Standard LSE Plan

Valley Clean Energy Authority

2020 INTEGRATED RESOURCE PLAN

September 1, 2020

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I. Executive Summary

Valley Clean Energy Alliance, or Valley Clean Energy (VCE), is a joint powers authority providing a state-authorized Community Choice Energy (CCE) program. Participating VCE governments include the City of Davis, the City of Woodland and the unincorporated parts of Yolo County. Beginning January 2021, the City of Winters will also join VCE. The vision of VCE is to enable the participating jurisdictions to determine the sources, modes of production, and costs of the electricity they procure for the residential, commercial, agricultural, and industrial users in their areas. Pacific Gas & Electric Company (PG&E) continues to deliver the electricity procured by VCE and to perform billing, metering, and other electric distribution utility functions and services. Customers within the participating jurisdictions have the choice not to participate in the VCE program. VCE's vision as an organization and as adopted by its Board in 2017 is shown in Figure 1. This integrated resource plan (IRP or resource plan) was prepared in accordance with Decision (D.) 20-03-028 by the California Public Utilities Commission (Commission) in proceeding R.16-02-007. The IRP follows the format provided by the Commission.

Figure 1. VCE Vision

The near-term vision for VCE is to provide electricity users with greater choice over the sources and prices of the electricity they use by:

- Offering basic electricity service with higher renewable electricity content, at a rate competitive with PG&E;
- Developing and offering additional low-carbon or local generation options at modest price premiums;
- Establishing an energy planning framework for developing local energy efficiency programs and local energy resources and infrastructure; and
- Accomplishing the goals enumerated above while accumulating reserve funds for future VCE energy programs and mitigation of future energy costs and risks.

The long-term vision for VCE is to continuously improve the electricity choices available to VCE customers, while expanding local energy-related economic opportunities, by:

- Causing the deployment of new renewable and low-carbon energy sources;
- Evaluating and adopting best practices of the electricity service industry for planning and operational management;
- Substantially increasing the renewable electricity content of basic electricity service, with the ultimate goal of achieving zero carbon emissions electricity;
- Developing and managing customized programs for energy efficiency, on-site electricity production and storage;
- Accelerating deployment of local energy resources to increase localized investment, employment, innovation and resilience;
- Working to achieve the climate action goals of participating jurisdictions to shape a sustainable energy future;
- Saving money for ratepayers on their energy bills; and
- Remaining open to the participation of additional jurisdictions.

Since VCE started serving load in June 2018 and in accordance with the action plan of its 2018 IRP, VCE has added resources under long-term contracts and is gradually building up a portfolio of short and long-term assets in line with its vision and the demand of its customers. To date, VCE has relied mainly on market purchases of energy, Resource Adequacy (RA), and Renewable Energy Credits (RECs) in order to serve its electric demand and meet regulatory requirements with respect to RA and renewable energy. Starting in 2021 VCE will increasingly meet electric demand with resources under long-term contracts. VCE has contracted for 50 megawatts (MW) of new solar resources to come online before the end of 2021 and is currently negotiating contracts for new RA capacity expected to bring 7 MW of new capacity online by August 2021 and another 2.5 MW by August 2022 in order to meet Commission-mandated capacity procurement requirements.

For the purposes of this IRP, VCE considered several portfolio alternatives that were reviewed and discussed by VCE's Board, its Community Advisory Committee and the general public over the course of several meetings and workshops that were open for attendance and public input. From this process followed the development of two resource portfolios that are presented in this report that meet the Commission's requirements for the two mandatory Conforming Portfolios as directed by D.20-03-028, corresponding to the overall 2030 greenhouse gas (GHG) emissions targets of 46 million metric tons (MMT) and 38 MMT, respectively. The first portfolio, entitled "**46MMT Conforming Portfolio**," is based on expanding VCE's solar PV contract portfolio with storage, local solar, and wind to create a balanced portfolio that meets state requirements. This portfolio is expected to result in estimated emissions of 135,000 metric tons per year by 2030, in accordance with Table 1 of the *Administrative Law Judge's Ruling Finalizing Load Forecasts and Greenhouse Gas Benchmarks for Individual 2020 Integrated Resource Plan Filings and Assigning Procurement Obligations Pursuant to D.19-11-016* (ALJ Ruling), and as modified by Commission staff in the Clean System Power Calculator template released on June 15, 2020 (henceforth 46MMT GHG Benchmark). Over the course of the 2020-2030 period, the renewable energy content of the portfolio is adjusted to meet statutory and regulatory RPS requirements as well as the GHG benchmark values stipulated by the Commission.

The second Conforming Portfolio, entitled "**38MMT Conforming Portfolio**," was prepared to demonstrate an alternative portfolio that meets the GHG requirements of the 38 MMT target, which for VCE amounts to 108,000 metric tons per year by the year 2030 per the ALJ Ruling, as modified by Commission staff in the Clean System Power Calculator template released on June 15, 2020 (henceforth 38MMT GHG Benchmark).[1]

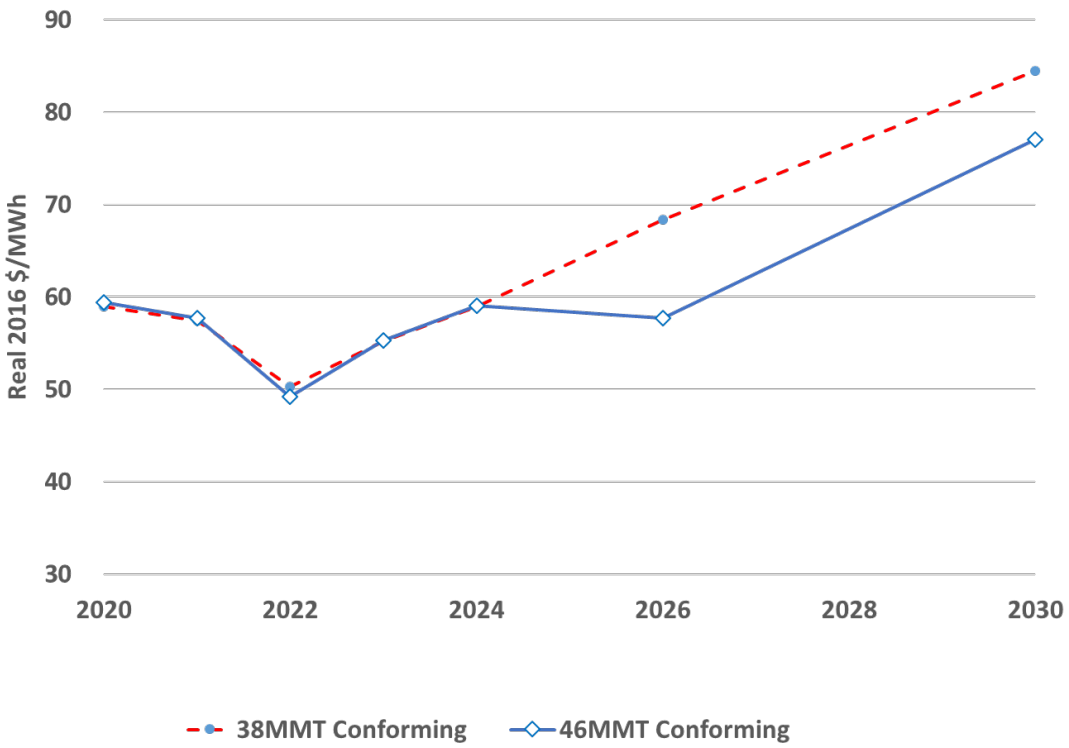
Ultimately, the choice of resource path is uncertain and will to a large extent depend on future market and technology-cost developments as well as on the evolving preferences of VCE customers. VCE's resource plan may therefore be adjusted according to market developments over the next several years.

This IRP was approved by VCE's Board at its meeting on August 13. 2020. At this meeting, the Board also selected the 46 MMT Conforming Portfolio as its preferred conforming portfolio.

Figure 2 shows a comparison of the estimated generation costs for each of the two Conforming Portfolios submitted for the 2020-2030 period.

