. Most of the capacity required by these orders is already under contract and any remaining requirement could be fulfilled by contracts that are currently under negotiation. The action plan for SCPA's preferred portfolio includes details for the next procurement priorities—which include contracting out-of-state wind resources by 2026 and progressing SCPA's Geothermal Opportunity Zone (GeoZone). GeoZone is an initiative led by SCPA in conjunction with local jurisdictions and private geothermal companies to facilitate development of new local clean firm resources by 2030.

SCPA's narrative also includes a detailed discussion of the assumptions and outputs from optimization of SCPA's portfolio. The preferred portfolio was selected after comparing the cost, risk, reliability, and environmental results to three alternatives. SCPA also provides information to support that its preferred portfolio is robust when considering risks identified by the CPUC including dependency on hydropower and existing resources.

II. Study Design

a. Objectives

SCPA recognizes significant value in the IRP process. From an internal perspective, the IRP provides a framework for SCPA to establish a robust long-term procurement strategy that is co-optimized for cost, risk, reliability, and environmental performance. Externally, participating in IRP provides SCPA an opportunity to share its on-the-ground procurement knowledge, community priorities, and the output of an optimized procurement strategy to inform statewide energy policy and transmission planning.

SCPA invested considerable resources to increase its capabilities for its 2022 IRP, which are described further in the Modeling Tools section below. These new capabilities are being leveraged to expand the scope and sophistication of objectives in developing a preferred portfolio. For 2022, the objectives for developing a preferred portfolio include the following:

- Selecting a portfolio that is co-optimized for cost, risk, and environmental performance through 2040.
- Developing a procurement strategy that meets all compliance requirements including Renewable Portfolio Standard (RPS), SB 100, IRP procurement orders, and resource adequacy.
- Assessing environmental performance and informing performance goals using hourly mitigated emissions rather than relying on annual emissions accounting as well as aligning climate objectives with other local agencies.
- Delivering a portfolio that meets or exceeds both reliability and lower set of emissions targets (30 MMT in 2030 / 25 MMT in 2035) while utilizing the CPUC's assumptions and SCPA's load assignment for the 2022 IRP process.
- Building resources that are well-suited for a highly-electrified and high renewable penetration future—specifically assets that look beyond summer reliability to provide capacity in winter evening.
- Incorporating feedback received from the community through public engagement on preferred resource types.
- Assessing the value of load flexibility and cross-sector emissions mitigations as alternatives to new clean resource procurement.

SCPA's 2022 IRP submission, including this narrative, the Clean System Power (CSP) calculator, and the Resource Data Template (RDT), all follow the requirements for this filing which include using the assigned load forecast, peak demand, and behind-the-meter solar forecast for all calculations. SCPA is submitting one portfolio that outperforms both the 30 MMT by 2030 and 25 MMT by 2035 targets. The inputs and GHG targets for SCPA are documented below.

Table 1. SCPA IRP Inputs & Targets

Year	Sales Forecast (GWh)	Annual Coincident Peak (MW)	BTM PV Capacity (MW)	BTM PV Generation (GWh)	30 MMT GHG Benchmark (MMT)	25 MMT GHG Benchmark (MMT)
2023	2,208.1	[redacted]	189.0	320.7		
2024	2,227.1		204.1	348.5		
2025	2,241.2		219.6	374.3		
2026	2,254.5		235.2	400.5		
2027	2,269.7		251.8	428.2		
2028	2,285.5		269.2	457.6		
2029	2,305.9		286.9	487.4		
2030	2,328.2		304.7	517.3	0.331	0.250
2031	2,353.0		322.2	546.7		
2032	2,374.6		339.4	575.6		
2033	2,401.0		356.6	604.2		
2034	2,427.4		373.2	631.9		
2035	2,457.9		389.8	659.2	0.254	0.203

b. Methodology

i. Modeling Tool(s)

SCPA contracted with Ascend Analytics (Ascend) starting in 2021 to use their PowerSIMM platform for resource and portfolio evaluation. SCPA's preferred portfolio was developed using Ascend's CAISO release 3.2 released in April 2022.

PowerSIMM significantly increases the sophistication of SCPA's portfolio evaluation. Whereas previous SCPA IRP portfolios were selected based on deterministic Excel-based models calibrated to historical price trends, PowerSIMM introduces the following advanced capabilities that are leveraged in development of SCPA's preferred portfolio:

- Stochastic modeling of price, load, and intermittent generation based on weather and gas price variability;
- Robust forecasts of price shapes, sub-hourly volatility, capacity prices, hourly marginal emissions factors, Effective Load Carrying Capability (ELCC), and RPS attributes derived from an Ascend-generated CAISO capacity expansion model;
- Forward-looking and dynamic locational basis pricing based on expected resource mix;
- Optimized dispatch of storage resources in energy and ancillary markets; and
- Automated resource selection to deliver a cost-optimized portfolio given compliance, capacity, and hourly marginal emissions constraints.

RESOLVE and SERVM model the performance of CAISO as a whole and select a portfolio and transmission upgrades that deliver reliability and GHG reductions at the lowest cost. In SCPA's use of PowerSIMM, the CAISO-wide supply stack is instead fixed. PowerSIMM's supply stack is based on the output of a CAISO capacity expansion model built by Ascend's expert staff. PowerSIMM models the performance of LSE resources based on correlations, price shapes, and other dependencies calibrated from the fixed supply stack. SCPA settled on this approach after considering the trade-offs of developing CAISO modeling expertise internally versus focusing efforts on modeling its own portfolio.

Compared to the 30 MMT Preferred System Plan (PSP) with LSE plans released in June 2022, Ascend's CAISO 3.2 supply stack shows less renewable build-out by 2035. Ascend's CAISO supply stack also includes more gas retirement that is not represented in the PSP which is partially offset by new dispatchable capacity that uses renewable fuels. Deployment of energy storage and load assumptions between the PSP and Ascend are comparable. Since Ascend's supply stack is smaller than the PSP, resources that provide capacity and monetize volatility (like battery storage) are likely favored more than resource selections from RESOLVE and SERVM modeling.

There are several significant factors in the California energy market that are not incorporated in SCPA's modeling tool or represented in the stochastic scenarios generated by PowerSIMM. Those include:

- **Extension of Diablo Canyon:** Ascend's CAISO 3.2 model assumes Diablo Canyon closes as planned. If Diablo Canyon does extend operations, it may reduce the economic case for capacity and baseload generation included in SCPA's portfolio.
- **California Strategic Electricity Reserve:** The strategic electricity reserve created in the 2022 energy trailer bill may lead to 5 GW of incremental resources from delayed retirements or new capacity. It is unclear how these resources will operate in the market, but they may reduce the need for a reserve margin and reduce the economic case for capacity included in SCPA's portfolio.
- **2022 Inflation Reduction Act:** Congress recently passed the 2022 Inflation Reduction Act which extends and expands tax credits and grants for renewable energy projects, energy efficiency, and electrification. This legislation will likely have significant impacts to both resource pricing and load growth that are not yet characterized.
- **Resource Adequacy Reform:** The CPUC is moving towards reforming resource adequacy to align with a 24-hour slice framework and exceedance or unforced capacity model. However, the detailed mechanics of this approach are still being determined. Accordingly, SCPA evaluated capacity using a conventional methodology. However, the expectation of a 24-hour slice framework did influence SCPA's portfolio selection.
- **Supply Chain Disruptions:** The short and medium impact of supply chain disruptions to renewable project development is still uncertain, including tailing effects of COVID

and the anti-circumvention inquiry into solar imports and the prospect of disruptions due to the findings of investigations into forced labor. SCPA addressed this concern by limiting near-term development to projects under contract or negotiation before 2027 and did not apply any schedule risk to the supply chain factor for projects before 2027.

Given the quickly changing dynamics of the energy market, SCPA expects to re-evaluate its long-term procurement strategy in early 2023.

ii. Modeling Approach

SCPA's preferred portfolio was designed not only to satisfy a compliance obligation but also to inform an SCPA-wide decarbonization and long-term procurement strategy. To accomplish these twin goals, SCPA extended the window for portfolio modeling beyond 2035 to 2040, developed an independent load forecast for PowerSIMM that aligns with de-carbonization opportunities from SCPA's Programs Department, and created metrics to evaluate both hourly marginal carbon emissions and winter reliability.

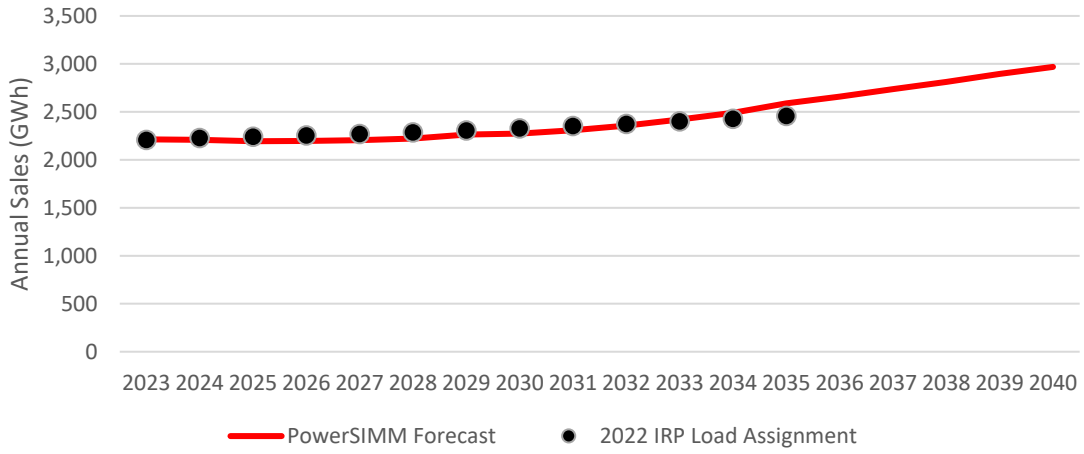
1. Load Forecast & Market Assumptions

The input load forecast includes explicit projections of light-duty electric vehicle adoption and building electrification that align with local characteristics and statewide trends from the preferred scenario in the 2022 California Air Resources Board Draft Scoping Plan. Linking the load forecast to the 2022 Draft Scoping Plan and SCPA de-carbonization programs provides benchmarks for SCPA to evaluate local carbon reductions, aligns ambitions with a technical plan to reach statewide carbon neutrality by 2045, and informs the design of a portfolio that can maintain affordability and reliability.

Figure 1 below compares the load forecast SCPA used as an input into PowerSIMM for resource selection to its 2022 IRP load forecast assignment that is used for assessing reliability and emissions in this filing. The two forecasts are within 3% of each other until after 2034, where SCPA's PowerSIMM forecast depicts accelerating growth from building electrification. By 2040, SCPA is evaluating a portfolio that can serve an increase in annual sales of over 33%. Estimating load growth over a decade in the future is difficult to achieve with precision, and SCPA will continue to re-evaluate demand needs in subsequent IRP filings.

SCPA adopted Ascend's projections for ELCCs, capacity and RPS pricing, and hourly marginal emissions for evaluating prospective portfolios in PowerSIMM. This ensures that input assumptions were consistent with the supply stack used to forecast the financial performance of candidate portfolios.

Figure 1. Comparison of PowerSIMM Load Forecast vs. IRP Assignment



2. *Resource Configuration*

Estimates for resource availability and contract pricing inputs were developed by a cross-discipline team in SCPA. Datasets from recent solicitations, the National Renewable Energy Laboratory, Ascend Analytics, the CAISO interconnection queue, and the CPUC's PSP were used to calibrate assumptions on maximum build pace, total available capacity, and contract cost by technology. An inventory of the different candidate resources considered in SCPA's portfolio development is shown in Table 2, along with their assigned category in the CSP calculator and a brief description of their assumed configuration.

Table 2. Candidate Resources Evaluated in PowerSIMM SCPA IRP portfolio development

Candidate Resource (CSP Category)	**Description**
New Solar + Storage (Hybrid or Paired Solar and Battery)	Modeled with a 1:1 capacity ratio of solar paired with 4-hour Lithium-ion battery with grid charging restrictions through 2030 and a shared interconnection constraint. Solar generation profile and locational pricing assumed location in Mojave Desert.
New Standalone Storage (Battery Storage)	Modeled as a 4-hour Lithium-ion battery. Locational pricing assumed location in Central Valley.
New Standalone Long-Duration Storage (Battery Storage)	Modeled as an 8-hour Lithium-ion battery. Locational pricing assumed location in Central Valley.
New Demand Response (Shed DR)	Modeled as a dispatchable resource with a restriction of running for 2 hours up to 6 times per month. Costs are assumed to be covered by SCPA's Programs budget similar to how SCPA's current GridSavvy Demand Response resource works.
New Out-of-State Wind (Wind Wyoming)	Modeled using developer-provided profiles, 2026 online date, and location from a prospective out-of-state wind project.
New Offshore Wind (Wind Offshore Humboldt)	Offshore wind profiles and pricing assumed location in Humboldt Bay. Not available for consideration until 2032.

Candidate Resource (CSP Category)	Description
New Solar (Solar New SCE SDG&E)	Solar profiles and pricing assumed location in Mojave Desert.
New Wind (Wind New SCE SDG&E)	Wind profiles and pricing assumed location in Palm Springs.
New GeoZone Baseload Geothermal (Geothermal)	Modeled using profiles for a binary air-cooled geothermal resource with no carbon emissions. Assumed location in Sonoma and Mendocino counties near the Geysers (GeoZone) for pricing. Not available for consideration until 2029.
New GeoZone Dispatchable Geothermal (Geothermal)	Modeled using profiles for a binary air-cooled geothermal resource coupled with technology to double capacity and shift up to 8 hours of generation to higher-need hours. This technology is being actively evaluated in the SCPA GeoZone initiative. Although SCPA's internal analysis using PowerSIMM captured the cost and value of the increased flexibility and capacity of these resources, the IRP filing templates treat them as ordinary geothermal. Location is assumed in GeoZone for pricing and not available for consideration until 2029.
Existing Long-term Geothermal (Geothermal)	[redacted]
Existing Short-term Carbon Free (Imported Hydro)	Modeled as potential year-by-year index plus contracts using a Pacific Northwest hydro profile for carbon accounting. Pricing assumed to escalate due to strengthening regional emissions targets. Available capacity declines due to increasing drought severity and increased competition.
Existing Short-term RPS (Solar Existing California)	Modeled as a potential year-by-year index plus contracts using a profile reflective of CAISO's existing renewable fleet for carbon accounting. Assumed to be existing solar for IRP template purposes. Pricing aligns with Ascend's expected market value for RPS.
Existing Short-term RA	Modeled as a potential year-by-year contract for system resource adequacy. Pricing aligns with Ascend's expected market value for resource adequacy. Availability declines due to expected fossil retirements.

Although SCPA assigned specific locations for evaluating the candidate resources in Table 2, SCPA focused its IRP portfolio development on identifying appropriate technologies and not necessarily on optimizing location. Accordingly, SCPA's preferred portfolio identifies selected resources generically. The only exception is for new geothermal where SCPA is undertaking a specific effort to grow resources in the Sonoma and Mendocino County jurisdiction through the GeoZone initiative. For other technologies, SCPA will evaluate the trade-offs of specific locations as it seeks to solicit and build the resources described in its Action Plan.

SCPA specifically did not evaluate new biomass as a candidate resource for its preferred portfolio due to local environmental opposition, despite new biomass being part of its 2020 IRP portfolio.

Unless stated otherwise in Table 2, SCPA did not allow any construction of candidate resources until 2027. This is due to the current supply chain, competitive demand, and transmission constraints SCPA is encountering in soliciting new resources in the current market. SCPA's preferred portfolio does include several new projects that are under contract, being actively negotiated, or specifically targeted to fulfill the mid-term reliability procurement (MTR) order. Unlike the candidate resources in Table 2, PowerSIMM is required to include these resources in all output portfolios. Those resources include:

- **Proxima Solar + Storage:** 70 MW solar PV + 32 MW 4-hour storage in Central Valley with commercial operation date (COD) in June 2024;
- **Tubbs Island Solar + Storage:** 11.6 MW Solar PV + 8 MW 4-hour storage in Sonoma County with COD in June 2024;

[redacted]

- **Fish Lake Geothermal:** 1.52 MW share of a 13 MW geothermal project procured by CC Power in Nevada with COD in June 2024;
- **MTR Standalone RA-Only:** A contract for 55 MW of standalone storage to fill remaining MTR obligations for SCPA with COD in June 2024;
- **Ormat Geothermal:** 14 MW share of a 125 MW portfolio of geothermal projects procured by California Community Power (CC Power), most likely located in Nevada and Imperial Irrigation District. with CODs starting in October 2024. The project is represented as 7 discrete projects in RDT but subject to change;
- **Goal line Storage:** 8.68 MW share of 50 MW 8-hour storage procured by CC Power in San Diego County with COD in June 2025;

[redacted]

- **Tumbleweed Storage:** 8.94 MW share of 69 MW 8-hour storage procured by CC Power in Kern County with COD in April 2026.

SCPA's modeling also assumed current contracts with existing resources were retained. As with new resources, PowerSIMM enabled precise modeling of generation profiles and pricing based on location. These contracts include long-term renewable and storage Power Purchase Agreements (PPAs) and short-term contracts for carbon-free energy, resource adequacy, and RPS.

3. *Portfolio Optimization & Constraints*

Portfolio optimization for SCPA's 2022 IRP is performed using PowerSIMM's Automated Resource Selection (ARS) capability. ARS uses mixed integer programming techniques to select a portfolio with minimal discounted supply cost within a given set of constraints. SCPA leverages PowerSIMM's stochastic capabilities and developed an optimized portfolio based on the results of 20 simulations. SCPA assumes a modest discount rate of 2% that is consistent with its risk-averse investment policy as a public agency.

All portfolios evaluated in PowerSIMM's ARS are subject to the following constraints:

- **Annual Energy Constraint: T**he selected supply resources, which can include system power with emissions, must serve between 92.5% and 107.5% of SCPA's annual load. Although SCPA allows the optimization to serve less than 100% of load due to allow for variability in load and intermittent renewables, any short position is assumed to be served by system power in post-processing.
- **Reserve Margin Constraint: T**he selected supply resources, which can include short-term resource adequacy contracts, must provide enough capacity to serve 115% of monthly peak load minus a 50 MW allowance for Cost Allocation Mechanism (CAM). Capacity calculations are based on the ELCCs output from Ascend's CAISO capacity expansion model.
- **RPS Constraint:** the supply portfolio must provide enough RPS to serve all SCPA's premium EverGreen product (100% 24/7 renewable energy generated within our service territory) and a target of 50% RPS or the annual RPS compliance requirement of SCPA's standard CleanStart product.

4. *Hourly Marginal Carbon Emissions*

As described in Section II(a) above, a key objective for SCPA in the 2022 IRP process is to assess environmental performance on an hourly basis. As California's penetration of renewables continues to rise, SCPA recognizes that evaluating the hourly and seasonal generation profile of candidate clean resources is increasingly important for quantifying their ability to displace natural gas. While evaluating hourly mitigated emissions goes beyond current compliance obligations, it is well aligned with the mechanics of the CPUC's CSP Calculator.