[1] The ALJ Ruling issued on April 15, 2020, and corrected through a subsequent Ruling on May 20, 2020, specifies a 46 MMT GHG Benchmark of 156,000 metric tons and a 38 MMT GHG Benchmark of 129,000 tons in 2030 for VCE. The template issued on June 15, 2020, reduced the 46 MMT GHG Benchmark to 135,000 metric tons and the 38 MMT GHG Benchmark to 108,000 metric tons in 2030 for VCE to account for VCE's allocation of behind-the-meter combined heat and power (BTM CHP) emissions.

Figure 2. Annual Generation Costs by Conforming Portfolio and Year



VCE's portfolio costs are significantly lower than those reported in the RESOLVE tool for the generation portion of the retail rate. This result is likely driven largely by a discrepancy in assumptions regarding costs for RA and for existing resources. VCE relied on its own forecasts for RA capacity, RECs, and carbon-free energy (large-scale hydro), while largely using the RESOLVE model's estimate of marginal energy costs and for the levelized cost of new resources in VCE's portfolio.

There are several important assumptions of VCE's IRP analysis that should be considered:

- With the exception of hydro resources, VCE's Conforming Portfolios are based on contracting only for new resources over the 2020-2030 period. The selected resources are all either RPS-eligible renewable energy sources or battery storage. For additional energy and capacity needs beyond those shown in the resource plan, VCE expects to rely on the California Independent System Operator (CAISO) market and on bilateral energy and capacity markets.
- The modeling and analysis are based mainly on assumptions and prices available in the Reference System Portfolio (RSP) results for the RESOLVE model that were developed for the Commission and that were made public on March 26, 2020.[2]

[2] https://www.cpuc.ca.gov/General.aspx?id=6442459770

- Quantities of individual resources in VCE's Conforming Portfolios were selected so as not to exceed VCE's proportional load-share of the RESOLVE model's "New Build Capacity Limit." In general, VCE's Conforming Portfolios select a resource mix that is relatively similar to VCE's proportional share of the resources selected in RSP. While VCE has a preference for local wind resources (e.g., Solano Wind), the selected resources for the Conforming Portfolios could be exchanged for other new renewable resources after 2025 since there is significant uncertainty on the exact sources and locations from where VCE may source its future wind resources.
- VCE considers the analyses and conclusions of this IRP report to be tentative for the period 2025-2030 and subject to adjustments as market conditions change and technology and customer preferences evolve.
- VCE's analysis considers only the generation portion of electric services delivered to VCE's customers since this is the only part for which VCE is responsible. It is anticipated that the IRP filing by PG&E will cover the other aspects, such as transmission, distribution, and Demand Side Management programs.
- VCE's Action Plan includes several activities that are expected to enable VCE to implement, fine-tune, and adjust its resource plan, including issuing a solicitation for long term and local renewable capacity.
- The load forecast and load shape used in this IRP are based on the California Energy Commission's (CEC) 2019 Integrated Energy Policy Report (IEPR) data, which uses load characteristics and shape from PG&E's service territory. Thus, neither the demand level nor the shape represent the best available view of VCE's load.
- The load forecast also does not include any impacts of the Covid-19 pandemic, which is expected to reduce demand significantly in 2020. VCE also expects that demand will remain depressed as a result of the expected 2020 recession and subsequent economic recovery in the 2020-2023 period.

The estimated 2030 GHG emissions for VCE using the Commission's Clean System Power Calculator template for each of the Conforming Portfolios developed, as well as the Commission GHG benchmark values for the 46MMT and 38MMT Conforming Portfolios, are shown in Table 1 below.

Table 1. Estimated GHG Emissions in 2030 by Portfolio using the Commission GHG Calculator (metric tons 000)

	46 MMT	38 MMT
ALJ Ruling 2030 GHG Benchmark for VCE	156	129
IRP Template 2030 GHG Benchmark for VCE (prior to accounting for BTM CHP emissions)	135	108
VCE's 2030 GHG emissions in Conforming Portfolios	135	108

VCE's IRP analysis is based on a simplified hourly production cost model of VCE's portfolio, where it is assumed that California as a whole follows the resource plan outlined in the 46MMT RSP and that VCE can freely buy and sell energy into the CAISO electricity and ancillary service

markets at the market prices expected in the RSP provided by the Commission.[3] VCE's analysis also uses the same assumptions that the RSP was based on, including levelized costs for new generating resources, and the same renewable energy resource classifications, renewable energy profiles, and geographical naming conventions (e.g., "Solano Wind" or "Sacramento River Solar"). The resulting resource portfolios also utilize resources wherein the use of each renewable energy resource or storage does not exceed VCE's proportional share of the resource potential.

VCE's Action Plan outlines key activities over the next several years for VCE. One near-term priority is to finalize one or more long-term power purchase agreements (PPAs) for new solar that will help VCE meet its long-term RPS obligations and expand its renewable energy portfolio. Another important near-term activity in the Action Plan is to complete the negotiation and procurement of long-term renewable energy contracts for local capacity in response to VCE's request for offers (RFO) that was issued in April 2020. Completion of vendor selection and PPA negotiations is expected by the end of 2020. VCE considers local resources to be important for meeting its long-term vision of managing customized programs, local investments, and employment, as well as helping participating jurisdictions achieve their long-term climate and sustainability goals.

The Action Plan also outlines other key activities over the next 1-3 years, including monitoring progress towards completion of new resources and initiating procurement of resources for the 2025-2030 period. Section IV of this report describes VCE's Action Plan in more detail.

The resource plans presented in this report differ slightly from the preliminary plan reported in VCE's most recent RPS plan. There are two main reasons for discrepancies: First, the resource plan presented here has been updated to conform to the revised GHG benchmarks that the Commission made public in June 2020. Second, since the filing of VCE's Draft 2020 RPS Procurement Plan, one of VCE's long-term solar PPAs has been cancelled due to breach of contract by the developer. VCE is currently negotiating for replacement resources by leveraging results from previous RFO processes and bilateral discussions, and expects to bring new capacity online by mid-2022.

II. Study Design

The study was designed to provide VCE, its Board, management, and community with a resource plan and portfolio that meets VCE's needs for renewable energy content, resource diversity and cost-effectiveness as well as to demonstrate compliance with all regulatory and statutory requirements. After discussions with the Board, its Community Advisory Committee

[3] For the 46MMT Conforming Portfolio, the power prices and other market Inputs for CAISO were derived from the RESOLVE case entitled "46MMT_20200207_2045_2GWPRM_NOOTCEXT_RSP_PD", and for the 38MMT Conforming Portfolio, VCE used " 38MMT_20200117_2045_2GWPRM_NOOTCEXT" that are available at https://www.cpuc.ca.gov/General.aspx?id=6442459770

and with input from the public, VCE prepared two Conforming Portfolios for submission: One Conforming Portfolio called "46MMT," which conforms with the 46MMT GHG benchmark for 2030, and one Conforming Portfolio called "38MMT" which conforms with the alternative GHG benchmark for which LSEs are required to also submit a resource portfolio.

VCE's modeling approach is based on utilizing electricity prices that represent a combination of prices in the futures market (2020-2022) and pricing data available through the Commission's RESOLVE model (2023-2030). In the model, VCE is considered as a "price taker" in the CAISO market wherein it is assumed that VCE, due to its small peak load and energy demand relative to the rest of the CAISO market, cannot influence prices and therefore can buy and sell power at CAISO spot market price for each respective portfolio (46MMT and 38MMT). Carbon dioxide (CO_2) allowance prices are implicitly reflected in the CAISO price.

VCE used its own market forecast for RA prices, where prices are expected to be set by the lowest cost resource for providing new capacity in the CAISO market. From 2025 onwards, 4-hour battery storage is expected to be the lowest cost resource for new capacity, which is reflected in VCE's portfolio choices detailed below. Our approach also uses the levelized costs provided in the RESOLVE model to estimate costs for resources in VCE's portfolios. Further details are provided in Sections II.a and II.b below.