To implement hourly marginal emissions counting in portfolio optimization, SCPA first ran a deterministic simulation of all existing and candidate resources and load in PowerSIMM. The hourly generation and load were then multiplied by an hourly marginal emissions factor output by Ascend's CAISO capacity model for a given year, month, and hour. The marginal emissions factor reflects the carbon emissions at a given hour relative to a counterfactual grid where that supply or load did not exist. Ascend determines the marginal emissions factor by using model price shapes, carbon price adders, and natural gas prices to determine the marginal heat rate for a given hour that can indicate the composition of gas and renewables

on margin and an effective emissions rate in the CAISO system. Like the CSP calculation, this provides a more accurate view of how energy procurement decisions impact emissions and displace fossil capacity than annual accounting or average emissions factors.

Figure 2 demonstrates the carbon mitigation capability of different generation technologies compared to the marginal emissions of SCPA's load normalized by unit of energy. This graph demonstrates several important trends influencing SCPA's IRP analysis:

- The spread of marginal emissions impact between technologies is narrow in the near-term but grows dramatically in the 2030s. This spread highlights the importance of considering the hourly generation profile in assessing carbon impact as the penetration of renewables grows instead of valuing each clean MWh equally.
- Several technologies (demand response, dispatchable geothermal, and hydro) can mitigate more emissions than incurred by load on a MWh basis but have limited availability, whereas the carbon mitigation efficiency of solar declines below load quickly.
- The marginal emissions mitigated for all technologies decline over time, particularly in the late 2030s as the entire California grid gets cleaner. Essentially, there is a point when there are fewer fossil fuel power sources left to displace in the electricity sector. This means that the marginal emissions impact of load also decreases as California gets closer to reaching the 2045 SB 100 goal of using only renewable power and large hydropower. These emission mitigations do not include avoided GHGs from fuel switching such as building and transportation electrification.

Figure 2. Hourly Marginal Carbon Emissions Mitigated by Supply Technology vs. Load Emissions Incurred per MWh

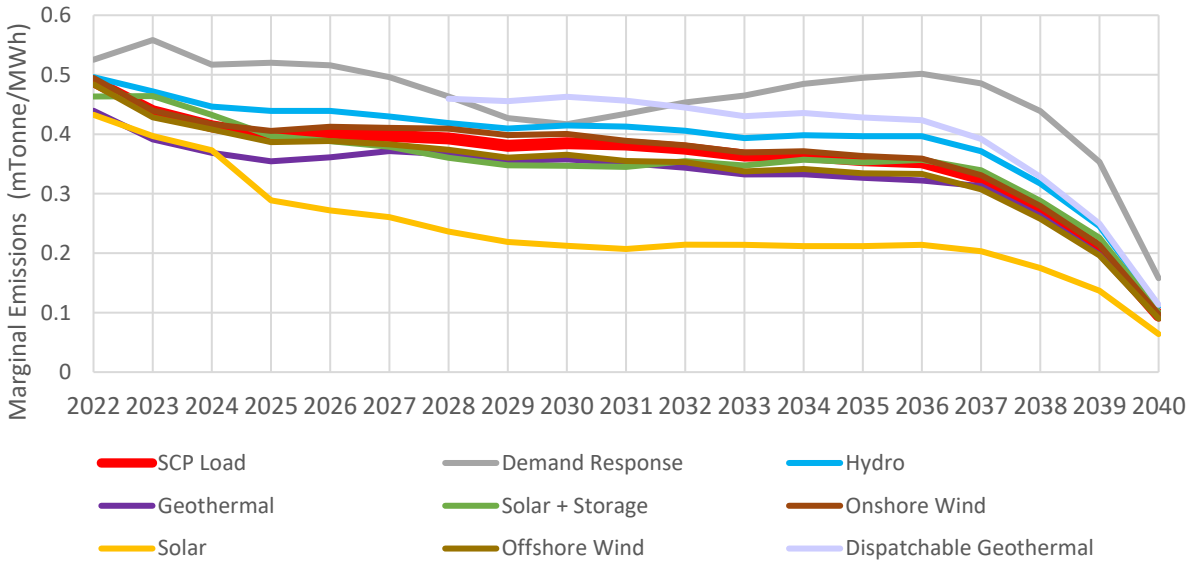
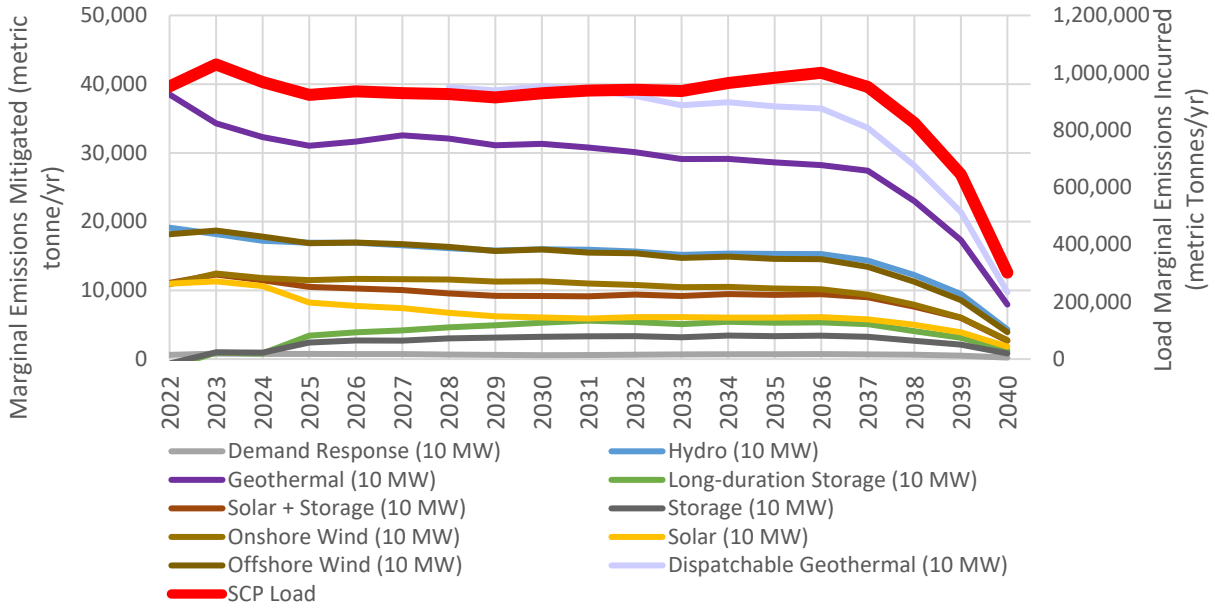


Figure 3 shows the emissions mitigation for various candidate resources on an annual basis (all 10 MW in size). The figure includes storage resources, which provide emissions mitigation

despite not being generators by shifting supply between low and high emitting hours. The emissions mitigation capability by resource is very dependent on the capacity factor, which is why geothermal resources stand out. The annual emissions incurred by SCPA's load are included (using a secondary axis) to show that less emissions mitigation from the supply portfolio is required to maintain carbon neutrality as overall grid emissions improve.

Figure 3. Marginal Emissions Mitigated by Candidate Resources vs. Marginal Emissions Incurred by Load



SCPA calculates the net marginal emissions of prospective portfolios by tabulating the annual hourly marginal emissions independently incurred by SCPA's load, adding emissions from any specified sources, such as geologic emissions from dry steam geothermal, and debiting the hourly marginal emissions mitigated by hourly supply profiles for each resource. Summarizing hourly emissions using this methodology allows SCPA to directly assess environmental performance and enforce constraints in PowerSIMM's ARS module which is run with annual granularity. The calculation is arithmetically equivalent to calculating net emissions for each hour (as done in the CSP) and summing the result. The utilization of hourly marginal carbon emissions in SCPA's portfolio development is discussed in the portfolio alternatives section below.

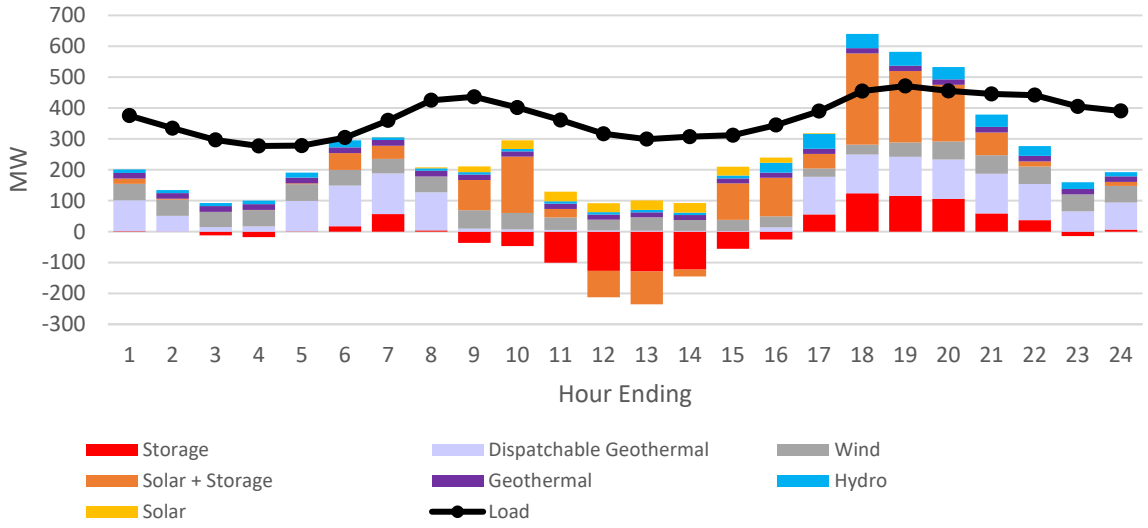
5. Winter Night Reliability

A growing concern in SCPA's resource portfolio planning is ensuring its supply portfolio provides reliability in the winter, particularly when extending the analysis into the late 2030s as building electrification drives load growth. The battery storage resources currently being deployed for summer reliability are less effective in the winter, given the frequency of multi-day periods with low solar output to charge the batteries. Although PowerSIMM's hourly

emissions profiles and price shapes reflect the challenge of serving load with clean resources in the winter, the capacity constraint is geared towards measuring summer reliability.

When reviewing portfolios optimized for supply cost and hourly marginal emissions, SCPA identified a specific misalignment between supply and load in the winter between the hours of 9pm and 5am. This is illustrated in Figure 4, which compares the hourly supply stack of a portfolio optimized for cost and hourly emissions versus load in the month of December. Although this portfolio is also short during solar hours, that disconnect is mostly due to PowerSIMM dispatching batteries to charge versus intrinsic resource characteristics.

Figure 4. Average December Load vs. Supply for Portfolio Optimized for Cost & Emissions



To evaluate portfolios for the December shortfall concern, SCPA defined a "Winter Night Reliability" metric that is used in PowerSIMM. This metric is calculated as the average output of a resource in December between the hours of 9pm and 5am. Storage resources are also assigned a reliability value that is reflective of the output during the same hours assuming an economically optimized dispatch profile. The sum of this metric is compared to the average load in December between 9pm and 5am and can be used as a constraint, like the planning reserve margin, to inform portfolio optimization. Although adding another constraint results in portfolios with more perceived cost, SCPA believes that portfolios with higher winter reliability will reduce the risk of navigating resource adequacy reform and uncertainties in a highly-renewable and highly-electrified grid in the future.

6. Portfolio Alternatives & Preferred Portfolio Selection

SCPA evaluated four portfolio alternatives before selecting the scenario to submit as its preferred portfolio for the 2022 IRP. SCPA started by creating a portfolio optimized for supply cost constrained by compliance objectives for RPS and resource adequacy. It then layered on hourly marginal emissions followed by winter reliability constraints within PowerSIMM. Table

3 below summarizes the configuration for the four portfolio alternatives. Ultimately, SCPA selected the "80% Winter Night Reliability by 2030" alternative as the basis for its preferred portfolio alternative. The study results are described in Section III and documented in the 2022 IRP templates. Importantly, this scenario also solves the current summer reliability problems in CAISO and avoids some of the costs of solving the summer and forthcoming winter reliability issues separately.

Table 3. Configuration of SCPA Portfolio Alternatives Considered for Preferred Portfolio

Portfolio Alternative	**Winter Night Reliability Constraints**	**Marginal Emissions Constraints**	**Compliance Constraints**
Compliance Baseline	None	None	• 100% RPS for premium EverGreen product • Target of 50% or annual RPS compliance % for standard CleanStart product • Capacity to serve 115% of peak monthly load
100% Marginal Emission Mitigation by 2026	None	Supply portfolio provides sufficient hourly marginal emissions mitigation to offset marginal emissions of load for years 2026 and beyond	
80% Winter Night Reliability by 2030 **(Preferred Portfolio)**	Supply portfolio Winter Night Reliability equivalent to 80% of the average load during the same assessment hours by 2030		
100% Winter Night Reliability by 2030	Supply portfolio Winter Night Reliability equivalent to 100% of the average load during the same assessment hours by 2030		

PowerSIMM's optimized portfolio for all four alternatives included aggressive deployment of standalone battery storage with up to 130 MW online by 2028. All four alternatives also sought to build 100 MW of out-of-state wind when it became available in 2026. Both resource types were cost effective without imposing additional emissions and reliability constraints.

The two alternatives without a Winter Night Reliability constraint identified hybrid solar and storage resources as the most cost-effective resources to serve SCPA's load, with steady annual deployment up to 352 MW in 2032. The Winter Night Reliability portfolios instead opted to build GeoZone dispatchable geothermal and new onshore wind first to gear-up for 2030.

All three portfolios with marginal emissions constraints used annual carbon free contracts to meet short-term emissions objectives through 2031. Short-term RPS contracts were required by all four portfolios through 2028. PowerSIMM used short-term RA contracts to satisfy planning reserve margin (PRM) requirements for all four alternatives through 2040, although

to a lesser degree than seen in SCPA's existing portfolio. SCPA assumes these short-term RA contracts would likely be served by natural gas assets.

Several candidate resources were not selected by any of the four candidate portfolios: offshore wind, standalone solar, and new GeoZone baseload (non-dispatchable) geothermal. PowerSIMM did not identify these resources as cost-effective in meeting any of the configured objectives. However, SCPA will continue to revisit these technologies frequently to retest their value as changes in policy, market conditions, and regulations occur. Given dispatchable geothermal is a novel technology, SCPA did test a sensitivity portfolio with only GeoZone baseload geothermal available. Results identified dispatchable geothermal would be replaced by GeoZone baseload geothermal and more onshore wind.

A few key metrics were used by SCPA to compare portfolio alternatives and ultimately inform selection of the 80% Winter Night Reliability by 2030 alternative as the preferred portfolio for IRP submission. Those metrics included supply cost, total customer bill premium, discounted supply cost, unit supply cost, net hourly marginal emissions, annual emissions, and summer and winter reliability. Supply cost figures include the cost of energy, capacity, RPS and carbon free attributes in nominal dollars. They do not include CAISO fees, SCPA overhead, and the cost of customer programs. These costs are incorporated into the total customer bill premium estimate assuming static non-supply costs from today. Figures 5-7 compare several of these metrics through time between alternatives and Table 4 provides a summary of results from 2022 through 2040. SCPA also used incremental hourly marginal carbon mitigation and associated costs to assess a carbon abatement cost.

Figure 5. Unit Supply Cost Comparison of Portfolio Alternatives

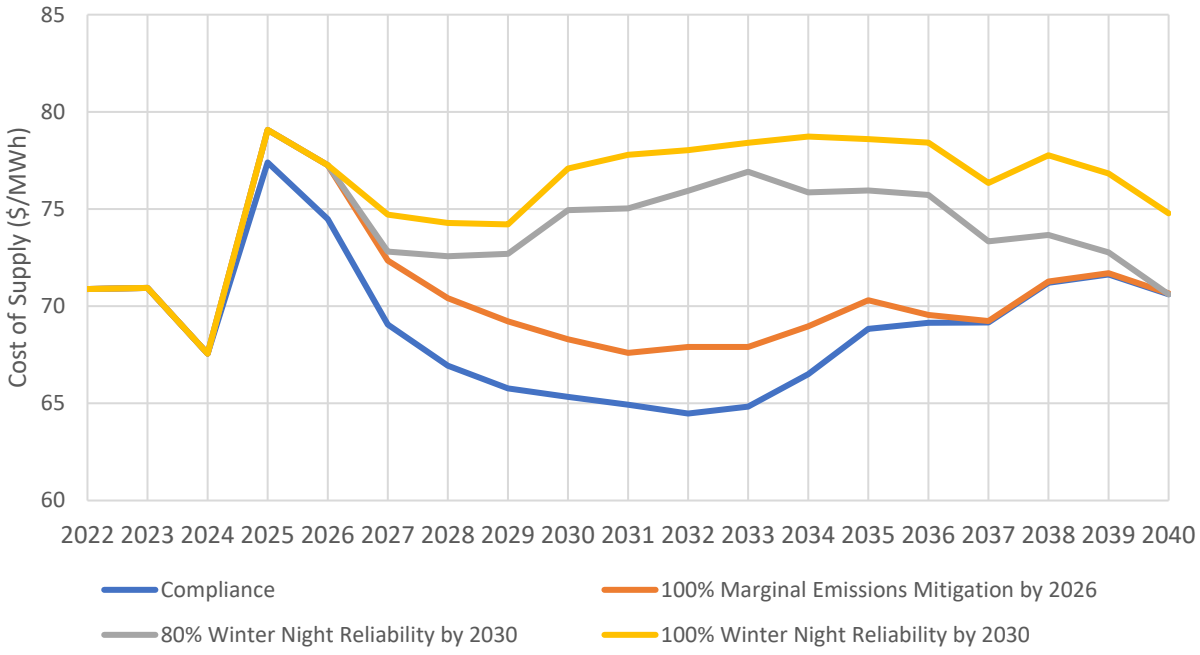


Figure 6. Net Hourly Marginal Emissions Comparison of Portfolio Alternatives

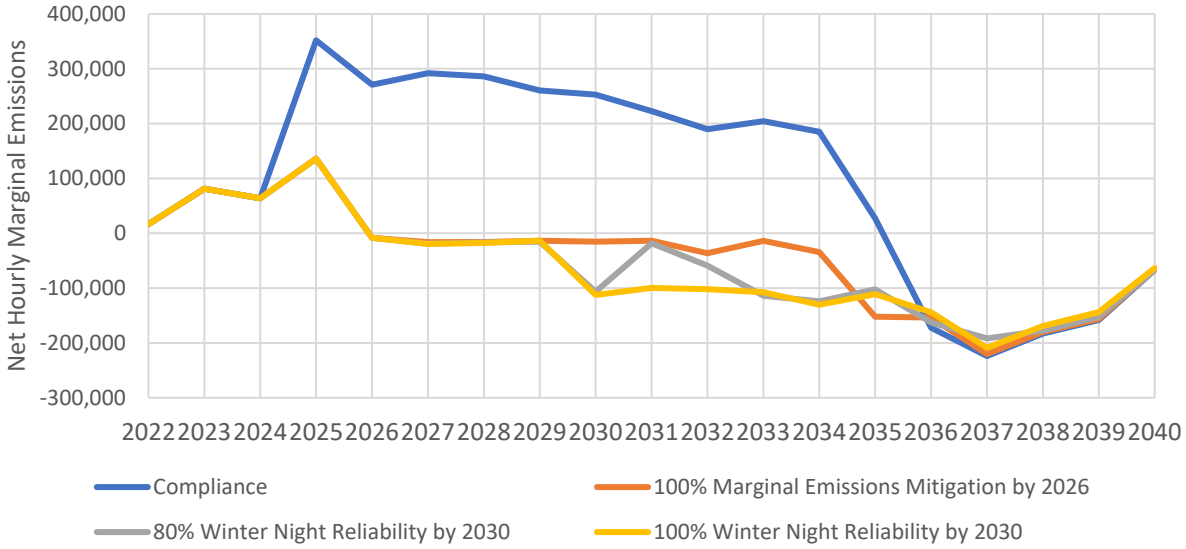
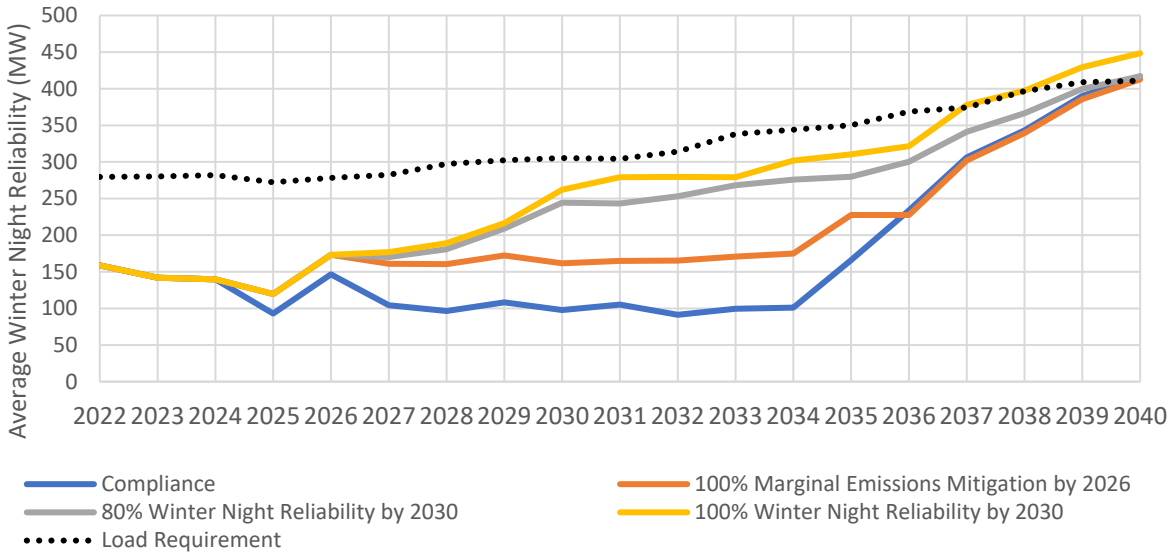


Figure 7. Average Winter Night Reliability Comparison of Portfolio Alternatives vs. Load Requirement

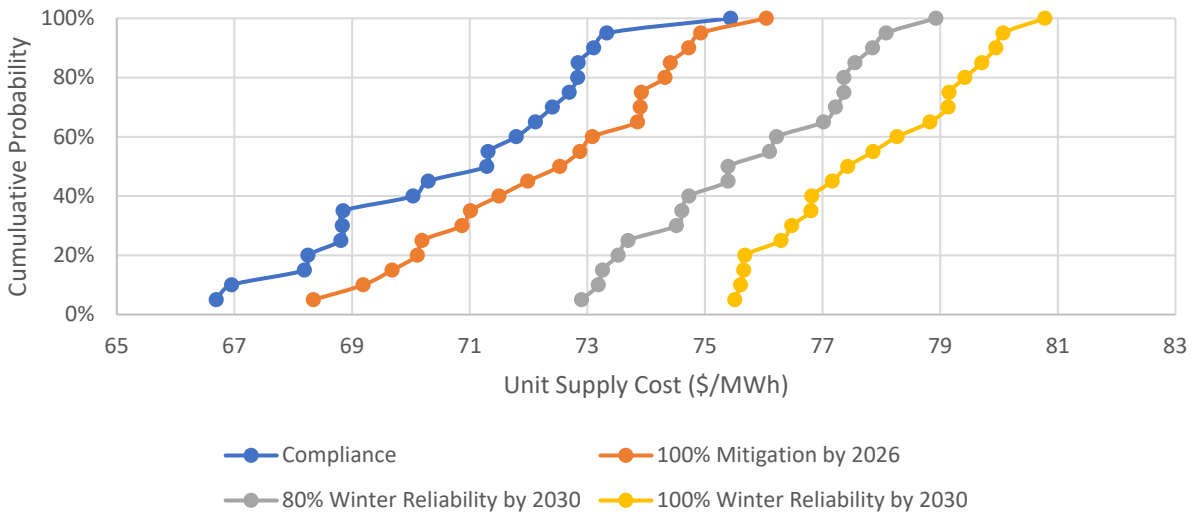


The metrics in Table 4 below are average results across 20 stochastic simulations within PowerSIMM. PowerSIMM's ARS specifically selects the optimum resources to minimize the average supply cost across stochastic simulations. To understand uncertainty and risk, SCPA also reviewed the distribution of stochastic results from PowerSIMM. Figure 8 shows the cumulative distribution of the supply cost for the four portfolio alternatives. Although the compliance and 100% mitigation portfolios are consistently cheaper, the wider breadth of their distribution indicates there is more uncertainty in their cost. This is likely due to their increased reliance on hybrid solar and storage resources where the net cost of resources is dependent on the ability of storage to shift energy supply and monetize volatility.

Table 4. Comparison of Key Metrics for Portfolio Alternatives (2022-2040)

Metric	Compliance	100% Marginal Emissions Mitigation by 2026	80% Winter Night Reliability by 2030 (**Preferred Portfolio**)	100% Winter Night Reliability by 2030
Average Annual Supply Cost (million $/yr)	178.4	182.5	191.2	196.6
Average Net Hourly Marginal Carbon Emissions (metric tonne/yr)	100,041	-41,995	-54,592	-60,705
Marginal Carbon Abatement Cost ($/metric tonne)	N/A	28.59	692.08	882.59
Unit Supply Cost ($/MWh)	68.96	70.53	73.90	75.99
Total Bill Premium vs. Compliance	N/A	+0.7%	+2.0%	+2.8%
Discounted Annual Supply Cost (million disc. $/yr)	148.7	152.1	159.1	163.2
Winter Night Reliability (Avg. % of Load Requirement)	51.6%	62.1%	73.6%	78.4%

Figure 8. Comparison of Stochastic Simulations of Supply Cost for Portfolio Alternatives



A comparison of metrics supports a strong case for adopting a 100% marginal emission mitigation target. For a 0.7% total bill premium, SCPA can deliver net negative hourly marginal emissions through 2040. The marginal abatement cost of $28.59/tonne is very competitive when comparing carbon mitigation options across sectors – for example,the 2022 auction settlement prices for California's Cap-and-Trade program have ranged from $27.00 to $30.85. Although the marginal abatement cost for also adopting Winter Night Reliability for a 2.0% total bill premium is not as competitive, SCPA ultimately selected the 80% Winter Night Reliability by 2030 alternative to submit as its preferred portfolio for the following reasons:

- SCPA believes that building resources that provide reliability through the winter will be key to enabling not just curtailment but retirement of natural gas resources. The long-term carbon mitigation impact of resources with winter reliability is likely understated by looking at hourly marginal emissions alone.
- The cost of supply resources may be overstated given the recent passage of the 2022 Inflation Reduction Act. Reduced pricing will provide additional incentive to build renewable resources and accelerate the need for solving winter reliability. When market data is available that reflects the impact of enhanced tax credits, SCPA expects the cost premium for providing winter reliability to shrink. The near-term impact may be tempered due to supply chain constraints.
- The large hourly open position in the portfolios without winter reliability targets exposes SCPA to both energy and capacity market risk that is only partially reflected in the stochastic results from PowerSIMM.
- The time series data on supply cost shows the cost of the 80% Winter Night Reliability by 2030 and the cheaper portfolios converging in the late 2030s. Many of the resources contracted and built in these portfolios will continue well into the 2040s and the long-term cost of investing early in winter reliability may be minimal.

7. Internal Portfolio Selection vs. Conforming Portfolio Study

Thus far, SCPA's 2022 IRP filing has focused on providing detailed information on SCPA's internal process for selecting a preferred portfolio for its 2022 IRP submission. SCPA specifically designed this process to deliver a portfolio that reflected SCPA's best available information and represented internal objectives.

However, in the RDT and CSP templates and following narrative sections, SCPA focuses on providing information to ensure that the submitted portfolio is conforming and provides the CPUC the necessary data to inform statewide resource planning. Table 5 below shows how inputs, assumptions, and methodologies may differ between the SCPA internal process used for selecting the preferred portfolio and the representation of a conforming portfolio in this filing.

Table 5. Comparison of Internal Portfolio Selection vs. Conforming Portfolio Study

Comparison	**Internal Portfolio Selection**	**Conforming Portfolio Study**
Load & Peak Demand Forecast	Internal hourly forecast aligned with cross-sector decarbonization targets; varied stochastically with weather by PowerSIMM	Annual load and peak demand from load share assignment; hourly baseline demand profiles from normalizing internal load model for calendar year 2030 and weather year 2009
Reliability Assessment	Calculated annually using Ascend ELCCs and compared to 115% PRM with 50 MW CAM allocation; dispatchable geothermal receives incremental capacity credit	Determined in RDT using 25 MMT ELCCs and assigned BTM solar and guidance on CAM; no incremental capacity credit for dispatchable geothermal
GHG Assessment	Hourly marginal emissions factor from Ascend applied to supply stack and compared to marginal emissions of load; does not include combined heat and power	Calculated in CSP and compared to LSE target for 25 MMT; includes an allocation of combined heat and power
CAISO Supply Stack	Ascend's CAISO 3.2 supply stack resulting from capacity expansion modeling by Ascend expert staff	Preferred System Plan incorporating LSE plans for 25 MMT 2035 target
Planning Horizon	2022-2040	2024-2035
Storage Dispatch	Optimized by PowerSIMM for each simulation across energy and ancillary markets; only includes full toll resources	CSP storage or hybrid profile; allows RA-only resources if not claimed by separate LSE
Resource Profiles	Varied stochastically by PowerSIMM for each weather simulation and trained using geographically-specific data; dispatchable geothermal allowed to shift load	CSP supply profiles (including dispatchable geothermal which uses provided geothermal profile)
SCPA Portfolio	Optimized using PowerSIMM ARS capability given constraints—4 portfolio alternatives evaluated	80% Winter Night Reliability by 2030 optimized portfolio selected by internal process
New Resource Costs	Calibrated internally using solicitation results and market knowledge and third-party sources	Economics not explicitly evaluated but inherits input assumptions from PSP
Winter Night Reliability	Assessed by comparing supply and load between 9pm and 5am in December	Not part of assessment

III. Study Results

a. Conforming and Alternative Portfolios

SCPA is submitting a single conforming portfolio that outperforms both the 25 MMT and 30 MMT by 2035 GHG targets. This portfolio was selected after completing an internal evaluation of four optimized portfolio alternatives described in Section II. Specifically, SCPA is submitting a conforming portfolio that is consistent with the 80% Winter Night Reliability by 2030 alternative. This portfolio meets compliance requirements, drives SCPA's internal calculation of net marginal emissions to zero by 2026, provides 80% of SCPA's target for Winter Night Reliability by 2030, and maintains affordable bills for SCPA customers.

i. Existing Resources Under Contract

Since starting service in 2014, SCPA has provided a diverse set of resources to serve its load and meet SCPA's objectives for de-carbonization. The submitted preferred portfolio contains the existing resources that are under long-term contract described in Table 6 below.

Table 6. Existing Resources Under Long-term Contract in SCPA Conforming Portfolio

Name	Resource Type	Nameplate	Contract End Year
Geysers	Geothermal	50 MW	2026
Mustang Solar	Solar PV	70 MW	2036
Golden Hills Wind	Wind	46 MW	2037
Lavio Solar	Solar PV	1 MW	2038
Stage Gulch Solar	Solar PV	1 MW	2038
Cloverdale Solar	Solar PV	1 MW	2039
IP Malbec Solar	Solar PV	1 MW	2039
Bodega West Solar	Solar PV	1 MW	2040
Petaluma East Solar	Solar PV	1 MW	2040
Mustang Storage (RA-Only)	Battery Storage	75 MW	2031

SCPA also executes short-term contracts with existing resources to provide resource adequacy, and renewable or carbon-free energy to meet SCPA environmental objectives. The RDT includes the following short-term contracts for the conforming portfolio that are in the scope of this filing (satisfy procurement order requirements or impact environmental and reliability assessments in 2024 and beyond):

- An RA contract eligible for incrementality in the backstop procurement order from Sutter Energy Center through 2023
- Various multi-year RA-only contracts from existing wind, solar, biomass, and co-generation units to satisfy near-term RA obligations through 2025
- A multi-year RPS index-plus contract from existing biomass through 2024

- A multi-year Asset Controlled Supplier index-plus contract through 2024
- A short-term intra-LSE contract for in-state hydro through 2024

iii. Existing Resources Identified for Future Contracting

SCPA's conforming portfolio also includes existing resources that are not yet under contract. Those resources include:

- Expected in-state hydro generation from SCPA's GHG-free Power Charge Indifference Adjustment (PCIA) allocation

[redacted]

- Short-term RPS contracts to meeting compliance and hourly carbon mitigation goals through 2029—varying from 44 to 271 GWh per year and assumed likely from existing solar
- Short-term carbon free contracts to meet hourly carbon mitigation goals through 2035—varying from 0 to 394 GWh per year and assumed to likely come from existing Pacific Northwest hydro
- Short-term resource adequacy contracts selected by PowerSIMM (SCPA's portfolio planning software) to meet reliability requirements—varying from 32 to 150 MW per year and assumed to likely come from existing combined cycle units
- Capacity from CAM, Central Procurement Entity (CPE), and Demand Response allocations as part of the annual resource adequacy process from existing cogeneration units, batteries, and combined cycle units; represented following guidance in the RDT User Guide
- Short-term resource adequacy contracts need to provide sufficient reliability assuming both the 25 MMT and 30 MMT ELCCs, varying from 19 to 184 MW given assumption that capacity will be from combined cycle units

iv. New Resources

The new resources included in SCPA's conforming portfolio are either specific projects SCPA has contracted for but not yet built, currently pursuing, or were selected based on supply cost optimization with the environmental, risk, reliability, and compliance constraints of the 80% Winter Night Reliability alternative. SCPA considered all candidate resources described in Table 2 of the Methodology section of this narrative. Table 7 below provides a comprehensive inventory of all new resources in SCPA's conforming portfolio, ordered by expected COD.

SCPA's near-time procurement is very concentrated in storage or paired solar and storage projects. Since the 2020 IRP, SCPA was able to expand the Proxima project to provide additional capacity to satisfy the MTR procurement order. The new Tubbs Island solar and storage project is the result of a solicitation SCPA conducted targeted at local resources to power its premium local renewable energy product, EverGreen. Many of the other near-term projects have been procured in collaboration with other CCAs, including CC Power contracts for long-duration storage and geothermal capacity.

Table 7. New Resources in SCPA's Conforming Portfolio

Name	Status	Resource Type	Contracted Nameplate	COD
GridSavvy Demand Response	Developing SCPA Program	Demand Response	5 MW by 2026 and 10 MW by 2030	2024
Proxima	Contracted	Solar + Storage	70 MW Solar + 32 MW 4-hr Storage	April 2024
Tubbs Island	Contracted	Solar + Storage	11.6 MW Solar + 8 MW 4-hr Storage	June 2024
[redacted]	Under Negotiation	Solar + Storage	[redacted]	[redacted]
Fish Lake	Contracted	Geothermal	1.52 MW	June 2024
MTR Storage (RA-Only)	Under Solicitation	Storage	55 MW 4-hr	June 2024
Ormat Portfolio	Contracted	Geothermal	14 MW	Starting October 2024
Goal Line	Contracted	Long Duration Storage	8.68 8-hr	June 2025
[redacted]	Under Negotiation	Storage	[redacted]	[redacted]
[redacted]	Under Negotiation	Out-of-State Wind	[redacted]	[redacted]
Tumbleweed	Contracted	Long Duration Storage	8.94 MW 8-hr	April 2026
Candidate Storage	Planned	Storage	30 MW 4-hr	2027
Candidate Solar + Storage	Planned	Solar + Storage	40 MW Solar + 40 MW 4-hr Storage	2027
Candidate Long-Duration Storage	Planned	Storage	30 MW 8-hr	2027
Candidate Storage	Planned	Storage	20 MW 4-hr	2028
Candidate In-State Wind	Planned	Wind	50 MW	2028
Candidate In-State Wind	Planned	Wind	50 MW	2029
Candidate In-State Wind	Planned	Wind	50 MW	2030
Candidate GeoZone Dispatchable	Planned	Geothermal	30 MW	2030
Candidate GeoZone Dispatchable	Planned	Geothermal	20 MW	2032
Candidate GeoZone Dispatchable	Planned	Geothermal	20 MW	2033
Candidate Solar + Storage	Planned	Solar + Storage	40 MW + 40 MW 4-hr Storage	2034

After the MTR order is satisfied, SCPA will continue to aggressively procure to provide reliability and to maximize carbon emissions mitigation. This includes additional storage and paired solar and storage in 2027.

SCPA's portfolio evaluation suggests there is high value in building onshore wind resources, but current opportunities are limited in California due to permitting and litigation issues. SCPA has identified an out-of-state wind project as an alternative that can COD in 2026. Long-term, SCPA is hoping to build additional in-state wind and represents a 3-year ramp-up from 2028-2030 to 150 MW of capacity. If contracts roll-off of existing in-state wind from other off-takers in that time frame, re-contracting existing resources may also be an alternative for SCPA to secure additional wind capacity.

To cost-effectively meet SCPA's internal targets for providing winter reliability, new geothermal capacity will be required. SCPA accordingly includes three geothermal projects ramping up to 70 MW of new capacity between 2030 and 2033. In internal modeling, these resources are treated as dispatchable and can shift up to 8 hours of generation to double capacity during high need hours. SCPA has been working with technology providers with this type of capability in its GeoZone initiative and preliminary analysis suggests its enhancement of project value outpaces the additional cost. However, for evaluation of the CSP emissions and reliability of the preferred portfolio in the RDT, these projects are being treated as ordinary geothermal resources.

SCPA's internal modeling extended beyond 2035 to 2040. In the results of internal modeling, the aggressive resource build-out accelerates to accommodate load growth from building and transportation electrification. In 2040, SCPA's portfolio includes the following additions beyond the capacities documented in this filing in 2035:

- 80 MW of new dispatchable geothermal
- 30 MW of new in-state wind
- 190 MW of new solar + storage

v. Comparison to 2021 PSP Portfolio

Table 8 provides a comparison of the new resource capacity build-out in SCPA's preferred portfolio relative to the 2021 PSP portfolios for 30 MMT and 25 MMT greenhouse gas targets for 2035. The net zero marginal emissions by 2026 and 80% Winter Night Reliability target for 2030 in SCPA's internal portfolio modeling result in a larger build-out than its load share of the PSP.

SCPA's focus on building resources to mitigate hours with high emissions and its requirement for Winter Night Reliability also result in a portfolio that is more weighted towards geothermal and wind rather than solar. The resources in SCPA's portfolio are likely harder to build than the resource mix in the PSP. Accordingly, SCPA is starting early in planning and pro-active engagement to build its preferred portfolio, as described in the Action Plan section.