The GHG planning price is not used in the VCE model runs because VCE does not propose to own or otherwise sign long-term contracts for fossil-fueled generation. VCE's only exposure to GHG avoidance costs is from the cost of GHG mitigation implicit in power market pricing for net purchases of energy from the CAISO and for net sales of renewables into the CAISO market.

Load Forecast

VCE's load forecast is based on the "mid Baseline mid AAEE" version of Form 1.1c of the CEC's 2019 IEPR demand forecast for the PG&E service area.[4] VCE also uses the PG&E service area hourly load shape, wherein VCE's hourly load is assumed to be proportional to its share of the annual electricity demand for the PG&E service territory for all hours.[5] VCE requested an update to its load forecast to reflect the fact that the City of Winters will join VCE starting in 2021. This request was granted in the ALJ Ruling that finalized load forecasts and GHG benchmarks for LSEs.[6] Table 2 below shows VCE's retail load forecast for the 2020-2030 period as well as the expected wholesale peak load for September (using VCE's 2021 RA allocation and the Resource Data Template spreadsheet provided by the Commission).

[4] https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-IEPR-03
[5] https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-IEPR-03
[6] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M333/K160/333160852.PDF

Table 2. VCE Electric Demand and Peak Load (2020-2030)

Year	Energy Demand (GWh) (Based on 2019 IEPR)	September Peak Demand (MW) (Using CPUC's Resource Data Template)
2020	706	191
2021	765	189
2022	761	190
2023	759	190
2024	760	191
2025	761	192
2026	761	193
2027	761	193
2028	761	194
2029	761	195
2030	761	197

a. Objectives

The objective of the IRP is to provide guidance for VCE's Board, executive management, and the public regarding the expected cost and environmental footprint of supplying VCE customers with reliable, affordable, and clean energy in the 2020-2030 period, as well as to support the Commission in its efforts to identify cost-effective resource choices that support reliability and policy goals. The resource portfolios presented in this IRP are the result of discussions among VCE's Board, advisory committee and the public regarding resource preferences, resource diversity, and cost effectiveness in meeting statutory and regulatory requirements, as well as VCE's own goals for its power supply. The detailed resource portfolio choices are discussed in the assumptions section below.

b. Methodology

Based on the updated IEPR load forecast for VCE, shown in Table 2 above, VCE's annual electric consumption in the 2020-2030 period represents less than half a percent of the statewide electric consumption (~0.4%). It is therefore expected that VCE will have little or no opportunity to influence market prices of any of the components of the electric supply for this IRP. In other words, VCE is a price taker. Under this expectation, VCE can transact energy, capacity, and RA and enter into short- or long-term contracts without impacting the overall market prices in these markets. This philosophy is reflected in our methodology. In a further effort to make the IRP consistent with the Commission's requirements and assumptions for California, VCE's methodology for quantifying the costs and GHG impacts of portfolio alternatives relies mainly on publicly available data provided by the Commission to support this IRP process as well as on the updated 2019 IEPR forecast that includes a forecast of VCE's electricity demand, including the City of Winters beginning in 2021.

Two Conforming Portfolios are presented in this IRP. The details of each portfolio are presented in Section III.a, below.

i. Modeling Tool(s)

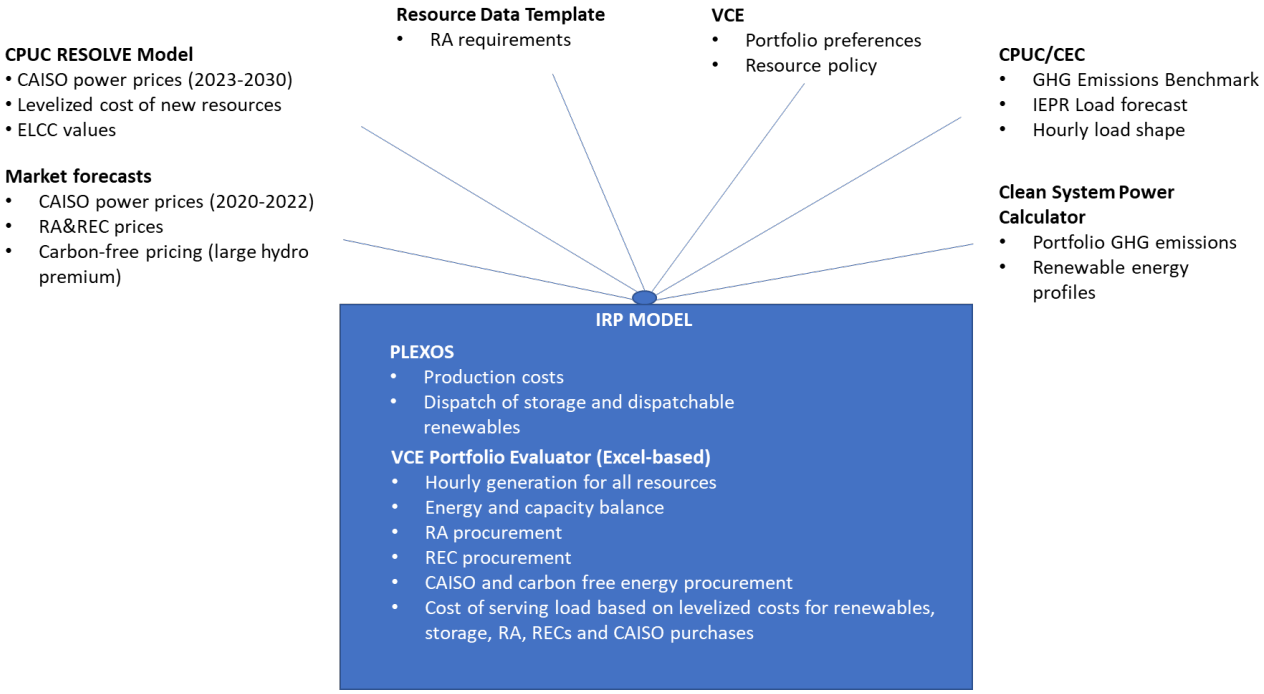
VCE's resource plan is based on a simplified production cost modeling approach that utilizes mainly publicly available data from the various tools provided by the Commission as well as the IEPR load forecast from the CEC. With this data, VCE developed an hourly spreadsheet model that captures the expected costs of providing electricity to VCE's customers in the 2020-2030 period, including the costs of RA, RECs, and carbon-free resources. In order to ensure that battery storage and dispatchable renewables such as biomass can be adequately co-optimized with the fixed-profile renewable resources, PLEXOS was used to determine an optimal battery dispatch profile and a renewable energy generation profile for dispatchable renewables that minimize the overall costs of meeting load.[7] This approach is consistent with the data and assumptions of the RESOLVE model, the Clean System Power calculator, Resource Data Template and the RPS calculator. The model relies on input assumptions and modeling results from the RSP that was adopted in D.20-03-028.

The RESOLVE model provides a simplified representation of the entire Western Electricity Coordinating Council (WECC) system and performs a cost-based simulation and forecast for the 2018-2030 period that selects resources and provides estimates of total and marginal costs as well as emissions and reliability parameters. With this model, only 37 representative days per year are modeled and subsequently aggregated to provide an estimate of full-year impacts. Based on the 37 days modeled in RESOLVE, VCE developed a power price forecast for all 8760 hours in a year. VCE's spreadsheet model assumes that prices and the cost and availability of resources are given. VCE is treated as a price taker in the CAISO market, wherein VCE's objective is to minimize costs for meeting its resource needs at given prices for capacity, energy, and new resources. The input assumptions used for this model are drawn from the RESOLVE model as well as from the Commission's Clean System Power calculator, the Resource Data Template, and CEC's IEPR load forecast. Figure 3 highlights the modeling methodology, tools and inputs used to prepare VCE's IRP portfolios.

VCE also iterated between its own models and the Commission-provided Clean System Power tool (CSP) and Resource Data Templates in order to make sure that the final selected portfolios are feasible, cost-effective and in compliance with Commission requirements and VCE Board preferences.

[7] VCE used version 8.1 of PLEXOS that is licensed by Energy Exemplar.