Table 8. Comparison of Cumulative New Capacity (MW) by Technology vs. Load Share of 2021 PSP Portfolios

Year	2030			2035		
Load Share of PSP	**1.09%**			**1.11%**		
Portfolio	**SCPA 2022 IRP**	**2021 PSP 30 MMT**	**2021 PSP 25 MMT**	**SCPA 2022 IRP**	**2021 PSP 30 MMT**	**2021 PSP 25 MMT**
Biomass	0.0	1.5	1.5	0.0	1.5	1.5
Geothermal	45.5	12.4	12.4	85.5	12.6	12.6
Wind	150.0	38.8	46.5	150.0	39.5	47.4
Wind OOS New Tx	100.0	19.6	52.6	100.0	51.4	53.6
Offshore Wind	0.0	2.1	2.2	0.0	52.2	52.2
Solar	121.6	189.7	220.2	161.6	193.3	241.8
Battery Storage	269.2	157.3	146.9	309.2	192.5	196.9
Pumped Storage	0.0	10.9	10.9	0.0	11.1	11.1
Shed DR	10.0	10.6	8.3	10.0	10.8	8.5
Total	691.3	442.9	501.4	811.3	565.0	625.6

b. Preferred Conforming Portfolios

SCPA is submitting a single preferred conforming portfolio that outperforms both the 30 MMT and 25 MMT greenhouse gas emission benchmarks. Given that SCPA selected the preferred portfolio after completing a detailed optimization through 2040, the selected resources are also well-suited to serve large increases in load from building and transportation electrification and remain robust as the grid approaches the long-term goals of SB 100. As described in Section II, the submitted portfolio is expected to carry a small cost premium relative to a portfolio focused solely on compliance. However, that cost is not significant enough to inhibit electrification and does not fully capture the value of potential opportunities and risks mitigated in the selected portfolio.

The preceding section provides a detailed description of the resources in SCPA's preferred conforming portfolio. Figure 9 below provides an illustration of the generation mix in the preferred portfolio breakdown by resource type. Biomass, system power, and hydro generation are all reduced through time and are replaced by increasing geothermal, wind, and solar paired with storage. Similar graphs for capacity through time are provided in the System Reliability Analysis section.

Figures 10 and 11 provide a view of how the preferred portfolio will be expected to operate on a seasonal and hourly basis in 2035 compared to load. Both visuals were prepared using the 25 MMT CSP calculator and associated profiles. The high concentration of geothermal and wind resources enable alignment between supply and load. Although there is still a gap in load from November through February, it is far smaller than portfolios without a winter reliability target. The small gap in evening hours can be addressed with more flexible storage operation than the assumption in the CSP profiles.

Figure 9. Annual Generation by Resource Type in SCPA IRP Conforming Preferred Portfolio

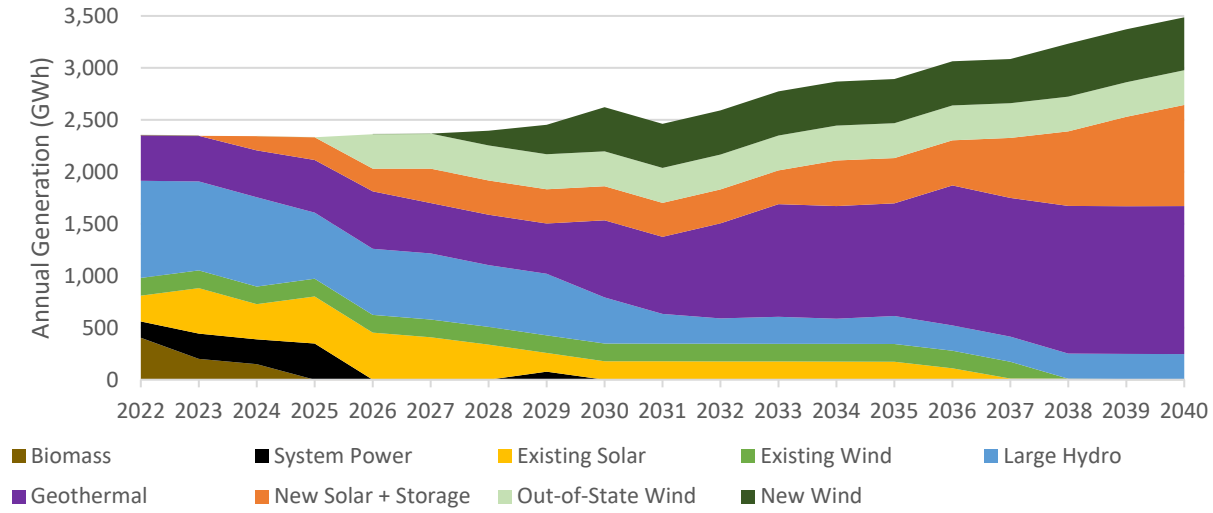


Figure 10. Average Hourly Supply Profile vs. Load of SCPA Preferred Portfolio in 2035 (Using CSP Profiles)

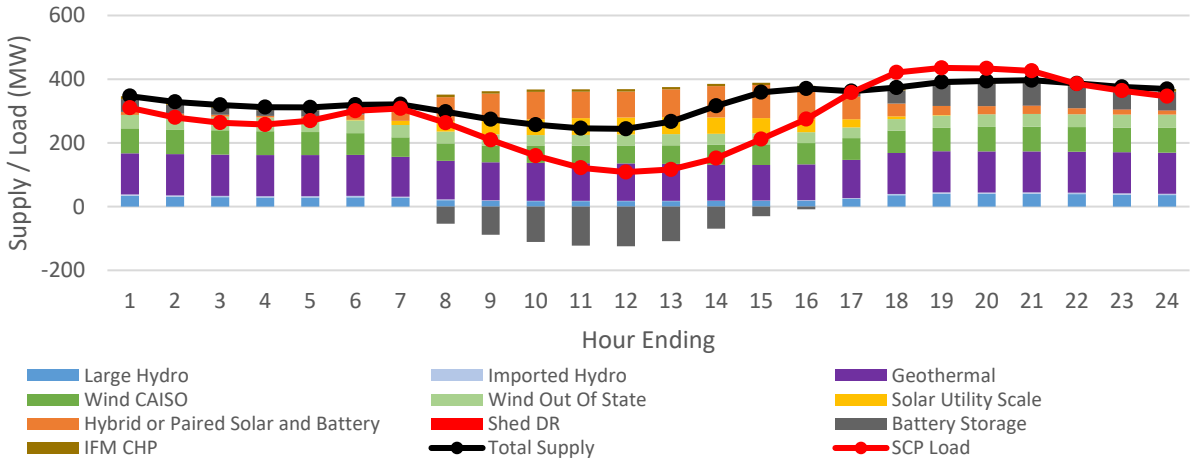
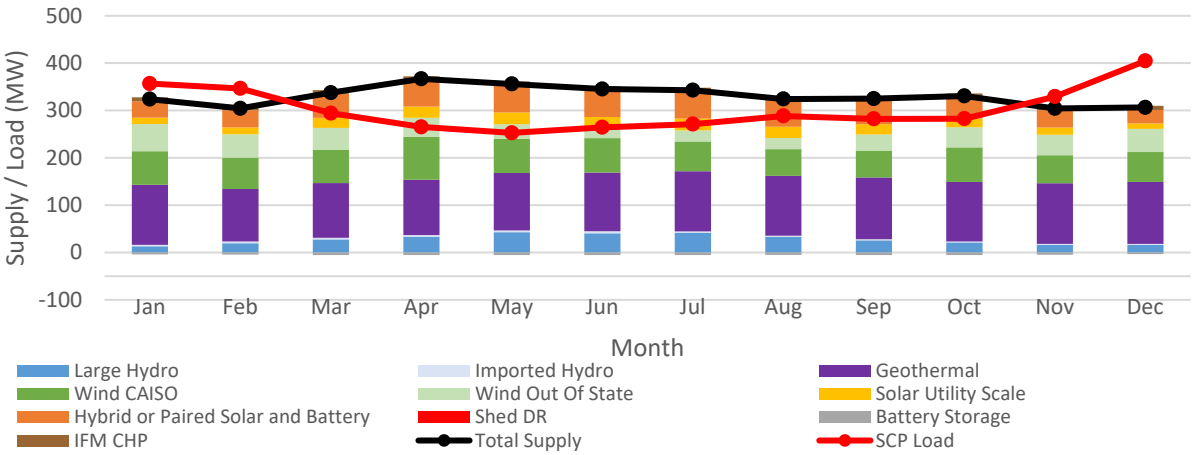


Figure 11. Average Monthly Supply Profiles vs. Load of SCPA Preferred Portfolio in 2035 (Using CSP Profiles)



SCPA's 2022 IRP preferred conforming portfolio is much more ambitious than the resource portfolio submitted in the 2020 IRP. Table 9 below provides a comparison of the cumulative new capacity in 2030 by technology between this 2022 IRP and SCPA's 2020 IRP.

Table 9. Comparison Cumulative New Capacity (MW) by Technology in 2030 vs. 2020 IRP

Portfolio	SCPA 2022 IRP	SCPA 2020 IRP	Delta
Biomass	0.0	5.0	-5.0
Geothermal	45.5	0.0	+45.5
Wind	150.0	80.0	+70.0
Wind OOS New Tx	100.0	0.0	+100.0
Offshore Wind	0.0	0.0	0.0
Solar	121.6	143.0	-21.4
Battery Storage	269.2	84.0	+185.2
Pumped Storage	0.0	20.0	-20.0
Shed DR	10.0	0.0	+10.0
Total	**691.3**	**332.0**	**+364.3**

The significant changes in SCPA's portfolio planning between IRP cycles can be attributed in part to the following factors:

- **Mid-term Reliability Order:** the MTR has placed a strong emphasis on building new resources and specifically motivated SCPA's procurement of additional storage and geothermal resources.
- **Local Conditions:** following the last IRP, SCPA has received community opposition to building new biomass (which has been removed from the plan) and is working on building support for new geothermal through the GeoZone initiative.
- **Voluntary Allocation & Market Offer (VAMO):** the 2020 IRP assumed SCPA would lean more heavily on RPS resources through the proposed VAMO resource; after completing a risk assessment, SCPA has decided to not participate in the VAMO process and instead build new resources. Considerations in the risk evaluation included uncertainty and lack of control on the generation mix, annual generation volumes, and expected delay in data confirming actual generation and cost.
- **Analytic Capabilities:** SCPA's investment in more sophisticated modeling tools has identified building new resources as a cost-effective approach and increased confidence in executing more aggressive procurement.
- **Climate Crisis:** Extreme weather, including severe drought and wildfires in SCPA's region, continue to build community support for pursuing increasingly ambitious climate objectives which are reflected in SCPA's goal of achieving net zero marginal emissions by 2026 in the preferred portfolio, a much more aggressive target than the annual emissions target informing the 2020 IRP portfolio.

Section II provides detail on why the preferred portfolio SCPA submitted for its 2022 IRP is preferrable to alternatives considered in SCPA's internal modeling. SCPA believes selection of this portfolio is well aligned with the following statutory and administrative requirements:

- **Meets Emission Reduction Targets:** Not only does SCPA's preferred portfolio meet the emissions targets evaluated in the 2022 IRP for 2030 and 2035, but it is also likely to be within the emission targets for the electricity sector when approaching SB 100 goals. The 2035 emissions of the preferred portfolio in the 25 MMT CSP are less than its load share of a sector-wide emission of 3 MMT. This is far less than the 30 MMT CARB is currently considering as a 2045 target for the electricity sector in the 2022 Draft Scoping Plan.
- **60% Renewable by 2030:** The preferred portfolio is 90% renewable in 2030—well exceeding the 60% by 2030 requirement. The share of renewable resources continues to grow past 2030. The portfolio also meets SB 100's 100% renewable or carbon free objective as soon as 2026.
- **Just and Reasonable Rates:** SCPA's portfolio evaluation suggests that the preferred portfolio carries a 2.0% total customer bill premium versus a minimally compliant portfolio. However, this evaluation does not price in the avoided social cost of carbon or the value of mitigating winter reliability risk in the preferred portfolio. In addition to being in better alignment with SCPA's objectives to enable decarbonization, the preferred portfolio is better suited to provide financial certainty and reliability as the grid transitions to clean and reliable year-round energy resources. Meanwhile, the preferred portfolio is still sufficiently low in cost to enable electrification across its customer base.
- **Minimize Impacts on Customer Bills:** Due to the roll-off of existing lower cost contracts, SCPA expects increasing supply cost regardless of its IRP portfolio in 2025. Past this date, SCPA's analysis expects the preferred portfolio to allow customer bills to remain stable and even decrease.
- **Ensure System & Local Reliability:** The preferred portfolio is built with system resource adequacy as a primary constraint and SCPA expects a decreased dependency on short-term resource adequacy in the Preferred Portfolio. The focus on building local geothermal capacity in the preferred portfolio will directly benefit local and system reliability.
- **65% Long Term RPS:** The preferred portfolio strongly favors building new resources to meet SCPA's objectives rather than relying on short-term goals. This results in SCPA's preferred portfolio forecasting that 100% of its RPS will be provided by long-term contracts by 2030.
- **Strengthen Diversity, Sustainability, and Resiliency:** SCPA's preferred portfolio replaces current hydropower with geothermal, wind, and hybrid solar and storage, resources that complement each other and create a more diverse and sustainable portfolio. SCPA's near-term procurement strategy supports developing resources with geographic diversity, including Nevada geothermal, long-duration storage in Southern

California, and hybrid resources in the Central Valley and North Bay. Although the geography of long-term resources was not a focus for designing the preferred portfolio, SCPA expects to continue selecting resources that are compatible with building a reliable bulk transmission grid. Meanwhile, SCPA's focus on building local resources, including the Tubbs Island project and the GeoZone, delivers the promise of providing direct economic and reliability benefits to SCPA customers.

- **Enhance Distribution Systems and Demand Side Management:** The preferred portfolio includes an objective to grow SCPA's existing demand response program to 5 MW by 2026 and 10 MW by 2030. SCPA is using this program to not only reduce SCPA's capacity obligation but also investigate new technologies and techniques to increase load flexibility and reduce customer bills. The preferred portfolio's focus on non-solar utility scale resources allows more capacity for behind-the-meter distributed resources for its customers.
- **Minimize Localized Air Pollutants:** SCPA's preferred portfolio is specifically designed to accelerate the retirement of natural gas resources that contribute air pollution with a particular burden on disadvantaged communities. It does this by both using an hourly marginal emissions factor target to identify resources that can effectively replace natural gas and identifying solutions to providing the grid with winter reliability, which is likely the last impediment to retiring natural gas capacity. Based on local feedback, the portfolio also phases out biomass resources. Although dry steam geothermal resources in SCPA's portfolio have geologic emissions that can burden local communities, SCPA is working through its GeoZone initiative to build new resources in a closed-loop configuration with no operational emissions.

Despite its low emissions, SCPA expects the preferred portfolio to operate reliably regardless of how other LSEs procure resources. The higher concentration of wind and geothermal provides energy and capacity in summer evenings and prepares the portfolio to meet reliability targets when the challenge shifts to supplying clean energy through winter. The preferred portfolio also shows SCPA procuring more flexible resources than its load share. The 277 MW of battery storage by 2035 is over 40% greater than its load share of 196.9 MW in the 25 MMT PSP. Additionally, SCPA is working on developing dispatchable geothermal resources with capabilities not quantified in the IRP filing. This flexibility will allow SCPA's portfolio to deliver low emissions, reliability, and adaption as other LSEs pursue their own procurement strategies and state policy evolves.

The preferred portfolio does not include any new natural gas resources or long-term re-contracting with existing gas resources. Although SCPA expects to continue to rely on short-term capacity contracts with existing gas resources, the preferred portfolio is specifically designed to accelerate retirement of fossil resources.

c. GHG Emissions Results

The GHG emissions calculated by the CSP calculator for the preferred portfolio are shown in Table 10 below relative to SCPA's target for both a statewide 2035 25 MMT and 2040 MMT target.

The only custom shape SCPA uses in the CSP calculator is for representing baseline load. SCPA believes using a custom load shape is prudent, given its seasonal energy usage differs from the state and generally peaks in the winter. The load shape was developed using SCPA's internal load forecasting model to predict hourly load given a 2009 weather year (consistent with the CSP calculator assumptions) and predicted demographic data for 2030. The resulting load was normalized by annual load and converted to the shape used in the CSP calculator. SCPA leveraged CPUC profiles for all load modifiers and generation by technology. Although SCPA develops custom load and resource-specific profiles for internal evaluation to design the preferred portfolio described in Section II, the submission uses CPUC profiles to ensure consistency in weather normalization and battery dispatch assumptions. SCPA completed all calculations using the 25 MMT version of the CSP calculator.

Table 10. GHG Emissions of Preferred Portfolio vs. Targets (Million Tonne CO2 per Year)

Resource	2030	2035
Preferred Portfolio	0.020	0.035
30 MMT Target	0.331	0.254
25 MMT Target	0.250	0.203

The preferred portfolio resulting emissions are far below SCPA's compliance targets. The resulting emissions of the preferred portfolio mostly derive from SCPA's mandatory allocation of behind-the-meter combined heat and power emissions. Before applying SCPA's allocation of combined heat and power, the preferred portfolio is carbon negative in 2030 and essentially zero in 2035. This is consistent with SCPA's internal metric of building a carbon neutral portfolio assessed using hourly marginal emissions by 2026.

d. Local Air Pollutant Minimization and Disadvantaged Communities

ii. Local Air Pollutants

The local air pollutant emissions associated with SCPA's preferred portfolio are tabulated in Table 11 below as calculated by the CSP calculator. In 2024, SCPA's portfolio contributes local pollution from short-term contracts for generation from biomass and an Asset Controlling Supplier. In 2030 and beyond, all SCPA's local air pollution is associated with its allocation of behind-the-meter combined heat and power. The preferred portfolio is expected to deliver net negative local air pollution from system power in 2030.

Table 11. Local Air Pollutants of Preferred Portfolio (Tonnes per Year)

Pollutant	2024	2026	2030	2035

NOx	150	13	11	4
PM2.5	49	2	2	0
SO2	18	0	0	0

The CSP calculator does not attribute local air pollution with geothermal generation. However, there are geologic emissions of nitrous oxide and sulfur dioxide associated with generation at the existing plants at the Geysers. A particular pollutant of concern for local residents is hydrogen sulfide, although the operators have taken considerable steps to mitigate these emissions. Although SCPA expects local geothermal power to comprise a large part of its portfolio, SCPA is exploring closed-loop technologies that can be deployed to nearly eliminate operational emissions for new development.

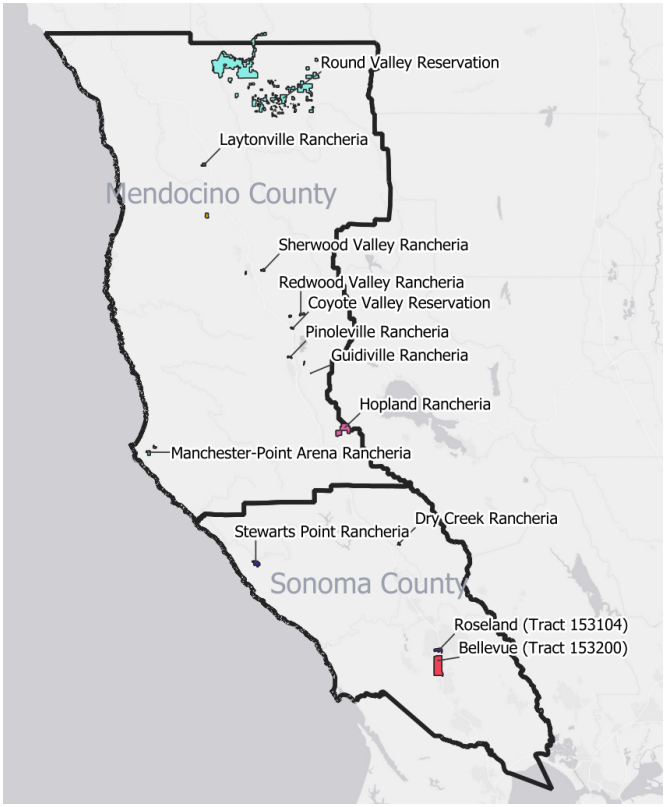
ii. Focus on Disadvantaged Communities

A summary of the disadvantaged communities SCPA serves, as defined by CalEPA for SB 535, is included in Table 12. The number of SCPA customers is estimated by mapping the coordinates of SCPA meters and comparing their location to the geographic boundaries of the CalEPA communities. A map of these communities is included as Figure 12. SCPA estimates 4,736 customers are located within one of these communities, representing 2.1% of its total customers served. This proportion is far smaller than the state average due in part to the limited presence of heavy industry and resulting pollution and favorable regional air quality.

Table 12. CalEPA Disadvantaged Communities in SCPA Territory

Community	Category	SCPA Customers
Bellevue (Tract 153200)	2017 DAC	2,763
Roseland (Tract 153104)	CalEnviroScreen 4.0 Top 25%	1,532
Coyote Valley Reservation	Tribal lands	36
Dry Creek Rancheria	Tribal lands	8
Guidiville Rancheria	Tribal lands	17
Hopland Rancheria	Tribal lands	56
Laytonville Rancheria	Tribal lands	38
Manchester-Point Arena Rancheria	Tribal lands	65
Pinoleville Rancheria	Tribal lands	34
Redwood Valley Rancheria	Tribal lands	73
Round Valley Reservation	Tribal lands	68
Sherwood Valley Rancheria	Tribal lands	37
Stewarts Point Rancheria	Tribal lands	9
Total		**4,736**

Figure 12. Map of Disadvantaged Communities in SCPA Service Territory



The supply resources in SCPA's preferred portfolio will not introduce air pollution in its own disadvantaged communities. The only emissions from local resources in SCPA's portfolio are from existing geothermal at the Geysers, which is not located near the disadvantaged communities, as shown in Figure 12. Although outside its territory, SCPA has engaged the Middletown Rancheria in Lake County, which is proximal to the Geysers, to understand opportunities to collaborate on resource development. Meanwhile, SCPA is specifically looking at technologies to enable new geothermal resources with reduced emissions in its GeoZone initiative.

SCPA engaged the community on development of local resources through public workshops and surveys in early 2021. During these workshops, SCPA specifically gauged the interest in developing new local biomass resources that could leverage feedstock from wildfire mitigation operations. The community voiced strong opposition to building new biomass resources, which lead SCPA to removing new biomass from its portfolio. Both pollution impacts and concerns that new resources would create a demand for forestry that outlived wildfire mitigation requirements were key concerns driving opposition.

SCPA is proactively working on improving its engagement with disadvantaged communities to inform both energy procurement strategy and the development of customer programs. Starting this year, SCPA is rolling-out the Empower program, an initiative to build strong relationships with community organizations within disadvantaged areas. SCPA plans to use

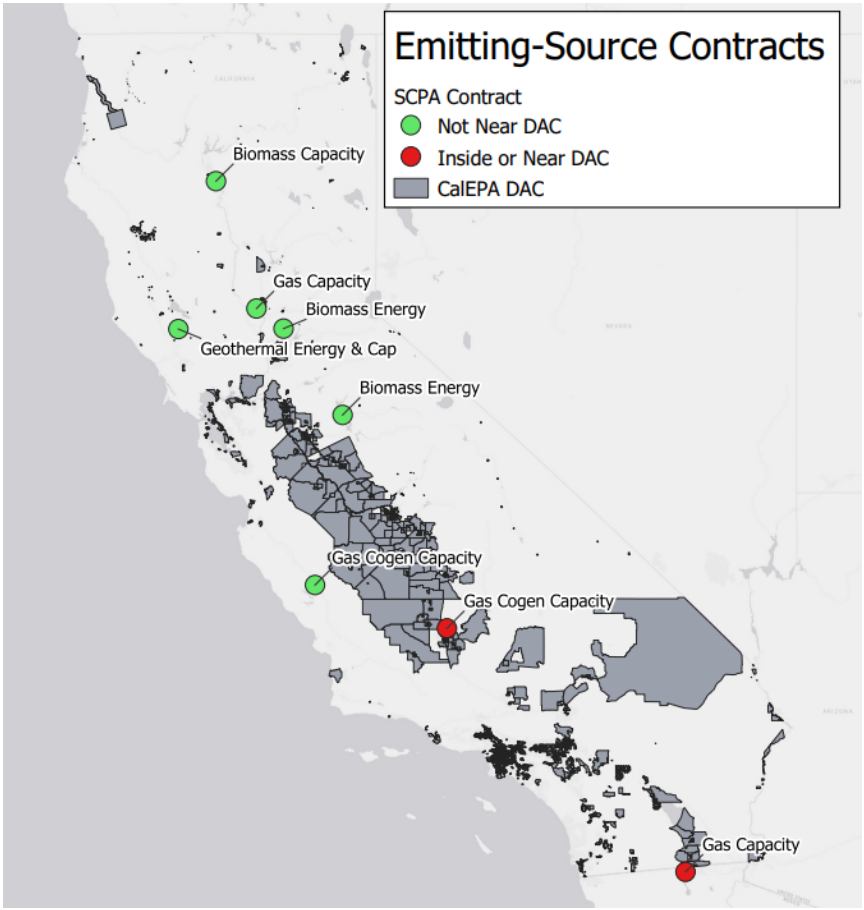
the Empower program as an opportunity to inform communities on its role as a CCA, on the benefits of decarbonization, and to socialize available customer programs. Long-term, SCPA hopes the Empower program will increase interest and promote engagement from disadvantaged community members and provide them an opportunity to contribute feedback in developing an effective and equitable strategy for moving forward with decarbonization. SCPA is also embarking on community needs assessments for residential, commercial, and agricultural customers to determine how SCPA customer programs can more directly help the local community. A particular focus will be on underserved and underrepresented customers.

As part of its core mission, SCPA has implemented numerous programs that directly reduce local air pollution by reducing the combustion of fossil fuels for transportation and building heating in communities SCPA serves. These programs include:

- The Drive EV program propelled early adoption of electric vehicles in SCPA's territory by offering up to a $4,000 incentive for the purchase or lease of a zero-emission vehicle (1,258 incentives were offered).
- The GridSavvy free charger program provides residents with free level 2 charging equipment to directly address barriers to electric vehicle ownership (over 4,300 chargers provided so far).
- The CEC's CALeVIP program uses matching funding from SCPA to offer large rebates for installing non-residential EV charging (2 DC fast chargers and 8 level 2 charging sites already operational).
- The Bike Electric program provided emission-free mobility to low-income customers by providing them with vouchers to significantly reduce the cost of e-bikes (over 428 vouchers through program).
- SCPA's Advanced Energy Center provides incentives and 0% interest financing on building electrification projects that replace combustion appliances.
- Advanced Energy Rebuild and Advanced Energy Build provided incentives for electrifying homes that were rebuilt from wildfires and homes that were being newly constructed, respectively.

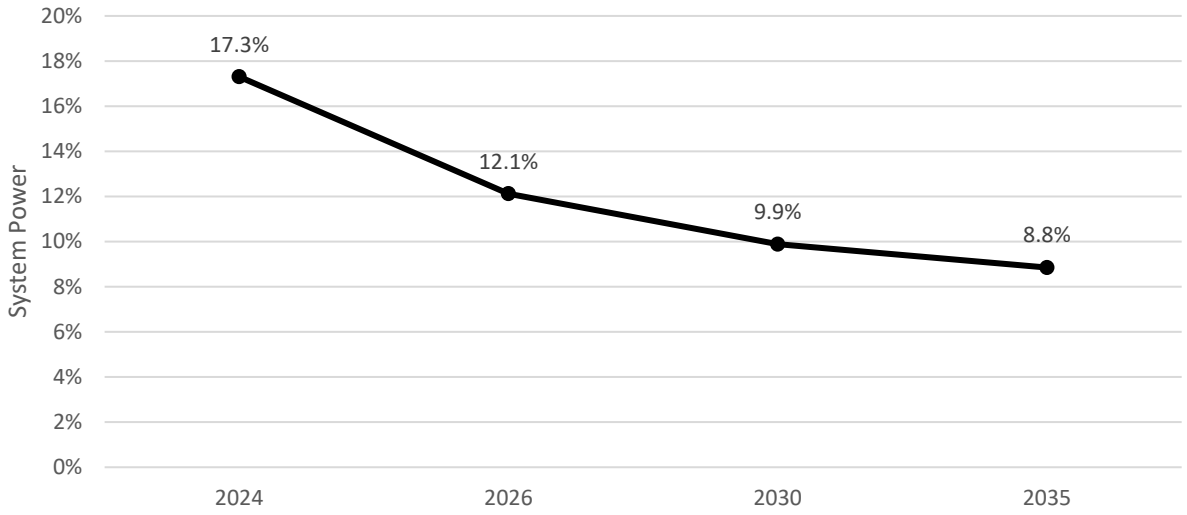
Although SCPA's portfolio and programs provide a net benefit to local air quality, reliance on resources outside its territory results in local air pollution impacts. Figure 13 maps contracts that are within the scope of this filing from resources with emissions. Although SCPA's energy contracts are not located in disadvantaged communities, several capacity contracts are in or near disadvantaged communities. Additionally, SCPA relies on system power throughout the year and short-term capacity contracts not explicitly described in this filing that do contribute local air pollutants, likely disproportionately in disadvantaged communities.

Figure 13. Map of SCPA Emitting-Source Contracts vs. CalEPA DACs



SCPA believes the most effective way to reduce local air pollution from electricity generation is to develop resources that enable the retirement of natural gas capacity. That is a key focus in the decision to adopt a portfolio that includes resources that can achieve the winter reliability historically provided by gas units. The performance of the preferred portfolio is also evident in Table 11 where SCPA's portfolio has reduced local air pollution by 97% in 2035 compared with 2024 levels. The System Reliability Analysis section below also discusses how SCPA's portfolio reduces its reliance on natural gas capacity. An additional useful metric SCPA evaluated is the percent of its load relying on system power on an hourly basis when gas units are on margin. Unlike the CSP calculator emissions results, this metric looks solely at SCPA's portfolio's dependence on system power with no crediting of excess generation. Results indicate that SCPA's hourly dependence on system power reduces by almost half between 2024 and 2035, as shown in Figure 14.

Figure 14. Hourly Share of Load from System Power (Gas on Margin)



e. Cost and Rate Analysis

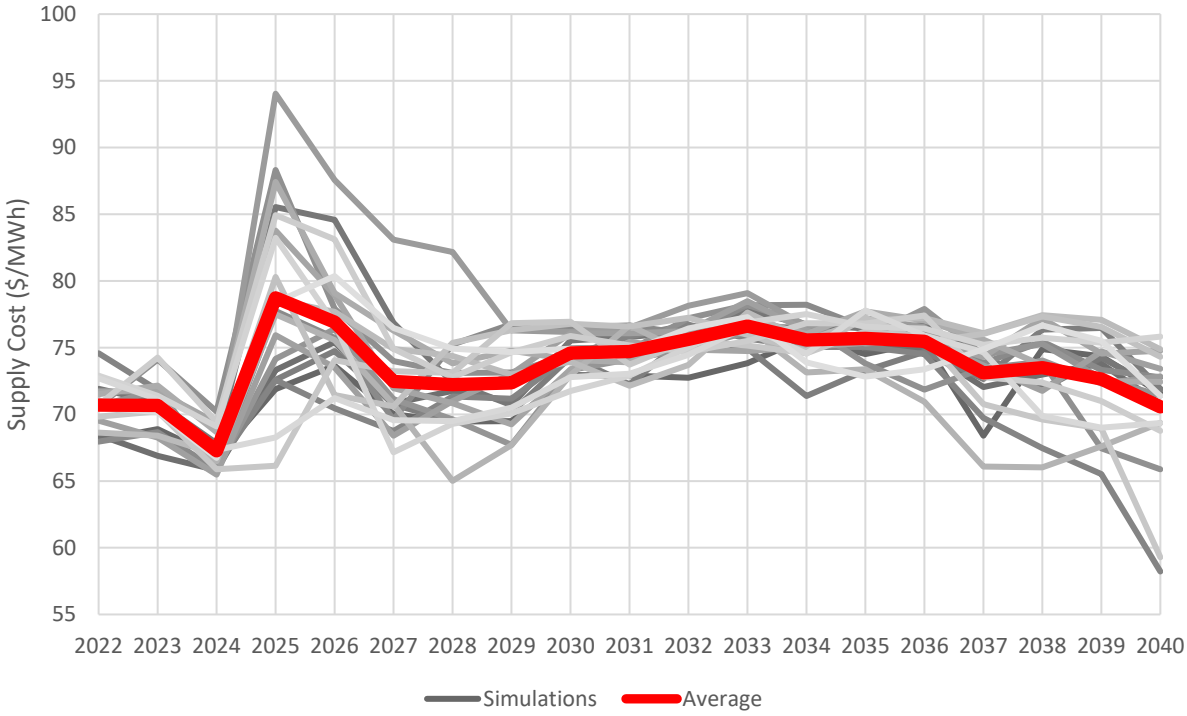
Cost and customer rate impacts were primary considerations in the development of SCPA's preferred conforming portfolio. As described in the Modeling Approach section and illustrated in Figure 5 and Table 4, SCPA evaluated the supply cost of four alternative portfolios before selecting a preferred portfolio including a minimum compliance baseline. The selected portfolio, which meets compliance and achieves 100% marginal emission mitigation by 2026 and 80% Winter Night Reliability by 2030, was estimated to cost $4.94/MWh more than the minimally compliant portfolio through 2040. This difference is estimated to represent approximately a 2% premium in total customer bills assuming current transmission and distribution rates, the PCIA, and non-supply components of SCPA's costs (programs, overhead, etc.).

The cost of the portfolio was assessed using Ascend's PowerSIMM platform, which is described thoroughly in the Modeling Tools section. PowerSIMM assumes other LSEs procure a supply stack matching the results of their CAISO-wide capacity expansion model which is informed by the 2021 PSP. Ascend's platform considers the trade-offs of revenues from energy arbitrage and capacity markets, the cost of bringing new capacity to market, as well as the impact of renewable portfolio standards and SB 100. SCPA used PowerSIMM's stochastic engine to both assess and optimize for a spectrum of possible market conditions.

Figure 15 below shows 20 simulations of supply cost, including energy, capacity, and attributes, for the preferred conforming portfolio along with the average used for optimization and comparison. SCPA reviews both the average and volatility over time to understand the implications of different procurement strategies. Existing financial hedges provide cost stability through 2024. After that period, costs are expected to increase in most simulations due to current market conditions and supply chain constraints. As SCPA aggressively builds a portfolio of clean resources and reduces its

dependence on market energy, uncertainty and volatility decreases. As vintage long-term PPAs roll-off and increased deployment drives the cost of new technologies down, SCPA projects the possibility of realizing decreased supply costs in the late 2030s.

Figure 15. Supply Cost Simulations for Preferred Conforming Portfolio



Although SCPA's preferred portfolio costs more than a minimally compliant alternative, SCPA believes the 2% total bill premium through 2040 is sufficiently low to maintain affordability and promote electrification of customer vehicles and buildings. Costs may rise by as much as $8.03/MWh between 2022 and 2025 (or 3.2% total customer bill impact), but that rise is due to expiration of pre-existing hedges coupled with recent market conditions. SCPA's assessment of cost is based on current market conditions and regulatory structures. The proposed portfolio is likely to lead to cost savings relative to alternative portfolios if reliability focus later shifts to winter evenings. SCPA's preferred portfolio will result in customer bill savings in that the portfolio is designed to concurrently address summer and winter reliability rather than building resources for summer and then looking for ways to find resources that provide needed clean energy in the winter. These potential savings are not incorporated in SCPA's analysis but are an important upside of the preferred portfolio.

A risk to customer rates is that the preferred portfolio builds in a long-term physical hedge for SCPA ratepayers that SCPA will need to manage through downturns in the market alongside PCIA. In market downturns, increases in PCIA require SCPA to reduce rates to maintain competitive rates compared to bundled customers. If SCPA has a large resource portfolio, as represented in the preferred conforming portfolio, downturns in the market will result in substantially reduced

revenues that will stress SCPA's margin. SCPA does not want this risk to detract from its ambitions to build the resources needed to drive decarbonization. Accordingly, SCPA is managing its financial position and leveraging available tools to monitor markets, PCIA and its portfolio to be prepared to weather market downturns.

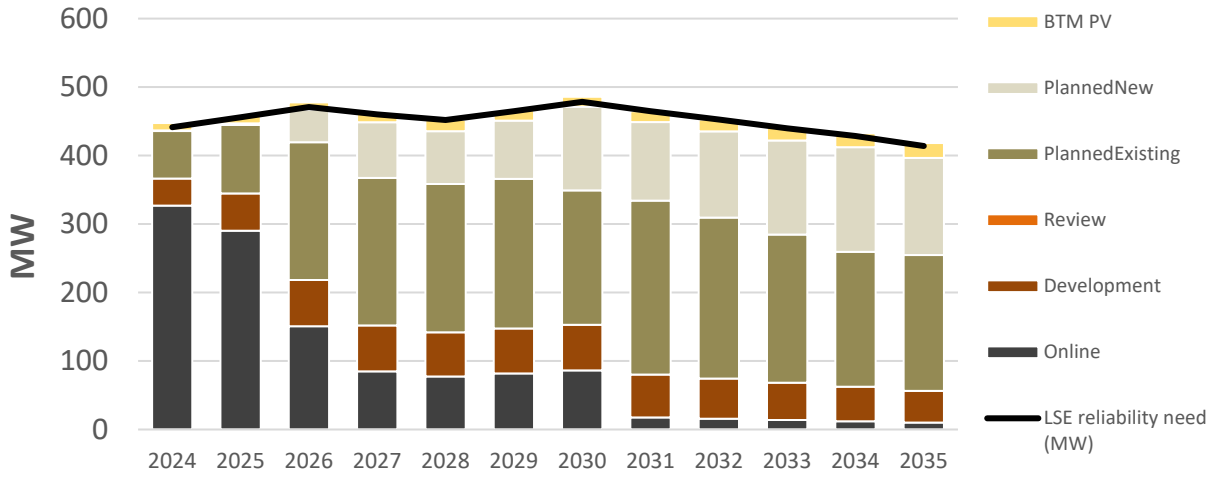
f. System Reliability Analysis

SCPA's portfolio provides system reliability, as demonstrated in Table 13 and Figure 16. The RDT includes existing contracts, SCPA's CAM allocation, the candidate resources and short-term contracts selected through portfolio optimization, and contracts that represent the required short-term capacity SCPA will need to procure to meet its total reliability need. Short-term capacity contracts are assumed to come from combined-cycle gas units, although SCPA will likely find short-term capacity from a diversity of resources. Although SCPA is sharing results from the 25 MMT RDT given it is submitting a single portfolio that outperforms 25 MMT emissions targets, the supply stack provides sufficient capacity for the 30 MMT scenario as well.