Figure 3. VCE's modeling methodology and data sources



ii. Modeling Approach

VCE worked with its Board, Community Advisory Board, and the public to shape two Conforming Portfolios: the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio.

The 46MMT Conforming Portfolio was created as a resource path for ensuring that VCE meets all statutory and regulatory requirements, including reaching the 46MMT GHG Benchmark by 2030. The 46MMT Conforming Portfolio represents a balanced approach using resources that VCE expects to be available in Northern California, including solar, wind and storage opportunities for long-term contracting. This results in a resource portfolio where only renewable energy sources and battery capacity are pursued. In addition to renewable resources, VCE also expects to rely to a limited extent on carbon-free hydro resources to ensure that VCE meets its 2030 46MMT GHG Benchmark as well as the 38MMT GHG Benchmark. Finally, to balance its total need for energy and capacity, VCE expects to rely on market purchases from the CAISO and bilateral markets. While VCE would welcome additional contracting for biofuels or other dispatchable baseload renewables, these are considerably more expensive than wind, solar and solar+storage hybrid resources and also have a significantly longer lead time to develop. Therefore, such resources were not selected in the resource plan.

The 38MMT Conforming Portfolio was developed to comply with requirements described D.20-03-028 as the second Conforming Portfolio and meets the lower 38MMT GHG Benchmark, as directed by the Commission. This 38MMT Conforming Portfolio is nearly identical to the 46MMT Conforming Portfolio, except that it includes the use of additional wind, battery storage

and large-scale hydro resources in the years leading up to 2030 in order to further reduce GHG emissions to the required levels.

The resource composition of each of the Conforming Portfolios is discussed in further detail below. Methodology and calculations used to generate metrics for the Conforming Portfolios were generally developed in Microsoft Excel, based on Commission data and are discussed in detail under Section II.b.i (Modeling Tools), above.

VCE did not develop any alternative portfolios for its IRP.

III. Study Results

This section shows study results for the two Conforming Portfolios that were considered by VCE. Detailed portfolio selection results are shown in Resource Data Templates for the 46MMT and 38MMT Conforming Portfolios that are filed together with this IRP. Considering that the planned resource procurement beyond what VCE will contract for in 2020 is not expected until 2025-2027, there is necessarily significant uncertainty in the plan and in the indicated preferred resource choices.

a. Conforming and Alternative Portfolios

Two portfolios are submitted for consideration in this IRP: the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio. The underlying data and scenarios are defined in D.20-03-028. The two portfolios were finalized after consulting VCE's Community Advisory Board and the public through public meetings. VCE is not submitting any alternative portfolios.

Since completing its first IRP, VCE has forged ahead with contracting for new renewable energy under long-term contracts that will span beyond the 2020-2030 contract period shown in this IRP. In the first half of 2020, VCE executed long-term PPAs for solar PV energy from two projects for a total of 122 MW. Unfortunately, VCE was forced to terminate one of those contracts, a 72 MW solar project in the southern California desert, due to breach of contract by the developer as a result of delays in the permitting process that are not expected to be resolved quickly. By using the results from its 2018 solicitation for energy as well as by conducting bilateral negotiations with developers, VCE expects to quickly replace this capacity with other renewable energy capacity that is already under development and that can be ready to come online by mid-2022.

VCE also is in the process of finalizing procurement of new RA capacity to come online in the 2021-2023 period, as well as additional local renewable energy resulting from VCE’s 2020 local renewables RFO. These near-term procurements and contracting form the basis of both Conforming Portfolios and are expected to bring 150 MW of new solar PV capacity, 7 MW of new demand response capacity and about 13 MW of new battery storage capacity to the CAISO market by 2023. The details of each Conforming Portfolio are discussed further below.

Significant uncertainty remains regarding the long-term load growth and resource needs for VCE. Therefore, the results shown in this section as well as in the attached Resource Data Template spreadsheet files for the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio are necessarily approximations that should be viewed as options and guidance on general direction rather than specific detailed procurement targets for the 2025-2030 period.

Table 3 below shows a summary of existing resources, Cost Allocation Mechanism (CAM) resource allocations and assumptions and the new resources planned for each of the Conforming Portfolios. Both Conforming Portfolios meet the Commission's IRP requirements. VCE's Board selected the portfolio entitled 46MMT as its Preferred Portfolio. The detailed resource choices for each portfolio are shown in the Resource Data Template files that were submitted together with this IRP and are summarized in Table 3.

VCE is currently actively negotiating for capacity that it expects to come online starting in 2021 to meet its procurement obligations under D.19-11-016. For the longer term, VCE expects to only use new renewable resources and existing small hydro resources in its portfolio and will procure long-term capacity and energy under long-term contracts through an open and transparent process. In order to achieve 2030 GHG emissions that match the Commission's requirements for the respective resource portfolios, VCE expects to rely on some large-scale hydro resources that may be from in-state or out-of-state generators. However, VCE also expects to continue to rely, at least in part, on short- to medium-term market purchases to meet its capacity and energy needs. Therefore, VCE's energy and capacity needs above what is shown in Table 3 are expected to be met by market purchases.

Table 3. Summary of Conforming Portfolios (MW Nameplate Capacity)

	46MMT Conforming Portfolio							38MMT Conforming Portfolio						
	2020	**2021**	**2022**	**2023**	**2024**	**2026**	**2030**	**2020**	**2021**	**2022**	**2023**	**2024**	**2026**	**2030**
BTM Solar	47	60	68	74	80	89	109	47	60	68	74	80	89	109
CAM, RMR & Demand Response Capacity[8]	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Contracted Resources (As of July 2020)														
New Solar PV		50	50	50	50	50	50		50	50	50	50	50	50
Existing Small Hydro	0.7	0.7	0.7	0.7	0.7			0.7	0.7	0.7	0.7	0.7		
Planned Resources														
New Wind						20	38						20	38
New Solar PV Capacity (CAISO)			75	75	75	75	75			75	75	75	75	75
New Local Solar				25	25	25	56				25	25	25	74
New Demand Response (aggregated)		7	7	7	7	7	7		7	7	7	7	7	7
New 4-hour Li-Ion Battery			2.5	12.5	12.5	12.5	43			2.5	12.5	12.5	12.5	63
Existing Small-Scale Hydro						0.7	0.7						0.7	0.7
Existing Large Scale Hydro							20							34

[8] September 2021 values shown. CAM and Reliability Must-Run (RMR) capacity is assumed to remain constant at 2021 levels throughout the 2020-2030 period.

Regarding costs and benefits of CAM resources, VCE has accounted for CAM capacity in its resource plan and assumes these resources will provide capacity for RA purposes but not contribute energy to meet VCE load. It should be noted that the operations and the costs of these resources are completely outside of VCE's control and the costs and benefits of these resources are therefore hard to assess. In VCE's modeling it is assumed this capacity will remain available and that VCE will pay market rates for the CAM capacity provided. Therefore, in VCE's modeling, the cost-impact of CAM resources is the same as adding generic RA capacity. VCE uses its own assumptions regarding the cost of new capacity that is based in part on the Commission's cost of 4-hour storage and forecasts of market prices for RA (see Section III.e below for additional details). The main benefit of CAM capacity is that it reduces VCE's RA obligation. If the CAM resources were to also cost less than other comparable RA resources, they could also bring economic benefits to VCE's ratepayers.

VCE's 46MMT and 38MMT, Conforming Portfolios conform with, respectively, the RSP and the 38MMT Scenario modeling results shown in the RESOLVE model. Table 4 shows a comparison of new resources in VCE's Conforming Portfolios relative to new resources in the Commission's RSP and 38MMT portfolios.

Table 4. Comparison of VCE's resource portfolios and the RSP (MW Nameplate Capacity)

Resource Type	2030 New Build Limit per RESOLVE**	VCE Proportional Share of New-Build Limit*	RSP	VCE Proportional Share of RSP*	VCE Preferred 46MMT Conforming Portfolio	38MMT Portfolio in RESOLVE	VCE Proportional Share of 38MMT*	VCE 38MMT Conforming Portfolio
New Wind, including OOS on new transmission	8,297	38	3,443	16	38	8,279	38	38
Utility-Scale Solar	N.A		11,017	50	181	11,995	55	199
Battery Storage	10,259	47	8,873	41	43	9,714	44	63
Pumped (long-duration) Storage	N.A		973	4	0	1,605	7	0
Shed Demand Response	N.A		222	1	7	222	1	7

* Based on VCE's load share using the Resource Data Template.
** N.A is shown for resource where no build limit was available in RESOLVE or where the constraint would not limit VCE's resource choices.