Table 13. Load and Resource Table by Contract Status for Preferred Conforming Portfolio (25 MMT RDT)

		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
LSE reliability need (MW)		441.5	455.9	470.8	460.2	452.0	464.7	478.4	464.8	452.7	439.8	428.6	414.0
ELCC by Contract Status	Online	326.9	290.3	150.7	84.8	77.3	81.8	86.3	17.7	15.8	13.9	12.1	10.2
	Development	39.7	54.5	67.7	67.3	64.7	65.7	66.6	62.6	58.5	54.4	50.3	46.2
	Review	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PlannedExisting	69.4	99.9	201.0	215.4	216.5	218.4	196.3	254.0	235.2	216.3	197.1	198.3
	PlannedNew	0.8	2.4	47.9	81.3	77.1	85.0	122.2	114.8	125.9	137.4	152.9	141.8
	BTM PV	10.9	10.7	10.4	13.2	16.4	15.5	14.4	15.8	17.2	18.7	20.2	21.8
	LSE total supply (effective MW)	447.5	457.8	477.7	462.0	452.0	466.4	485.8	464.8	452.7	440.8	432.6	418.3
Net capacity position		+6.0	+1.8	+6,9	+1.8	-	+1.7	+7.3	-	-	+1.0	+3.9	+4.4

Figure 16. Capacity by Contract Status for Preferred Conforming Portfolio (25 MMT RDT)



Because it is an emerging technology, SCPA did not include the expected reliability contribution of dispatchable geothermal assets in its submission (or in Table 13 or Figure 16). However, this capability was incorporated into SCPA's PowerSIMM modeling and portfolio selection. SCPA is exploring this technology through its GeoZone initiative, and recent research suggests that flexible enhanced geothermal resources could provide a significant and cost-effective source of reliability for the Western decarbonized grid[1]. If it were represented in the RDT, geothermal flexibility could add 70 MW of additional capacity by 2033 (with units able to double capacity for long durations when needed) and reduce the dependency on short-term contracts from gas units. SCPA submitted informal comments to the CPUC IRP team in October 2022 on inputs and assumptions for the 2022-23 IRP cycle that the CPUC should consider including flexible geothermal resources as a candidate resource in future capacity expansion studies for the state.

An additional reliability check SCPA performed on its preferred conforming portfolio was to compare its short-term RA (assumed to be from combined cycle gas units) relative to its peak share of the statewide PSP capacity from gas units. That comparison is illustrated in Table 14 and shows that SCPA's preferred conforming portfolio consistently relies on less short-term resource adequacy than its peak share of the natural gas fleet even without representing credit from the potential dispatchability of geothermal resources in SCPA's portfolio.

Table 14. Preferred Conforming Portfolio Short-term RA vs. Peak Share of PSP Reliable Gas Capacity (30 MMT)

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
PSP Gas Peaker + CCGT Reliable Capacity (GW)	23.69	23.65	23.65	23.65	23.65	23.65	23.65	23.65	23.65	23.65	23.65	23.69
SCP Marginal Peak Share	0.94%	0.94%	0.94%	0.94%	0.94%	0.94%	0.94%	0.94%	0.95%	0.95%	0.96%	0.95%
SCP Share of Gas Peaker + CCGT Reliable Capacity (MW)	224.6	222.0	221.8	221.7	222.7	222.6	223.0	223.1	224.0	224.5	226.0	225.7
SCP Preferred Conforming Portfolio Short-term RA (eff MW)	188.2	203.3	208.3	173.9	175.1	176.9	154.7	212.9	194.7	176.4	157.7	159.4
Preferred Conforming Portfolio vs. Peak Share (eff MW)	-36.4	-18.7	-13.5	-47.7	-47.5	-45.7	-68.3	-10.2	-29.2	-48.2	-68.3	-66.3

If SCPA is successful in adding 70 MW of additional capacity to its GeoZone resources by 2035 by incorporating flexibility, it could be relying on less than 90 MW of natural gas capacity. This would represent over a 50% reduction from current levels and make a meaningful difference in the retirement of existing natural gas resources. As discussed in Section III(d)(ii), reducing SCPA's

[1] Ricks, et. al (2022). The Role of Flexible Geothermal Power in Decarbonized Electricity Systems. https://zenodo.org/record/7093330/files/Working%20Paper.pdf?download=1

dependency on natural gas resources is one of the most important steps it can take in reducing burdens on disadvantaged communities whose community members disproportionately endure the environmental and health consequences of the continued operation of natural gas facilities.

g. High Electrification Planning

The high electrification demand side projections developed by the CEC expect 17% additional load by 2035. This projected growth is roughly equivalent to the load growth represented in SCPA's projections between 2035 and 2039 in its internal modeling (which is 17.8% over its 2035 load assignment). Accordingly, SCPA is including resources its internal portfolio optimization selected to build between 2035 and 2039 in Table 15 below to describe the procurement SCPA would likely pursue to maintain its same goals for hourly emissions, capacity, and winter reliability in a high electrification scenario. Given that internal goals are driving SCPA's procurement strategy, it is likely these resources would be procured regardless of the adopted 2035 GHG target.

Table 15. Preferred Resources for High Electrification

Resource Type	MW	Annual GWh	2035 GHG Target	Transmission Zone	Substation/Bus	Alternative Location	Note
Paired Solar and Battery	150	427	N/A	Generic CAISO	Not Specified	Not Specified	Assumes 1:1 ratio of solar to storage
Geothermal	80	686	N/A	Solano	Geysers	None	Assumed to be dispatchable GeoZone resources
Wind	30	85	N/A	Generic CAISO	Not Specified	Not Specified	Could be offshore wind at lower prices

As Discussed in the III(n) Transmission Planning section below, SCPA's 2022 IRP focuses on technology selection and does not specify the location or characterize transmission constraints for candidate resources except those in the GeoZone or under contract or negotiation. This is true for the incremental resources in Table 15 as well. SCPA is not particular about the transmission zone for these resources except that they should preferentially be in CAISO to avoid needing import capability.

Accelerating the deployment of resources in Table 15 to be ready by 2035 is possible with early planning and policy support. The location of additional paired solar and storage resources can be flexible based on the availability of transmission capacity. In-state onshore wind development has been difficult due to permitting issues, particularly concerning environmental impacts. A focused effort to address the concerns of stakeholders and permitting reform may unlock these resources in current or new resource areas. Offshore wind capacity would be a suitable substitute if it reaches economies of scale. Growing the target for GeoZone geothermal development by 80 MW for 2035 is possible with early planning and investments in identifying transmission constraints and de-risking new technologies to enable at-scale deployment.

h. Existing Resource Planning

SCPA's preferred portfolio for its 2022 IRP reduces its reliance on existing resources for providing energy and capacity as compared to its 2020 IRP. Table 16 and Table 17 below compare both energy and nameplate capacity provided by existing resources in the year 2030 for the 2022 IRP vs. the 2020 IRP. The most significant difference in existing resources is for existing wind and solar. This is because SCPA assumed that it would participate in the VAMO process for RPS procurement in its 2020 IRP but opted to contract directly for resources, most of which will likely be new, in its 2022 IRP. The 2022 IRP includes increased dependency on existing hydro and geothermal for energy. SCPA is confident it can procure the level of existing hydro in its 2022 IRP because over half of the planned existing hydro is from SCPA's GHG-free VAMO allocation. SCPA has a proven track record of procuring in-state and import hydro at high levels relative to its load share (SCPA procured 891 GWh in 2021), and the 444 GWh planned in 2030 is not far above its load share of the PSP (325 GWh). The amount of energy planned from existing geothermal is above SCPA's load share, but less than the 50 MW SCPA contracted from the Geysers through a contract that will expire in 2026.

Table 16. Comparison of 2030 Generation from Existing Resources (GWh) - 2022 IRP vs. 2020 IRP

Technology	2020 IRP GWh	2022 IRP GWh	Delta GWh
Solar	477	178	-300
Wind	236	170	-65
Hydro	398	444	+46
Geothermal	267	350	+84
Biomass	42	0	-42
Total	**1,420**	**1,142**	**-278**

Table 17. Comparison of 2030 Capacity from Existing Resources (Nameplate MW) - 2022 IRP vs. 2020 IRP

Technology	2020 IRP MW	2022 IRP MW	Delta MW
Solar	70	40	-30
Wind	46	46	0
Hydro	0	0	0
Geothermal	30	40	+10
Biomass	3	0	-3
Battery	0	87	+87
Demand Response	13	6	-7
Pumped Hydro	30	0	-30
Unknown	301	182	-119
Total	**493**	**402**	**-91**

As represented in Table 17, SCPA's 2022 IRP shows a significant reduction in its reliance on existing unknown resources (likely gas) compared to its 2020 IRP. Although there is an increase in dependency on existing batteries, most of that change is due to the commissioning of a 75 MW resource in October 2021 following the 2020 IRP, which changed its status from "'in development" to "existing."

Although SCPA believes it is well-positioned to procure the hydropower represented in its 2022 IRP, increasing drought severity and competition from other LSEs and the Pacific Northwest may introduce challenges. SCPA will continue to monitor market conditions through forthcoming IRP

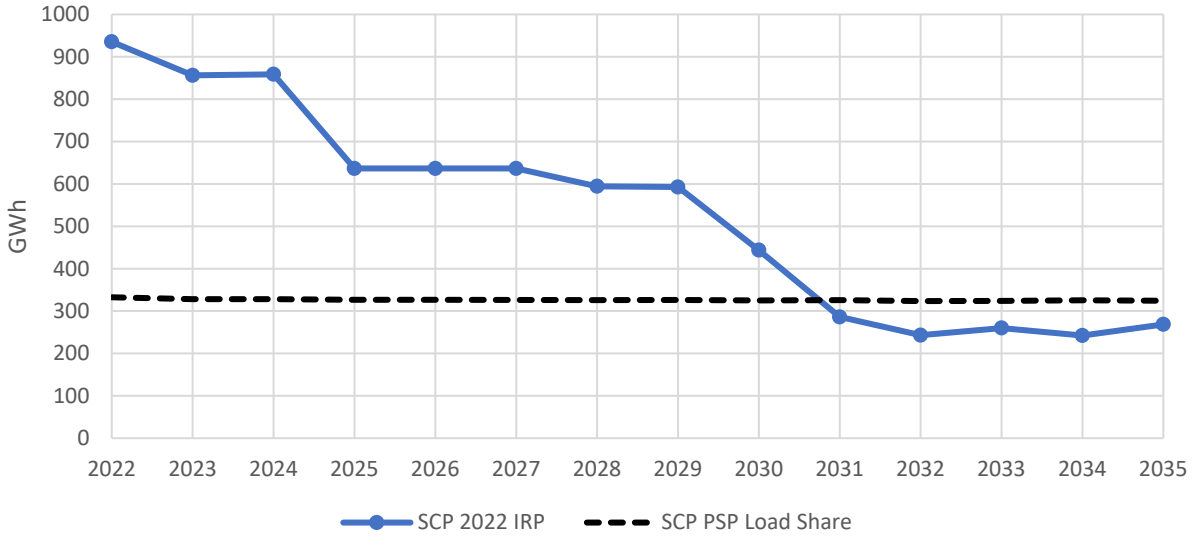
cycles to assess alternative resources. This issue is discussed with additional detail in the next section.

i. Hydro Generation Risk Management

SCPA has traditionally relied on a significant amount of hydropower from in-state resources and the Pacific Northwest to supply customers with clean power. These resources are generally contracted as energy-only index-plus contracts. SCPA also participates in the PG&E GHG-free VAMO process, which provides PCIA-paying customers with their share of power from the existing hydropower fleet.

In developing its preferred portfolio, SCPA recognized that increasing drought severity, competition from other LSEs, and more ambitious environmental targets in the Pacific Northwest may risk its ability to continue sourcing hydropower at existing levels. Accordingly, SCPA's portfolio modeling included both a tightening constraint on hydropower availability and a projected cost increase (SCPA assumed a 43% increase in unit cost by 2030). As shown in Figure 17, SCPA's resulting preferred portfolio reduces hydropower to below its load share of the PSP by 2031.

Figure 17. SCPA Preferred Portfolio Hydro Generation vs. PSP Load Share



Although hydro availability will be critical for meeting SCPA's internal targets for hourly carbon emissions mitigation and winter reliability, SCPA does not anticipate a risk of compliance with the GHG benchmarks or system reliability if it cannot procure according to plan. Even with hydropower reduced to zero without a clean replacement, SCPA's 25 MMT CSP calculator still outperforms emissions targets for 2030 and 2035. SCPA's preferred portfolio also does not include any hydropower for resource adequacy.

Given recent experience with large volatility in annual hydropower output from in-state resources, SCPA has established a robust operational process for monitoring and updating hydropower

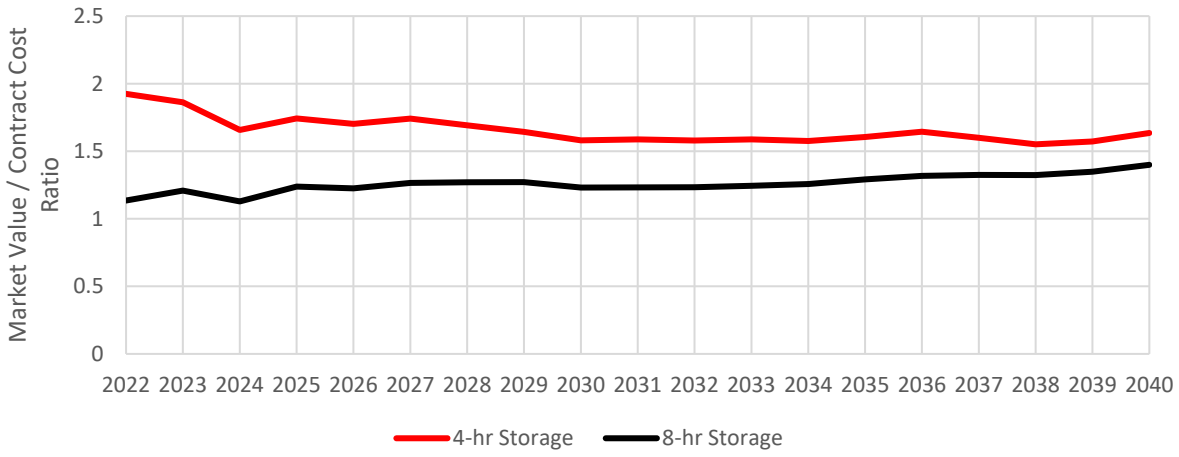
forecasts using information provided by the Department of Water Resources. If SCPA identifies a risk of falling short of its environmental targets mid-year, SCPA will look for short-term alternative resources. Procuring resources in this manner, especially if SCPA opts to procure renewable resources as a replacement, can result in cost impacts to customers. As an extreme example, procuring replacement energy at a $10/MWh premium for 50% of its planned hydropower in 2024 would result in a $2/MWh increase in supply cost which would reflect a total customer bill impact of less than 1%.

j. Long-Duration Storage Planning

SCPA contracted for 17.6 MW of new 8-hour duration storage earlier in 2022 through a solicitation with CC Power. The mid-term procurement order was the motivation for this procurement and the two contracted resources are represented in SCPA's preferred portfolio. Both resources are lithium-ion batteries.

SCPA's portfolio also includes 30 MW of additional long-duration storage in 2027. SCPA's evaluation of long-duration storage at existing prices suggests that this resource adds net value to the portfolio when incorporating capacity value and market activities such as energy arbitrage and ancillary services. However, the ratio of value to cost for long-duration storage is not as high as for 4-hour batteries. SCPA expects its portfolio modelling tool selected 8-hour storage because the capacity expansion maxed-out its available deployment of more efficient 4-hour resources. Figure 18 below shows the market value to cost ratio of 4-hour and 8-hour storage resources based on SCPA's modeling in PowerSIMM. The advantage narrows through time, but 4-hour resources consistently deliver more value through the analysis period despite decreasing ELCCs. Hopefully, new technologies can drive down the cost of long-duration storage disproportionately, but in current conditions SCPA would likely select two 4-hour resources instead of a single 8-hour resource unless transmission capacity is constrained. SCPA will likely not pursue voluntary procurement beyond the additional 30 MW without improved cost efficiency.

Figure 18. Market Value / Cost Ratio for 4-hr and 8-hr Storage



It is important to note that SCPA is counting on clean firm resources, such as dispatchable geothermal, to meet its internal targets for winter reliability. If these resources do not prove viable, it is possible that SCPA's appetite for long-duration storage would grow but SCPA did not specifically test this sensitivity. However, the storage resources would need to be paired with cost-effective generation resources that ideally have high-capacity factors in the winter.

k. Clean Firm Power Planning

SCPA's preferred portfolio contains a significant amount of clean firm power from geothermal resources. SCPA currently contracts for 50 MW of existing geothermal from the [redacted].

Additionally, SCPA has already contracted for new geothermal resources to satisfy its share of the mid-term reliability order. Through CC Power, SCPA contracted with other CCAs for a new 13 MW geothermal plant in Nevada (SCPA's share is 1.52 MW) and separately for up to a 125 MW portfolio of new geothermal projects in Nevada and California (SCPA's share is up to 14 MW). Almost all these resources are expected to be outside the CAISO balancing authority in northern Nevada or the Imperial Irrigation District and will require Maximum Import Capability (MIC) to be secured to deliver energy and capacity. MIC at northern Nevada delivery points is limited, and suppliers have indicated that transmission capacity on NV Energy to southern Nevada is constrained. MIC expansion at northern Nevada delivery points such as Gonder, Summit, and Silver Peak would considerably decrease the risk that these projects are not able to provide clean firm capacity to CAISO. Transmission projects that focus on better connections to CAISO with northern Nevada resources, such as alleviating the Control substation constraint for the Oxbow line, could also de-risk northern Nevada as a source of clean firm resources and potentially reduce significant wheeling costs through other transmission providers.

The CC Power 125 MW portfolio also may contain a new resource inside CAISO at the Geysers. However, the Phase 1 results of its Cluster 14 study indicate that the project is dependent on the 500kV Delevan network upgrade—which is expected to take 12 years to construct and after the envisioned extension in the mid-term reliability order. This may result in substituting an import resource.

SCPA also plans to contract for 70 MW of additional new dispatchable geothermal within its GeoZone by 2035. Clean firm generation is essential to cost-effectively meeting the Winter Night Reliability targets SCPA set in its 2022 IRP planning. SCPA estimates the market value of dispatchable geothermal (including energy, renewable, and capacity value) to exceed contract costs by 2035. Outside the IRP planning window, SCPA's portfolio optimization also selected 80 MW of additional dispatchable geothermal power to be built by 2038. Ultimately, SCPA hopes to facilitate over 500 MW of new geothermal resources in the GeoZone, although it will not contract directly for all of it.

Although geothermal resources look promising, it is important to note that they carry several unique risks relative to alternative resources:

- **Exploration Risk:** geothermal resources need to be confirmed and characterized by exploration wells, which are costly and time-intensive. Some of SCPA's CC Power portfolio requires additional exploration to confirm. If resources are not as large as predicted or uneconomic, project substitutions could lead to project delays. Several new technologies SCPA is exploring in the GeoZone do not carry as much exploration risk, making them more scalable.
- **Technology:** SCPA's planned projects in the GeoZone are expected to leverage new emerging technologies. These technologies offer the promise of making geothermal more scalable and flexible, cheaper, and less environmentally impactful. However, success of these technologies will be dependent on pilots and demonstration projects occurring later this decade.
- **Transmission:** geothermal resources are more geographically constrained than alternative clean resources such as solar and storage. Accordingly, they cannot necessarily be located where transmission is readily available. Transmission is already a key concern for the CC Power geothermal portfolio. SCPA is early on in the process of assessing transmission constraints for the GeoZone. The availability of transmission will impact the schedule and cost of clean firm resource deployment.

l. Out-of-State Wind Planning

SCPA is including 100 MW of new out-of-state wind by 2026 in its preferred portfolio. Out-of-state wind is an effective substitute for new in-state wind which has limited availability in the near-term due to the complications of permitting wind resources in California. The large scale of out-of-state wind resources allow it to offer competitive pricing for customers. The generation profile and capacity value are also complementary to SCPA's portfolio, especially considering its positive impact on internal goals for hourly emissions mitigation and winter reliability.

The primary risk of out-of-state wind is that it mostly relies on new transmission. SCPA is specifically looking at contracting from [redacted], which is dependent on CAISO's approval of [redacted] transmission project [redacted]

To provide resource adequacy, out-of-state wind will also require MIC. The wind project SCPA is considering will compete with solar, storage, and geothermal projects planned in [redacted] the magnitude of

potential import resources may require MIC expansion. MIC expansion would compete for deliverability for internal CAISO resources seeking deliverability [redacted].

SCPA limited the amount of out-of-state wind available in its portfolio optimization to 100 MW due to concerns about its own MIC allocation, especially considering SCPA will be using MIC for near-term clean firm resources and the limitation on its ability to secure long-term MIC reservations. If CAISO does significantly expand MIC, resulting in increased allocations for SCPA, the appetite for out-of-state wind would likely grow until the availability of in-state wind resources improves.

m. Offshore Wind Planning

SCPA's preferred portfolio does not include offshore wind. However, offshore wind was included as a candidate resource in its portfolio optimization. SCPA used slightly higher cost assumptions than the CPUC based on its own assessment of the state of technology and the market. Based on its input assumptions, SCPA identified GeoZone geothermal, out-of-state wind, onshore wind, and paired solar and storage as more cost-effective resources.

With slightly different cost assumptions or changes in resource availability, particularly with in-state onshore wind, SCPA would likely see a significant role for offshore wind in its portfolio. The high capacity factor and generation profile of offshore wind can substitute for onshore wind or even some level of clean firm capacity.

Although SCPA's preferred portfolio does not include offshore wind, it strongly supports statewide efforts to plan for offshore wind, including those required by Assembly Bill 525. California's ambitious decarbonization plans do not allow for emerging technologies, including offshore wind and geothermal, to be eliminated from consideration. Large-scale and cross-discipline planning greatly improves the chances of viability. SCPA hopes the state will consider similar planning efforts for geothermal, long-duration storage, and other candidate resources.

In evaluating offshore wind as a candidate resource, SCPA did not explicitly study the viability of offshore wind in California's central coast region versus California's north coast region. However, SCPA is investigating potential synergies between providing transmission for north coast resources and new geothermal resources in the GeoZone. Offshore wind resources in the north coast are also more likely to improve the reliability and resiliency of the grid in SCPA's territory.

n. Transmission Planning

SCPA's preferred portfolio includes six projects under contract that should be included in the baseline for modeling in the transmission planning process. A description of the transmission status based on information from developers for each of these contracts is included below:

- **Proxima Solar + Storage (COD June 2024):** The Proxima project is in CAISO queue position 1244 and will interconnect through a new switchyard to the Quinto – Westley 230 kV

transmission line. The project is dependent on construction of the new switchyard by PG&E (currently planned completion in May 2023) and a WAPA upgrade (Tracy Circuit Breaker Replacement – planned completion in October 2023).

- **Tubbs Island Solar + Storage (COD June 2024):** The Tubbs Island project is pursuing interconnection through the Independent Study Process and will interconnect to the Sonoma substation. Tubbs Island has passed its Electrical Independence Study and is waiting on the results of its System Impact Study to inform the need for any transmission upgrades. The developer does expect a new dedicated feeder from the point of interconnection to the Sonoma substation will be required.
- **Fish Lake Geothermal (COD June 2024):** The Fish Lake geothermal project will connect to the Silver Peak substation in NV Energy territory. It is currently finalizing its interconnection agreement and expecting execution shortly. The developer does not anticipate any transmission-scale upgrades, just an upgrade to the Silver Peak substation. Fish Lake has secured transmission [redacted], where CC Power members have secured 2023 MIC in preparation for a long-term MIC reservation. However, wheeling power [redacted] has resulted in higher costs that could be mitigated if MIC in northern Nevada became available.
- **Ormat Geothermal Portfolio (COD starting Oct 2024):** The Ormat portfolio of geothermal projects are expected to mostly be import resources in northern NV Energy territory or the Imperial Irrigation District. Projects are at various stages of maturity in their subsurface characterization, permitting, and interconnection. The RDT contains a representation of the portfolio. Ormat has limited ability to deliver at southern Nevada import points (Mead and Merchant), so MIC expansion will likely be needed at Summit, Gonder, and Silver Peak to deliver up to 125 MW. One potential CAISO resource in the portfolio (at the Geysers – queue position 1859) recently received Phase 1 results from its Cluster 14 study indicating that it is impacted by a costly network upgrade with a 12-year construction timeframe (Delevan 500 kV)which may require an import resource substitution.
- **Goal Line Long-duration Storage (COD June 2025):** The Goal Line project is in CAISO queue position 1832 and will interconnect to the Esco Substation 69 kV. Network upgrades are possible, but the full extent is not yet known. The project is currently navigating the Cluster 14 study process.
- **Tumbleweed Long-duration Storage (COD April 2026):** The Tumbleweed project is in CAISO queue positions 1076 and 1217 and will interconnect to the Whirlwind Substation 230 kV. The developer has not indicated any specific transmission projects necessary to facilitate commissioning.

SCPA included several planned projects in its preferred portfolio that are not contracted but under serious consideration. These projects have reached SCPA's threshold for investment grade status. They have been reviewed by SCPA's Risk Oversight Committee, are geographically specific, and should be seriously considered in transmission planning:

- [redacted] **Storage (COD December 2025):** The [redacted] project is in CAISO queue position [redacted] and will interconnect to [redacted]. The project is dependent on completion of [redacted] project, which is scheduled to be complete in the fourth quarter of 2024.

- **Out-of-state Wind (COD 2026):** As described in Section III(I), SCPA is specifically considering an out-of-state wind resource in [redacted]. This project is dependent on CAISO approval of the [redacted] transmission project which could be online by 2025 to facilitate a 2026 COD. This resource will also require MIC availability at the [redacted] delivery point. The project under consideration is cost-effective even when burdened with an amortized cost of the proposed transmission project and provides a schedule, generation profile, and capacity contribution that are difficult to replicate with alternatives.

SCPA also specified the location for 70 MW of dispatchable GeoZone resources planned in the early 2030s. These resources will be in the Solano Geothermal resource area. SCPA includes a location for these resources because the GeoZone initiative is specifically focused on developing 500 MW of local resources near and around the Geysers.

If the dispatchable capability of these resources (bringing them up to 140 MW of capacity contribution), other Geysers projects in the queue, and future growth projections for GeoZone are included, the demand on transmission will far exceed the 79 MW assigned in the busbar mapping results for the PSP portfolio for the 2022-23 Transmission Planning Process. Given these resources are planned no earlier than 2030. and existing transmission infrastructure was designed for a much larger resource than the existing Geysers output, SCPA is hopeful cost-effective transmission solutions will be identified. Depending on the substation used for interconnection at Geysers, Eagle Rock, or an alternative local substation, development in the GeoZone will also be subject to downstream system constraints like the Cortina-Vaca Dixon 230 kV or Contra Costa – Delta Switchyard 230 kV. Although resources in the GeoZone are not yet "investment grade," SCPA is beginning to dedicate resources in characterizing transmission in the area and encourages the CPUC to consider scenarios where significant geothermal capacity is available and cost-effective from the GeoZone.

SCPA did not complete a rigorous assessment of transmission constraints for any of the other planned resources in its portfolio including generic paired solar, generic storage, and generic wind. Instead, SCPA focused on the tradeoffs of cost, generation profile, and the capacity value of different technologies. SCPA will consider contracting for resources with these technologies in California and will rely on developers to identify locations with available transmission.

Locational data for transmission planning in SCPA's 2022 IRP mostly aligns with data provided in its 2020 IRP. SCPA's 2020 IRP included the specific location for the Proxima project and Mustang battery which remains unchanged in the 2022 IRP. SCPA's 2020 IRP also anticipated more local solar capacity, which is represented in the Tubbs Island project in SCPA's 2022 IRP. The only significant difference is that an 80 MW Solano wind project was included in SCPA's 2020 IRP that

has since been cancelled. The rest of the new resources planned in the 2020 IRP were generic. Although the technology and magnitude of selected resources has changed significantly, this change should not have geographic implications on the CPUC's busbar mapping methodology.

IV. Action Plan

SCPA's current top priority is satisfying its obligation from the D.19-11-016 and D.21-06-35 procurement orders. As described below, SCPA is positioned to satisfy all requirements. The next focus will be contracting the resources to meet SCPA's internal goal of reaching 100% hourly marginal emissions mitigation by 2026 and 80% Winter Night Reliability by 2030, while also meeting expected load growth from electric vehicle adoption and building electrification.

a. Proposed Procurement Activities and Potential Barriers

A description of SCPA's completed and planned procurement activities for each resource category is included below. SCPA has also highlighted a description of any anticipated barriers or risks for successfully completing the proposed activities.

In general, SCPA would like to stress that the demand induced from procurement orders and the current architecture of CAISO's interconnection process have made contracting new resources extremely difficult and costly to our ratepayers. These issues are likely to be exacerbated further by the Inflation Reduction Act, which provides additional economic incentive for renewable development. Despite these conditions, SCPA recognizes the importance of its role in building resources to provide California with a clean and reliable grid and expects to fully comply with ordered procurement. However, SCPA proposes future procurement policy that considers opportunities to grow the supply of resources in tandem with demand, perhaps through permitting reform, improved transparency and flexibility in the interconnection process, and supplier incentives. Expanding the lead time granted to LSEs for satisfying procurement orders would also help alleviate the current extreme market conditions.

i. Resources to meet D.19-11-016 procurement requirements

SCPA's D.19-11-016 requirement was satisfied when the Mustang battery storage was commissioned in October 2021. SCPA applied 36 MW of the capacity from this 75 MW resource, along with 7.3 MW procured from Sutter Energy Center to satisfy its 43.3 MW of procurement required by D.19-11-016. These contracts are represented as online resources in SCPA's 2022 IRP.

ii. Resources to meet D.21-06-035 procurement requirements, including:

a. 1,000 MW of firm zero-emitting resource requirements

SCPA has contracted for up to 15.5 MW of new geothermal capacity through its share of two executed contracts from CC Power. These resources were identified through a solicitation completed in early 2022. Together, SCPA expects them to provide 12.9 MW of MTR Net Qualifying Capacity (NQC) (based on September NQC evaluation hours) which satisfies its 12.5 MW obligation.

The 13 MW Fish Lake geothermal project, of which SCPA's share is 1.52 MW, is expected to be commissioned in June 2024. As represented in the RDT, the project has high viability scores with subsurface characterization complete, a nearly finalized interconnection agreement, and partial financing. CC Power also secured the MIC at the project's delivery point sufficient to claim a long-term reservation through the duration of the contract.

The Ormat portfolio of up to 125 MW, of which SCPA's share is 14 MW, has several risks. The contract included an illustrative facility list indicating a possible first COD in October 2024 and final COD in 2026. SCPA used the illustrative facility list to calibrate the representation of the Ormat portfolio in the RDT, which is likely to mostly rely on resources in northern NV Energy territory or the Imperial Irrigation District. Unlike Fish Lake, many of the projects in Ormat's portfolio are still dependent on subsurface characterization and need additional permitting. Importantly, although CC Power is hopeful the Ormat contract will provide 125 MW of capacity for MTR, only 64 MW is guaranteed. Because specific projects are not yet identified, CC Power has also not been able to secure MIC, which is scarce in northern Nevada and may be difficult to obtain. Although Ormat can provide some transmission service to southern Nevada, MIC expansion at Gonder, Silver Peak, and Summit or transmission upgrades will likely be required to deliver the maximum capacity of the portfolio to CAISO.

CC Power currently holds bi-weekly meetings with Ormat and plans to closely follow development progress in the Ormat portfolio. An update will be provided to the CPUC on timing and scope of the contract in the planned February 2023 MTR regulatory filing. If it is determined unlikely Ormat can deliver 125 MW by June 2028, SCPA will consider offering a solicitation for replacement capacity independently or through CC Power in 2023.

b. 1,000 MW of long-duration storage resource requirements

SCPA has contracted for 17.6 MW of long-duration storage through its share of two executed contracts from CC Power. These resources were identified through a solicitation starting in 2021. Together, SCPA expects these two projects to provide 13.8 MW of MTR NQC based on marginal ELCC which satisfies its 12.5 MW obligation.

The first project, the 50 MW Goal Line 8-hour lithium-ion storage project, is expected to COD in June 2024. The second project, the 69 MW Tumbleweed 8-hour lithium-ion storage project, is expected to COD in April 2026. Developers of both projects are indicating that they have high levels of viability and there are no known transmission constraints. SCPA does not expect a need to procure additional long-duration storage capacity to meet its MTR obligation.

c. 2,500 MW of zero-emissions generation, generation paired with storage, or demand response resource requirements

SCPA expects to satisfy most of its zero-emission generation MTR requirement through its existing contracts for the Proxima project, which is a 70 MW solar + 32 MW 4-hour storage resource with COD in June 2024, and the Tubbs Island project, a 11.6 MW + 8 MW 4-hour storage resource with COD in June 2024. Part of the

Proxima project consisting of 50 MW solar + 5 MW 4-hour storage was included in the MTR baseline. Accordingly, SCPA is only using an expanded contract (called "PROXIMA_EXPANSION" in the RDT) it executed following the MTR to satisfy the zero-emission generation requirement. Together, SCPA expects the Proxima expansion and Tubbs Island projects to provide 28 MW of zero-emission NQC using average solar profiles and storage configurations, which is just short of its 31 MW obligation.
The Proxima project has a high level of viability. It was originally planned to COD in 2023 and is far along in its design, permitting, and interconnection work. It is dependent on several transmission upgrades, but they are currently scheduled to complete in time to facilitate a COD of June 2024.

The Tubbs Island project is pursuing interconnection through the Independent Study Process. The project passed its Electrical Independence Study, but still needs to undergo its System Impact Study.

SCPA is exploring a couple of alternatives to both satisfy the remaining 3 MW NQC of its zero-emission obligation and provide back-up assurance given the early stage of Tubbs Island. These alternatives include an [redacted], which is represented in the IRP as a planned resource, or alternative local resources SCPA identified through a solicitation in early 2022. If the CPUC modifies the procurement order baseline, as considered in the September ALJ ruling, it also may be possible that the original Proxima project could be used to satisfy the remaining zero-emission obligation.

d. All other procurement requirements

SCPA is meeting the three general tranches of MTR procurement by applying 39 MW of the Mustang battery storage project that is already online alongside the Proxima and Tubbs Island projects that also satisfy zero-emission generation requirements. However, SCPA still requires approximately 50 MW of NQC for the 2024 tranche of 2024 to be compliant. In its 2022 IRP, SCPA represents filling this requirement with a 55 MW 4-hour storage resource (called "MTR_STANDALONE" in the RDT).

SCPA has conducted two joint solicitations with other CCAs in 2022 attempting to identify a resource to satisfy its residual MTR requirement. Although the first solicitation garnered a significant amount of responses, few met SCPA's threshold for viability and cost competitiveness and one prospective resource ultimately fell through. The second solicitation did include a proposal that SCPA is currently negotiating.

iii. Offshore wind

As described in Section III(m), SCPA's preferred portfolio does not include any planned offshore wind. However, SCPA will actively monitor the availability and cost of offshore wind relative to other technologies and consider it as a candidate resource in future IRPs.

iv. Out-of-state wind

SCPA is actively negotiating a contract for out-of-state wind with a COD of 2026. As described in Section III(I), the project under consideration is dependent on CAISO's approval of the [redacted] transmission line. Accordingly, SCPA is strongly invested in the planning process for that line [redacted]

SCPA is currently under exclusivity for [redacted] but will also start investigating substitute resources, including Wyoming wind, existing in-state wind, and new in-state wind. To ensure adequate supply is available by 2026 to meet its hourly carbon emissions target, SCPA will likely need to pursue any alternative opportunities before the end of 2023.

v. Other renewable energy not described above

- **Existing Geothermal (40 MW starting 2027):** SCPA's IRP includes 40 MW of existing geothermal starting in 2027 [redacted], it will also investigate opportunities to contract from other geothermal resources in California.

- **New Paired Solar + Storage (40 MW in 2027 and 40 MW in 2034):** SCPA will likely seek to procure its planned paired solar and storage capacity through an open solicitation. To facilitate a 2027 COD, the solicitation would likely be released in early 2024. SCPA is hopeful that elevated pricing from induced demand and supply chain disruptions is tempered before additional resources are contracted. SCPA will also give special consideration to local resources that provide local economic and resiliency benefits.