VCE's resource selection for the Conforming Portfolios considered both VCE's share of the RSP and its share of the resource new-build limits listed in RESOLVE, based on VCE's load share of the overall CAISO load as calculated using the Resource Data Template. Table 4 shows that the key resource expected to be limited in the 2020-2030 period is wind. While the RESOLVE model also suggests limitations on the potential for new battery storage, VCE believes such limitations are likely not binding, considering that storage is a flexible and scalable resource that can be installed on existing electric conductors at almost any location on the grid – from small behind-

the-meter applications to large utility-scale batteries. VCE selected its resource portfolios so as to be consistent with the maximum build limits for wind as shown in Table 4, where VCE expects to reach 38 MW of wind in both scenarios by 2030, corresponding to its share of the New Build Limit. Table 4 also suggests that VCE plans to expand solar PV and battery storage beyond its proportional share of the RSP, mainly as a means to ensure that VCE's GHG emissions meet the Commission's benchmarks for 2030.

Although not shown in Table 4, VCE also ensured that its expected use of large hydro and future market purchases from existing baseline resources will not exceed its proportional load share of those resources. VCE has not included any Pumped Storage hydro in its resource plan – this is further discussed in Section III.h below. Finally, VCE's resource needs could be met in part by existing resources, to the extent such resources participate in VCE's future resource procurement solicitations and if procurement is not be limited by the Commission to only new resources (e.g., D.19-011-016 required LSEs to procure new system RA capacity).

b. Preferred Conforming Portfolios

i. 46 MMT Conforming Portfolio

The 46MMT Portfolio more closely aligns with VCE's current blueprint for its own procurement than the 38MMT Portfolio, and therefore represents VCE's preferred resource portfolio. This portfolio represents a continuation of VCE's renewable energy-focused portfolio that will allow VCE to reach nearly an 80% RPS level by 2030. VCE contracted for new solar PV capacity in the first half of 2020 and is in the process of completing the procurement for the 2021 and 2022 new capacity mandated by Commission. VCE expects to continue expanding and diversifying its portfolio of renewable energy and energy storage over the forecast period by: 1) adding local solar PV capacity in 2023 and later also in the 2028-2030 period; 2) adding significant battery capacity in the 2025-2030 period to facilitate integration of renewables and provide new RA capacity; and 3) adding in-state and out-of-state wind resources in the 2026-2030 period. VCE also expects to add large-scale hydro resources to its portfolio through short- or long-term contracts. Each of the resources were selected so as to be consistent with the RSP and the RESOLVE model's New Build Capacity Limit.

A summary of the resource choices in this portfolio is shown in Table 3 above. The resulting generation from the 46MMT Conforming Portfolio as well as the estimated annual electric demand is summarized in Table 5 below. Portfolio details for the 46MMT Conforming Portfolio are also shown in the Excel files for new and existing resources that were part of this submission.

Table 5. Summary of annual electric demand and generation by resource type for the 46MMT Conforming Portfolio (GWh)

	2020	2021	2022	2023	2024	2026	2030
Retail Electric Demand	706	765	761	759	760	761	761
Wholesale Energy Demand (accounting for losses)	770	834	829	827	828	829	829
Market purchases	530	772	588	423	424	315	191
Carbon Free Energy	233	29	0	0	0	54	54
Wind	0	0	0	0	0	55	104
Solar	0	26	235	404	404	404	485
Small Hydro	6.7	6.4	6.4	6.4	6.4	6.4	6.4
Storage	-	(0.2)	(0.4)	(6.3)	(5.9)	(4.7)	(10.3)
RECs	308	118	-	-	-	-	-
RPS Delivered (% of Retail load)	45%	20%	32%	54%	54%	61%	78%

The portfolio generation summarized in Table 5 shows the expected performance of the 46MMT Conforming Portfolio that is consistent with VCE's long-term preferences and conforms with Commission and statutory requirements.

VCE's long-term operational goals include maintaining electricity prices that are competitive with PG&E retail prices while at the same time delivering a supply portfolio that is both cleaner and more locally sourced than PG&E's portfolio. Considering these priorities, the long-term portfolio mix is likely to be adjusted compared to the above in line with changes in market prices.

There are several reasons why VCE's preferred 46MMT Conforming Portfolio relies on a mix of renewable resources, including solar PV, wind, small-scale hydro and battery storage. First, a high level of renewable energy is preferred by VCE and its customers. Second, relying on a mix of wind, solar, hydro, and storage helps match renewable generation to VCE's load profile compared to a more solar-heavy portfolio, which could otherwise be preferred from a cost perspective. Even though other resources, such as geothermal resources, biomass and pumped storage hydro are attractive from the perspective of resource diversification and ability to match VCE's load, VCE believes these resources are also significantly more challenging to develop, making them less feasible options to pursue in the near term. VCE is also a very small load-serving entity (LSE), which would necessitate teaming up with other LSEs to develop and/or contract for non-solar resources. This adds risk to the development and contracting cycle. Finally, levelized costs for 4-hour battery storage are expected to be competitive with conventional gas-fired capacity (as available in the CAISO RA market) beginning around 2025, making battery storage a cost-preferred resource for RA.

VCE used the levelized cost estimates that were included in the RESOLVE model as a basis for estimating generation costs of different technologies. Based on this, VCE expects solar PV to be the lowest cost supply alternative for existing and new sources in the 2020-2030 period. VCE recently signed a long-term contract for 50 MW of new solar PV capacity expected to come online before 2022, and is currently negotiating with developers to add additional volumes. This new resource is not part of the designated Baseline resources, as defined by D.20-03-028. In

addition, VCE issued an RFO for new local resources in Q2 of 2020, which is expected to result in about 25 MW of new solar capacity, possibly combined with approximately 10 MW of storage, to come online by 2023. Also in the first half of 2020, VCE partnered with Redwood Coast Energy Authority and issued an RFO for up to 20 MW of RA capacity to come online on or before August 1, 2021. Half of this capacity will be for VCE and will ensure that VCE meets the additional system RA procurement mandates for 2021 set out in D.19-11-016.

As part of VCE's action plan that is described in Section IV of this report, VCE plans to conduct additional solicitations for new resources as needed to ensure sufficient resources are also available in the 2025-2030 period. The exact timing of such solicitations will depend on how fast VCE's electric demand grows in the next 3-5 years. For example, VCE expects that the COVID-19 pandemic of 2020 along with the ensuing economic recession will dampen electric demand to levels significantly below those shown in this IRP during the 2020-2023 period.

In line with many other industry analysts, the RESOLVE model's levelized costs for battery storage also suggests a long-term declining trend. Declining costs for battery storage suggest that in the next ten years, batteries are likely to become the most cost-effective means of meeting VCE's RA needs, surpassing traditional gas-fired generation in terms of resource costs. Therefore, the preferred 46MMT Conforming Portfolio includes up to 43 MW of battery capacity by 2030. If battery storage costs decline faster than anticipated, VCE may consider increasing its reliance on batteries, and conversely, if battery costs remain at close to 2018-2020 levels, then VCE is likely to rely more on market purchases for its RA needs.

ii. 38 MMT Conforming Portfolio

VCE's 38MMT Conforming Portfolio conforms with the additional requirement for LSEs to develop a second Conforming Portfolio based on their 38 MMT GHG target. To achieve the GHG emissions associated with the 38MMT Conforming Portfolio, VCE expanded the resource portfolio slightly under the resource categories of Solar, Battery Storage and large-scale hydro. As with the 46MMT Conforming Portfolio, VCE values a balanced portfolio approach and may adjust its resource choices in the future, depending on the cost and availability of other renewable energy and energy storage resources. In creating the 38MMT Conforming Portfolio, VCE also aims to ensure that VCE does not exceed its proportional share of limited resources such as large-scale hydro or wind. VCE notes, however, that if, due to resource limitations of a particular wind resource (e.g., Solano Wind), VCE's share of such a resource exceeds its proportional share based on load, VCE would be open to sourcing the same generation technology and capacity from another geographical area. The 46MMT and the 38MMT Conforming Portfolios are identical until after 2026. The compliance of this portfolio with statutory and regulatory mandates is discussed further in subsection (v) below.