- **In-State Wind (150 MW with CODs from 2028-2030):** SCPA is already monitoring the market for opportunities to procure in-state wind. Although recent development has been stymied by permitting issues, SCPA is hopeful that some of the reforms implemented in AB 205 and the increased incentives from the Inflation Reduction Act revitalize wind project development in California. By 2024, if the queue of new wind resources in California does not grow, SCPA will likely start investigating alternative resources including offshore wind, additional out-of-state wind, or existing in-state wind. Any of these resources would likely be procured through an open solicitation released no later than 2025.
- **New Dispatchable GeoZone Geothermal (70 MW with CODs from 2030-2033):** SCPA selected three development partners for developing new local geothermal resources in the GeoZone in 2022. These partners were selected through a rigorous solicitation process including a panel of industry experts. SCPA will be working with each partner to de-risk their technology and deploy it at-scale with a plan for over 500 MW. SCPA started the GeoZone initiative because SCPA realized

the importance of developing clean firm resources in California and recognized the long lead times, technology risk, and permitting barriers to in-state geothermal development. SCPA will be working with its GeoZone partners in 2023 to plan the required subsurface characterization, technology pilots, and transmission planning to facilitate commissioning an operational facility in 2030. State and local policy support in the form of grant funding, transmission studies, and permitting reform will be essential in successful implementation of the GeoZone.

vi. Other energy storage not described above

- **New Standalone Storage (30 MW in 2027 and 20 MW in 2028):** SCPA's preferred portfolio includes additional storage procurement beyond its MTR obligation to provide capacity and contribute to its internal goals for hourly carbon emission mitigation and winter reliability. Currently, SCPA is planning on waiting until 2027 and 2028 to procure additional storage due to current constrained market conditions. However, , SCPA is also considering procuring excess capacity from MTR resources currently under negotiation that would satisfy its IRP's long-term storage appetite. If SCPA does not procure excess capacity, it would likely plan on releasing a solicitation for additional storage in 2024 when it hopes the market reaches more of an equilibrium. SCPA is also monitoring several proposed closed-loop hydropower projects in the region with a dual use for firefighting that might prove viable alternatives to battery storage. SCPA may also consider behind-the-meter storage resources if transmission constraints continue to hamper procurement of wholesale resources.
- **New Long-duration Storage (30 MW in 2027):** SCPA's preferred portfolio includes 30 MW of additional long-duration storage beyond its MTR obligation. Although SCPA assumed 8-hour batteries in its modeling, it has a strong interest in alternative technologies, particularly if there is a cost advantage to lithium-ion batteries. SCPA, at a minimum, expects to explore thermal storage as part of its GeoZone initiative, which could satisfy its IRP appetite for long-duration storage. If batteries are still the most cost-effective resource, SCPA may consider contracting for larger amounts of shorter-duration storage as an alternative (as discussed in Section III(j)). If SCPA does need to go to the market to procure long-duration storage in 2027, it would likely submit a solicitation in 2024.

vii. Other demand response not described above

- **GridSavvy Demand Response (ramp-up starting in 2024 to 10 MW by 2030):** SCPA launched its own demand response program called GridSavvy in 2017. The initial focus of GridSavvy was to experiment with automated demand response of electric vehicle chargers and later, smart thermostats and water heaters. In 2022, SCPA partnered with AutoGrid to revamp GridSavvy, which now includes a behavioral demand response option for customers. SCPA plans on aggressively growing enrollment, including expansion to commercial customers, with a target

of delivering 10 MW of capacity by 2030. SCPA has not settled whether GridSavvy will be used for load modification or become a market resource.

viii. Other energy efficiency not described above

SCPA is very invested in promoting energy efficiency to its customers. SCPA is currently offering energy efficiency services through several programs including loaning DIY energy and water savings toolkits, performing commercial energy audits, and deploying energy efficiency technologies through SCPA's Advanced Energy Center. SCPA is also leveraging CPUC funding to incentivize energy efficiency projects for its customers through Recurve's FLEXmarket platform.

ix. Other distributed generation not described above

SCPA incentivizes distributed generation through its NetGreen+ program, which compensates customers with solar for their excess generation. SCPA's program credits excess generation at customers' retail rate plus a bonus penny. Excess annual generation is credited at double PG&E's premium net surplus compensation rate. SCPA is also promoting deployment of distributed storage by prepaying the financial incentive for customers eligible for the Self-Generation Incentive Program.

x. Transportation electrification, including any investments above and beyond what is included in Integrated Energy Policy Report (IEPR)

SCPA continues to aggressively promote transportation electrification. SCPA first rolled-out its Drive EV incentive program in October 2016, which offered certificates worth up to $4,000 that customers could use to offset the cost of buying or leasing electric vehicles. Following Drive EV, SCPA shifted focus to addressing other barriers for transportation electrification and implemented a free level 2 EV charger program for customers that is still active and support for commercial level 2 and DC fast chargers through the California Electric Vehicle Infrastructure Project (CALeVIP). Most recently, SCPA offered low-income customers $1,000 large incentives for purchasing e-bikes. SCPA is actively monitoring EV adoption, vehicle miles travelled (VMT), and gasoline sales in its territory and endeavors to outperform the electrification targets embedded in IEPR.

xi. Building electrification, including any investments above and beyond what is included in Integrated Energy Policy Report (IEPR)

SCPA has implemented several programs targeted at driving building electrification. The first program was the Advanced Energy Rebuild, which offered large incentives for wildfire rebuild projects that included energy efficiency or electrification measures. SCPA then implemented Advanced Energy Build, like Advanced Energy Rebuild, but for new construction residences separate from rebuilt homes. SCPA has opened an Advanced Energy Center with a website and storefront in Santa Rosa that focuses on deploying building electrification projects. The Advanced Energy Center showcases electric alternatives for customers, trains local contractors, and offers on-bill financing for electric appliances. SCPA also lends out portable induction cooking units to entice consumers to switch from gas stoves and partnered with BayREN in incentivizing electrification upgrades for multifamily homes. As with transportation electrification, SCPA measures

the impact of building electrification through reduced natural gas usage and aims to achieve at or above the pace of electrification embedded in IEPR.

xii. Other

SCPA's IRP also includes short-term resource adequacy, renewable index-plus, and carbon free contracts. Most of these contracts are executed through bi-lateral trades administered by SCPA's experienced Procurement team. These contracts could be executed within the same year as delivery or several years in advance. Allowing some level of flexibility in contracting for energy and capacity has allowed SCPA to quickly react to changes in load, the market, or performance of the generation fleet. Although the preferred portfolio builds a much larger fleet of long-term resources under contract, short-term contracts will still play a key role in enabling SCPA to provide cost-effective, clean, and reliable power to its customers.

b. Disadvantaged Communities

SCPA describes its approach to engagement and minimization of criteria air pollution in Disadvantaged Communities in detail in Section III(d)(ii). SCPA is increasing its focus on outreach to local Disadvantaged Communities through its new Empower program while also working to reduce statewide impacts to impacted communities by adopting an IRP that reduces dependency on fossil-fueled resources for both energy and capacity.

As shown in Figure 13, SCPA's portfolio includes two capacity contracts from gas resources located near gas-fired resources. Although SCPA has not adopted a specific metric or scoring criteria in its procurement process, it will continue to monitor the amount of energy and capacity obtained from resources with criteria air pollution near disadvantaged communities. SCPA believes its 2022 IRP, which reduces power from biomass and system energy and targets 100% hourly emissions mitigation by 2026 and 80% Winter Night Reliability by 2030, will greatly reduce the future need for contracts from resources with criteria air pollutants. Monitoring both hourly marginal emissions and Winter Night Reliability against targets should be strong leading indicators for criteria air pollution. If SCPA's preferred portfolio is successful in building resources that mitigate high hourly emissions and ultimately provide reliable energy in the winter, it will enable retirement of fossil-fueled units near disadvantaged communities.

In 2021 and 2022, SCPA solicited community feedback for resource planning through two virtual public workshops on local resource planning and three presentations on the 2022 IRP. SCPA also administered a public survey on IRP trade-offs in late 2021, which was translated in Spanish. Although responses from the survey confirmed that the community is aligned with SCPA's priorities for driving emissions reductions, SCPA believes responses predominately came from more affluent customers. SCPA hopes to leverage its Empower program to increase the breadth and diversity of feedback it receives from the community.

SCPA's Empower program seeks to establish community relationships that can lead to more targeted engagement of disadvantaged communities. SCPA is hopeful that success in Empower will provide a foundation for inclusive and robust discussions of energy procurement decisions. Community needs assessments are also being planned to develop programs that serve the needs of underserved and underrepresented customers. No specific procurement-focused events are scheduled, but SCPA expects to begin community engagement on resource decisions when it

reconsiders its Local Resource Plan (LRP) in 2023. Through Empower, SCPA plans to facilitate discussions in partnership with community leaders and expects future in-person meetings will be effective in promoting community engagement.

c. Commission Direction of Actions

SCPA expects to respond to alternatives to the CPUC's approach to IRP procurement later this year in comments on the recently released Staff paper. In general, SCPA is strongly supportive of an approach that is technologically neutral, and values resources based on their emissions and capacity impact. Giving LSEs the autonomy to select the resource mix to meet their share of statewide reliability and environmental objectives fosters more innovation (as evidenced through SCPA's GeoZone initiative) and creates productive competition between developers and proposed technologies. The CPUC should also take steps to ensure that it does not discourage excess procurement and allows that procurement to count towards future orders. Allowing excess resources to count towards future orders de-risks an aggressive procurement strategy, as represented in SCPA's 2022 IRP.

V. Lessons Learned

SCPA is heavily invested in the IRP process and believes it is incredibly important in encouraging long-term planning for all LSEs, maintaining accountability for greenhouse gas emissions in the electric sector, and identifying important transmission investments. SCPA participated in the CPUC's first IRP process in 2018 and has developed stronger analytic capabilities and policy awareness through the subsequent two filings. SCPA's 2022 IRP submission benefits from the usage of Ascend's PowerSIMM platform as well as SCPA staff experience in past IRP development and engagement in the process.

SCPA is greatly appreciative of improvements the CPUC IRP team implemented in the RDT and CSP calculator templates for the 2022 cycle to streamline data input. Limiting the scope of data to future years and implementing a mechanism to directly transfer data between the RDT and CSP calculator saved considerable time and allowed SCPA staff to instead focus on additional analysis and data quality control. SCPA also appreciates the CPUC's decision to only require submission of a single portfolio if it outperforms the most ambitious emissions target.

In prior IRPs, SCPA spent considerable time defining its own resource profiles for IRP calculations. In hindsight, SCPA believes this effort likely created unnecessary complication in the CSP calculator's analysis and likely represented more precision than what is necessary for an IRP emissions analysis. For the 2022 IRP, SCPA leveraged its own datasets for portfolio optimization in PowerSIMM but used the provided SERVM profiles for resource generation and storage dispatch in the CSP emissions calculations. The only exception was for load because SCPA's load has a distinctly different shape than the state's load profile. SCPA specifically developed a load profile for the same weather year as the CSP calculator to avoid introducing unintended error. Unless the CPUC extracts value from the custom resource profiles, it may want to remove them in future IRP CSP calculators to avoid LSEs spending time to characterize them as SCPA did in prior cycles.

SCPA found the narrative template for the 2022 IRP cumbersome to complete. There are several instances where prompts in the narrative overlap. Additionally, the strict structure of the narrative and detailed requirements results in a document that is not very approachable by the public. When SCPA prepared its IRP for board approval in the past three cycles, it prepared a separate memo that is more concise and cohesive. The CPUC should consider allowing for more flexibility in the IRP narrative that can be consumed by the public. If there are specific questions LSEs need to be answered, the CPUC could require a separate streamlined questionnaire. These types of adjustments would allow time for LSEs to complete technical analysis and result in reference materials that are more likely to be read by public stakeholders.

Beyond filing requirements, SCPA also provides the following recommendations for improving the IRP analysis for the 2024 cycle:

- The CPUC should shift from looking at sensitivities for electric sector emissions (e.g. 30 MMT and 25 MMT in 2035) to load forecasts and/or technological outcomes. SCPA believes the uncertainty around the pace of transportation electrification and the viability of technologies, particularly offshore wind and candidate clean firm resources, is far more impactful than a swing in 5 MMT of emissions. SCPA appreciates the opportunity in the 2022 IRP to weigh-in on potential resources for high electrification scenarios, but this type of study should be a core focus in the 2024 IRP.

- The IRP analysis should go out through at least 2045 to fully capture the trajectory of meeting SB 100 goals. This will require LSEs to start thinking about the types of resources needed to provide energy and reliability in a 100% renewable or carbon free grid.

- The CPUC should start considering whether winter reliability needs to be assessed alongside summer reliability. If additional electrification and solar growth leads to loss-of-load in winter months, the CPUC should explore whether the existing marginal ELCC approach to assessing capacity works or whether a parallel winter reliability measure needs to be defined like SCPA's approach in its 2022 IRP.

Glossary of Terms

Alternative Portfolio: *LSEs are permitted to submit "Alternative Portfolios" developed from scenarios using different assumptions from those used in the Preferred System Plan with updates. Any deviations from the "Conforming Portfolio" must be explained and justified.*

Approve (Plan)*: the CPUC's obligation to approve an LSE's integrated resource plan derives from Public Utilities Code Section 454.52(b)(2) and the procurement planning process described in Public Utilities Code Section 454.5, in addition to the CPUC obligation to ensure safe and reliable service at just and reasonable rates under Public Utilities Code Section 451.*

Balancing Authority Area (CAISO): *the collection of generation, transmission, and loads within the metered boundaries of the Balancing Authority. The Balancing Authority maintains load-resource balance within this area.*

Baseline resources: *Those resources assumed to be fixed as a capacity expansion model input, as opposed to Candidate resources, which are selected by the model and are incremental to the Baseline. Baseline resources are existing (already online) or owned or contracted to come online within the planning horizon. Existing resources with announced retirements are excluded from the Baseline for the applicable years. Being "contracted" refers to a resource holding signed contract/s with an LSE/s for much of its energy and capacity, as applicable, for a significant portion of its useful life. The contracts refer to those approved by the CPUC and/or the LSE's governing board, as applicable. These criteria indicate the resource is relatively certain to come online. Baseline resources that are not online at the time of modeling may have a failure rate applied to their nameplate capacity to allow for the risk of them failing to come online.*

California Community Power (CC Power): *a Joint Powers Agency formed in 2021 comprised of ten Community Choice Aggregators (CCAs) to enable joint procurement of energy and capacity resources.*

Candidate resource: *those resources, such as renewables, energy storage, natural gas generation, and demand response, available for selection in IRP capacity expansion modeling, incremental to the Baseline resources.*

Capacity Expansion Model: *a capacity expansion model is a computer model that simulates generation and transmission investment to meet forecast electric load over many years, usually with the objective of minimizing the total cost of owning and operating the electrical system. Capacity expansion models can also be configured to only allow solutions that meet specific requirements, such as providing a minimum amount of capacity to ensure the reliability of the system or maintaining greenhouse gas emissions below an established level.*

Certify (a Community Choice Aggregator Plan)*: Public Utilities Code 454.52(b)(3) requires the CPUC to certify the integrated resource plans of CCAs. "Certify" requires a formal act of the Commission to determine that the CCA's Plan complies with the requirements of the statute and the process established via Public Utilities Code 454.51(a). In addition, the Commission must review the CCA Plans to determine any potential impacts on public utility bundled customers under Public Utilities Code Sections 451 and 454, among others.*

Clean System Power (CSP) methodology*: the methodology used to estimate GHG and criteria pollutant emissions associated with an LSE's Portfolio based on how the LSE will expect to rely on system power on an hourly basis.*

Community Choice Aggregator (CCA)*: a governmental entity formed by a city or county to procure electricity for its residents, businesses, and municipal facilities.*

Conforming Portfolio*: the LSE portfolio that conforms to IRP Planning Standards, the 2030 LSE-specific GHG Emissions Benchmark, use of the LSE's assigned load forecast, use of inputs and assumptions matching those used in developing the Reference System Portfolio, as well as other IRP requirements including the filing of a complete Narrative Template, a Resource Data Template and Clean System Power Calculator*.

Effective Load Carrying Capacity (ELCC)*: a percentage that expresses how well a resource is able avoid loss-of-load events (considering availability and use limitations). The percentage is relative to a reference resource, for example a resource that is always available with no use limitations. It is calculated via probabilistic reliability modeling, and yields a single percentage value for a given resource or grouping of resources.*

Effective Megawatts (MW): *perfect capacity equivalent MW, such as the MW calculated by applying an ELCC % multiplier to nameplate MW.*

Electric Service Provider*: an entity that offers electric service to a retail or end-use customer, but which does not fall within the definition of an electrical corporation under Public Utilities Code Section 218.*

Filing Entity*: an entity required by statute to file an integrated resource plan with CPUC.*

Future*: a set of assumptions about future conditions, such as load or gas prices.*

Geothermal Opportunity Zone (GeoZone): *an initiative started by the Sonoma Clean Power Authority in 2021 to partner with local jurisdictions and geothermal development companies to reinvigorate geothermal development in its region.*

GHG Benchmark (or LSE-specific 2030 GHG Benchmark)*: the mass-based GHG emission planning targets calculated by Staff for each LSE based on the methodology established by the California Air Resources Board and required for use in LSE Portfolio development in IRP.*

GHG Planning Price: *the systemwide marginal GHG abatement cost associated with achieving a specific electric sector 2030 GHG planning target.*

Integrated Resources Planning Standards (Planning Standards)*: the set of CPUC IRP rules, guidelines, formulas and metrics that LSEs must include in their LSE Plans.*

Integrated Resource Planning (IRP) process*: integrated resource planning process; the repeating cycle through which integrated resource plans are prepared, submitted, and reviewed by the CPUC*

Long term*: more than 5 years unless otherwise specified.*

Load Serving Entity*: an electrical corporation, electric service provider, community choice aggregator, or electric cooperative.*

Load Serving Entity (LSE) Plan*: an LSE's integrated resource plan; the full set of documents and information submitted by an LSE to the CPUC as part of the IRP process.*

Load Serving Entity (LSE) Portfolio*: a set of supply- and/or demand-side resources with certain attributes that together serve the LSE's assigned load over the IRP planning horizon.*

Loss of Load Expectation (LOLE): *a metric that quantifies the expected frequency of loss-of-load events per year. Loss-of-load is any instance where available generating capacity is insufficient to serve electric demand. If one or more instances of loss-of-load occurring within the same day regardless of duration are counted as one loss-of-load event, then the LOLE metric can be compared to a reference point such as the industry probabilistic reliability standard of "one expected day in 10 years," i.e. an LOLE of 0.1.*

Maximum Import Capability (MIC): a California ISO metric that represents a quantity in MWs of imports determined by the CAISO to be simultaneously deliverable to the aggregate of load in the ISO's

Balancing Authority (BAA) Area and thus eligible for use in the Resource Adequacy process. The California ISO assess a MIC MW value for each intertie into the ISO's BAA and allocated yearly to the LSEs. A LSE's RA import showings are limited to its share of the MIC at each intertie.

Net Qualifying Capacity (NQC): *Qualifying Capacity reduced, as applicable, based on: (1) testing and verification; (2) application of performance criteria; and (3) deliverability restrictions. The Net Qualifying Capacity determination shall be made by the California ISO pursuant to the provisions of this California ISO Tariff and the applicable Business Practice Manual.*

Non-modeled costs*: embedded fixed costs in today's energy system (e.g., existing distribution revenue requirement, existing transmission revenue requirement, and energy efficiency program cost).*

Nonstandard LSE Plan*: type of integrated resource plan that an LSE may be eligible to file if it serves load outside the CAISO balancing authority area.*

Optimization*: an exercise undertaken in the CPUC's Integrated Resource Planning (IRP) process using a capacity expansion model to identify a least-cost portfolio of electricity resources for meeting specific policy constraints, such as GHG reduction or RPS targets, while maintaining reliability given a set of assumptions about the future. Optimization in IRP considers resources assumed to be online over the planning horizon (baseline resources), some of which the model may choose not to retain, and additional resources (candidate resources) that the model is able to select to meet future grid needs.*

Planned resource: *any resource included in an LSE portfolio, whether already online or not, that is yet to be procured. Relating this to capacity expansion modeling terms, planned resources can be baseline resources (needing contract renewal, or currently owned/contracted by another LSE), candidate resources, or possibly resources that were not considered by the modeling, e.g., due to the passage of time between the modeling taking place and LSEs developing their plans. Planned resources can be specific (e.g., with a CAISO ID) or generic, with only the type, size and some geographic information identified.*

Qualifying capacity*: the maximum amount of Resource Adequacy Benefits a generating facility could provide before an assessment of its net qualifying capacity.*

Preferred Conforming Portfolio*: the conforming portfolio preferred by an LSE as the most suitable to its own needs; submitted to CPUC for review as one element of the LSE's overall IRP plan.*

Preferred System Plan: *the Commission's integrated resource plan composed of both the aggregation of LSE portfolios (i.e., Preferred System Portfolio) and the set of actions necessary to implement that portfolio (i.e., Preferred System Action Plan).*

Preferred System Portfolio: *the combined portfolios of individual LSEs within the CAISO, aggregated, reviewed and possibly modified by Commission staff as a proposal to the Commission, and adopted by the Commission as most responsive to statutory requirements per Pub. Util. Code 454.51; part of the Preferred System Plan.*

Short term*: 1 to 3 years (unless otherwise specified).*

Staff*: CPUC Energy Division staff (unless otherwise specified).*

Standard LSE Plan*: type of integrated resource plan that an LSE is required to file if it serves load within the CAISO balancing authority area (unless the LSE demonstrates exemption from the IRP process).*

Transmission Planning Process (TPP)*: annual process conducted by the California Independent System Operator (CAISO) to identify potential transmission system limitations and areas that need reinforcements over a 10-year horizon.*