Table 6. Summary of annual electric demand and generation by resource type for the 38MMT Conforming Portfolio (GWh).

	2020	2021	2022	2023	2024	2026	2030
Retail Electric Demand	706	765	761	759	760	761	761
Wholesale Energy Demand (accounting for losses)	770	834	829	827	828	829	829
Market purchases	530	772	588	423	424	315	111
Carbon Free Energy	233	29	0	0	0	54	91
Wind	0	0	0	0	0	55	104
Solar	0	26	235	404	404	404	532
Small Hydro	6.7	6.4	6.4	6.4	6.4	6.4	6.4
Storage	-	(0.2)	(0.4)	(6.3)	(5.9)	(4.7)	(15.0)
RECs	308	118	-	-	-	-	-
RPS Delivered (% of Retail load)	45%	20%	32%	54%	54%	61%	84%

iii. Compliance with Statutory and Regulatory Requirements

Section 454.52 (a) (1) of the Public Utilities Code sets out several requirements which LSEs must comply with in their IRPs:

- **Meet GHG emissions reduction targets established by the State Air Resources Board.** VCE has estimated GHG emissions of 135,000 metric tons and 108,000 metric tons, respectively, in 2030 under the 46MMT and 38MMT Conforming Portfolios, which are consistent with the GHG Benchmarks established for VCE in the ALJ Ruling and the CSP.

- **Procure at least 60 percent eligible renewable energy resources by December 31, 2030.** Both Conforming Portfolios considered in this IRP will meet the statutory RPS requirements. The actual level of RPS achieved in each compliance period will depend on how market conditions and prices for renewable energy evolve and on whether VCE's renewable energy procurement policies change. While VCE has a strong commitment to clean, local energy, maintaining competitive retail electric prices are also a key consideration in the balancing of priorities for VCE.

- **Just and reasonable rates.** VCE's rates are approved by its Board in accordance with VCE policies. VCE's goal is to meet or beat PG&E's retail electric rates. As of mid-2020, VCE's retail rates match those of PG&E.

- **Minimize impacts on ratepayers' bills.** VCE's 46MMT and 38MMT Conforming Portfolios result in estimated generation costs that are substantially below the generation costs estimated in the RESOLVE model. (VCE's IRP does not analyze costs like transmission and distribution costs that impact customer bills because, as a CCA, these costs are outside of VCE's control and are the responsibility of PG&E.) Minimizing impacts on ratepayer bills is a top priority for VCE when it procures on behalf of its customers, in addition to striving for a cleaner resource portfolio that utilizes local resources in line with VCE customer preferences. See Section III.e. below for additional details.

- **Ensure system and local reliability.** Since VCE is not a distribution utility, most of the obligations in this area do not apply. However, VCE incorporates in its resource plan the need for providing system and local RA at 115% of the expected monthly peak load for VCE. The estimated costs for such capacity are incorporated in the resource costs for all portfolios. Additionally, VCE will incorporate into its long-term PPAs with intermittent renewable resources the ability to curtail output in the face of negative market prices. The resource plans for both the 46MMT and the 38MMT Conforming Portfolios include procurement of battery storage RA capacity that go beyond current procurement mandates, including the replacement of Diablo Canyon capacity. More generally, VCE's Conforming Portfolios rely on a diverse mix of solar, wind, hydro, energy storage, and demand response resources. Both Conforming Portfolios thus help support system reliability beyond VCE's proportional share of the market.

- **Enhance distribution systems and demand-side energy management.** Since the distribution system and demand side management programs are managed by PG&E, the responsibility for meeting these requirements lies with PG&E. VCE has not taken any action to assume the responsibility for demand-side programs from PG&E. As discussed in Section III.d.ii of this report, VCE recently initiated program activities, including providing information on energy efficiency. In the future, once VCE accrues sufficient financial reserves, load management programs such as demand response and managed charging of electric vehicles could potentially become cost-competitive ways of ensuring that VCE's capacity needs are met. VCE will continue to explore programs that can be offered in parallel with PG&E's customer programs.

- **Minimize localized air pollutants and other GHG emissions, with early priority on disadvantaged communities identified pursuant to Section 39711 of the Health and Safety Code.** VCE's 46MMT and 38MMT Conforming Portfolios minimize local air pollutants and other GHG emissions, and prioritize disadvantaged communities (DACs). There are no power plants in VCE's DAC. VCE's Conforming Portfolios add new renewable and energy storage resources, reducing VCE's reliance on system power. As a result, local air pollutants and GHG emissions would be significantly reduced under either Conforming Portfolio, without increasing burdens on existing DACs. Finally, VCE's focus on building financial reserves and cash flow is expected to result in new customer programs that provide additional benefits to customers, including those in DACs. See Section III.d.i below for additional details.

Additional requirements

- **Beginning January 1, 2021, at least 65 percent of the procurement a retail seller counts toward the renewables portfolio standard requirement of each compliance period shall be from its contracts of 10 years or more. (Pub. Util. Code § 399.13 (b).)** As shown in Table 3 and in the spreadsheets submitted with this IRP, VCE has contracted for 50 MW of solar PV capacity that will come online in 2021, and is currently undergoing negotiations with developers with the intent to enter into an additional

long-term renewable energy contract by the end of the year, which will ensure that the long term requirement is met for the 2021-2024 compliance period and beyond.

- **Replace Diablo Canyon Capacity (D.20-03-028).** See Section IV.e. of this resource plan.

- **Procurement mandate (D.19-11-016).** VCE was ordered to procure a total of 12.6 MW of new capacity to come online by 2023 in the following manner: 6.3 MW by August 1, 2021, 9.4 MW by August 1, 2022 and 12.6 MW by August 1, 2023. As highlighted in Section IV and other parts of this IRP, VCE jointly conducted an RFP with Redwood Coast Energy Authority (RCEA) in Q2 2020 for RA capacity of up to 20 MW with at least 11.7 MW being available by August 1, 2021, which reflects the capacity of VCE's and RCEA's 2021 procurement mandates. At the time of this filing the procurement of capacity resulting from this RFP has not yet been finalized. Contract negotiations are in progress and VCE expects to complete contracting by the end of September 2020. VCE expects these procurement efforts to result in 7 MW of new demand response capacity for VCE with a commercial operation date (COD) no later than August 1, 2021 and 2.5 MW of battery storage capacity with COD no later than August 1, 2022. The additional procurement of capacity to meet the full obligation by 2023 is expected to be met by solar+storage hybrid capacity coming online in 2023 as a result of VCE's 2020 RFO for local resources. VCE's Action Plan includes activities to finalize procurement activities and to monitor progress closely to ensure the capacity comes online in a timely manner.

c. GHG Emissions Results

The estimated GHG emissions from the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio match the requirements set out by the ALJ Ruling and as later implemented through the CSP Calculators for each scenario issued by the Energy Division on June 15, 2020. Based on guidance provided from the Commission and its staff, VCE understands that its 46MMT Conforming Portfolio should match the LSE's individual 2030 GHG target, i.e. neither be higher nor lower than the targets of 156,000 metric tons (i.e., 135,000 metric tons through CSP Calculator) for VCE. In the 38MMT scenario the LSE may use portfolios that achieve emissions that meet or are lower than the LSE's benchmark, which is 129,000 metric tons (108,000 metric tons through CSP Calculator) for VCE.[9] VCE has chosen to have both of its Conforming Portfolios closely match the Commission benchmark emissions allocated to VCE, but also notes that lower costs and lower GHG emissions could materialize if capital costs for new renewable energy continue to decline in line with the historical trends for solar PV and storage, making it advantageous to invest more heavily in renewable energy.

In the 46MMT Conforming Portfolio, VCE expects that about 20 MW of large-scale hydro resources will be needed to achieve its modified GHG benchmark of 135,000 metric tons per year by 2030. In the 38MMT Conforming Portfolio VCE expects that about 34 MW of carbon-free large-scale hydro generation would be necessary to meet the goal, sourced from either

[9] Energy Division, "2020 IRP Filings Filing Requirements' Questions and Answers," updated August 11, 2020.

California or out-of-state. Table 7 shows the estimated emissions from VCE's portfolios for the 2020-2030 period using the CSP Calculator provided by the Commission. In using this tool, VCE used the default settings and only entered VCE's load and the respective resources selected in VCE's Conforming Portfolios. Table 7 also shows the estimated emissions of NOx, PM2.5 and SO2 during the forecast period.

Table 7. Estimate CO_2 and pollutant emissions by year and resource portfolio

	46MMT Conforming Portfolio (Preferred)				38MMT Conforming Portfolio			
	2020	2022	2026	2030	2020	2022	2026	2030
CO_2 (000 metric tons)	307	220	179	135	307	221	182	108
$PM_{2.5}$ (tons)	11.2	8.2	6.7	5.8	11.3	8.3	7.0	4.7
SO_2 (tons)	1.1	0.8	0.6	0.6	1.1	0.8	0.7	0.5
NO_x (tons)	17.4	13.5	12.6	11.0	17.4	13.6	13.1	8.3

d. Local Air Pollutant Minimization and Disadvantaged Communities

i. Local Air Pollutants

VCE's emissions are entirely a result of using system power for parts of its short-term and long-term power supply. VCE does not have any fossil-fueled power plants within its service territory. It is therefore expected that changes to air emissions from power plants will have little or no impact on the air quality within its service territory. Table 7 above demonstrates that based on the CSP calculator for the 46MMT preferred Conforming Portfolio, emissions of particulate matter and SO_2 will fall by nearly 50% and NO_x by more than 35% in the 2020-2030 period as a result of the power grid becoming cleaner and VCE's increased use of renewable energy and storage in its power supply, including via long-term contracts.

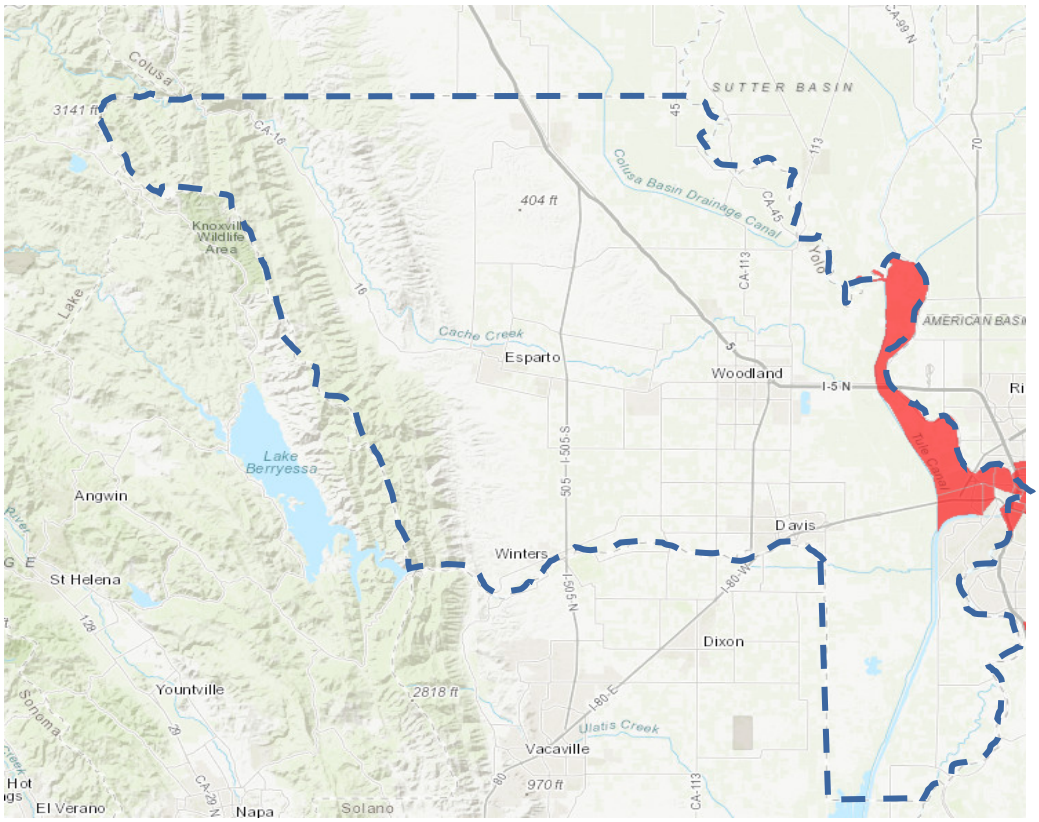
Both of VCE's Conforming Portfolios expand the use of renewable energy in the forecast period and also increase the amount of battery storage from zero in 2020 to 43 MW by 2030 in the 46MMT Conforming Portfolio and up to 63 MW in the 38MMT Conforming Portfolio. The combination of higher amounts of renewable energy and expanded use of battery storage will contribute to reducing VCE's reliance on system power over the forecast period. The Action Plan provides additional detail about how and when VCE plans to conduct resource solicitations for new energy and capacity resources.

ii. Focus on Disadvantaged Communities

Disadvantaged communities are defined as the top 25% impacted areas within the service territory, where the impact is determined using the CalEnviroScreen 3.0 tool. VCE notes that the CalEnviroScreen tool has not been updated since VCE's last IRP submission in 2018, and therefore VCE's assessment is also virtually unchanged. Based on CalEnviroScreen 3.0 tool, there are only four census tracts in Yolo County that meet the Commission's criteria for DACs. Of these, only area 101.02, which is a largely rural census tract, is partially located in VCE's

service territory. The total number of households in this census tract was 2,408 in 2016.[10] Based on a cross-comparison with VCE customer addresses in this area, it is estimated that fewer than 100 VCE customer accounts are located within this impacted area. Thus, less than 0.15% of VCE's customers are estimated to be in a DAC. According to the CalEnviroscreen 3.0 tool,[11] the key reasons for this census tract falling within the top 25% appears to be risks associated with a combination of low-income and environmental factors such as groundwater risks, cleanup sites, hazardous waste and air pollution. There are no power plants in this DAC. The fact that the impacted areas are situated close to major transportation hubs likely contributes to the CalEnviroscreen 3.0 rating.

Figure 4. CalEnviroScreen 3.0 Results for Yolo County



VCE's rates are designed to provide economic benefits for all ratepayers, including those DACs. It should also be noted that the DAC area identified in VCE's service territory does not appear to have any significant land suitable for renewable energy development, due to the predominant land use types such as prime farmlands, Williamson Act Lands, conservation easements, and Sacramento River bypass (flood) channels.

[10] 2016 US Census Bureau statistics for census tract 101.02 (https://www.census.gov/data/data-tools.html)
[11] https://oehha.ca.gov/media/downloads/calenviroscreen/document/ces3results.xlsx

Until further notice, PG&E will continue to make its existing energy efficiency and demand response programs available to VCE customers. In addition, VCE recently started two programs that will help air quality and energy affordability for all VCE customers, including residents of DACs, as described in the following summaries.

Transportation Electrification. VCE has initiated its Transportation Electrification Program (TEP), which is designed to focus on customer-facing activities that advance local electrification of the transportation system. Decarbonizing the transportation sector is of high priority to VCE and its local government member agencies due to their central implementation role of State transportation goals. With a high level of emissions generated by the transportation sector in California (41%) and an even higher percentage of overall emissions from the transportation sector at the local level in Yolo County, VCE is in the best position to catalyze transportation electrification at the local level. VCE's multi-year goals for the TEP include: 1) Accelerate electrification of transportation and move consumer spending from gallons to kWh; 2) Improve air quality in service territory and adjacent locations; 3) Build upon the Climate Action Plans of Yolo County, Woodland, Winters and Davis; and 4) Become a trusted source of information within our community regarding electrification.

One current example of VCE's efforts on the TEP includes securing a $2.9 million dollar grant from the Sacramento Area Council of Governments (SACOG) that lays the foundation for increased public electric vehicle (EV) charging opportunities and multi-modal transportation hubs in Yolo County. This work has begun and will be completed over the next 4 years. Additionally, VCE provides an online education tool for customers to find information regarding EVs such as: EV benefits, EV facts, a savings calculator, a CO_2 reduction calculator, EV models, a EV charger locator, and available credits and rebates. The EV customer education and decision support tool is found on the VCE website at: https://valleycleanenergy.org/electric-vehicles/.

Energy Efficiency (EE). VCE's Energy Efficiency (EE) Program focuses on providing relevant and actionable EE information to VCE customers. The starting point will include developing an online EE graphic that will identify the most common household EE measures along with links to available rebates, with the objective to help customers reduce energy usage, reduce emissions related to energy usage and save customers money. The EE customer education and decision support information is found on the VCE website at: https://valleycleanenergy.org/energy-efficiency/.

e. Cost and Rate Analysis

VCE's cost and rate analysis is limited to an assessment of generation costs.[12] VCE recognizes that while areas such as transmission, distribution, and programs are very important for the

[12] The generation costs include wholesale energy costs, RA costs, costs for RECs and contracted renewables. They do not include any transmission or distribution costs.

overall energy cost for VCE customers, PG&E is responsible for the energy delivery infrastructure. Any costs associated with this infrastructure are expected to be addressed in PG&E's IRP filing, as required for IOU IRPs under the directions provided in the Commission's template.

VCE's generation rates are the same as PG&E's. They were raised to this level from a previous discount to PG&E rates in order to ensure the near-term financial stability of VCE during its startup phase. Over time, VCE hopes to be able to again introduce rate discounts relative to PG&E rate, but VCE also notes that this depends critically on the level of the Power Charge Indifference Adjustment (PCIA) and other costs over which VCE has only limited influence.

Figure 5 shows a comparison of the estimated generation costs for VCE in each of the years 2020-2024, 2026, and 2030 for the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio. The figure also contrasts the estimated costs for VCE's generation supply with the expected generation costs reported in the RESOLVE model's RSP. The results for VCE's portfolios were derived by using the Commission-provided tools, including RESOLVE modeling results and assumptions, as described in Section II above.

Figure 5. Estimated annual generation costs by resource portfolio for VCE versus RESOLVE model results (2016 $/MWh)

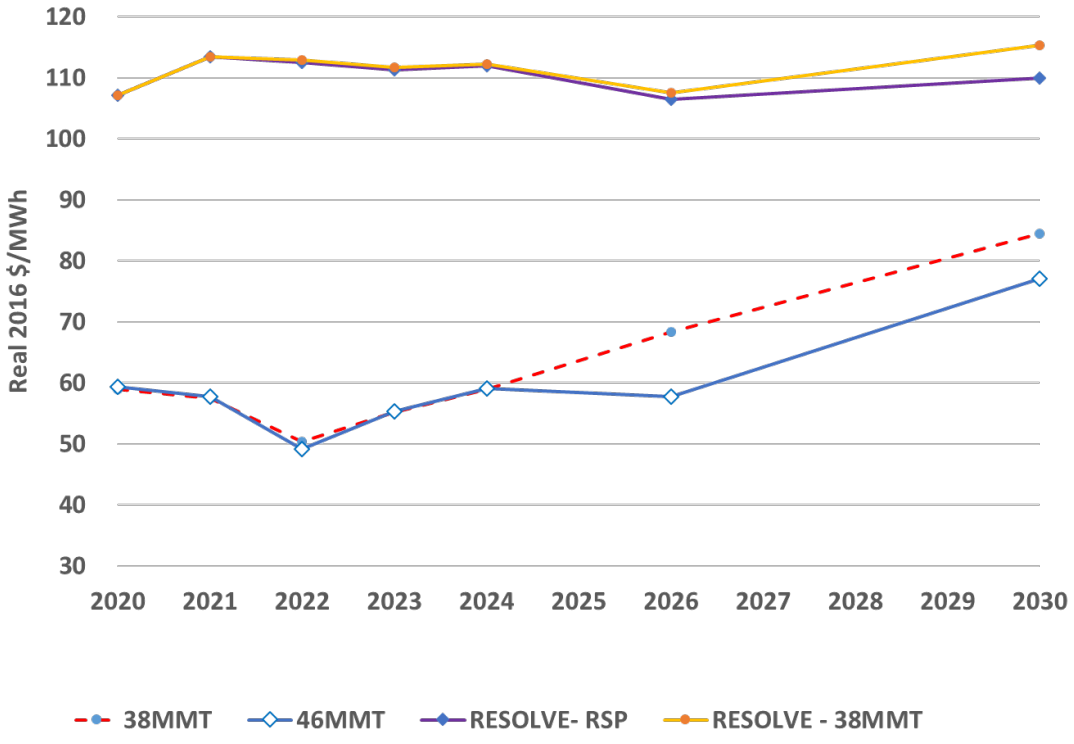


Figure 5 shows that the preferred 46MMT Conforming Portfolio and 38MMT Portfolio will remain significantly below the RESOLVE model's estimated generation costs for the RSP for the entire forecast period. One reason for this difference may be a difference in modeling methodology for capacity between VCE and that of the RESOLVE model. VCE uses a forecast of capacity (or RA) prices in California covering the 2020-2030 period. This forecast is based on current and expected market conditions for capacity. In the long term, VCE's forecasted capacity costs are also capped by the least-cost technology for bringing more capacity to the CAISO market. Prior to 2025, this is estimated to be gas-fired combustion turbine capacity, and after 2025 it is expected to be 4-hour lithium-ion battery storage. In contrast, the RESOLVE model appears to model estimated generator fixed costs directly (including financing of new capacity) and set revenue requirements (and thus generation rates) to include all such fixed and financing costs, possibly resulting in higher estimated costs for generation.

As discussed in Section II above, VCE uses the hourly marginal cost of electricity from the RESOLVE model along with the RESOLVE model's levelized costs for new capacity. The methodology is thus consistent with VCE being a price-taker in the CAISO energy and capacity markets wherein other LSE's are following the RSP.

For market purchases, it is assumed that in the 2020-2022 period, energy and RA will be available at prices indicated through current RA prices in bilateral (or once-through cooling natural gas resources) markets. Energy is expected to be available at prices corresponding to futures prices for NP15. In the 2023-2030 period, it is assumed that energy can be procured at the estimated hourly CAISO price reported for RESOLVE's RSP. It is also assumed that RA can be secured at a capacity corresponding to the lowest capacity cost between the traditional provider of capacity, a natural gas-fired combustion turbine generator, and the emerging capacity resource – 4-hour lithium-ion batteries. Cost estimates displayed in the RESOLVE model suggests that from 2025 onwards, 4-hour battery storage capacity will be a lower-cost alternative than conventional gas fired generation. This expectation is based on the assumption that the RA resource will operate for energy only infrequently and that sufficient resources will be available in the system to meet nighttime and winter energy demand.

The difference in the estimated costs of VCE's portfolio and the RESOLVE model results implies that other LSEs could also find a lower-cost solution than the RESOLVE RSP, mainly due to new renewable resources having lower costs than the marginal cost of CAISO power. This, in turn, makes the RESOLVE model outcome increasingly unlikely as a market outcome and could potentially leave existing assets unable to recover their full costs. VCE recommends that the Commission look into this potential outcome to better understand overall results when aggregating individual LSE IRPs.

For 2021, VCE has been allocated about 15-17 MW of CAM capacity during the summer months and between 8-14 MW in non-summer months. The allocated capacity corresponds to about 10% of VCE's monthly capacity requirements. The financial costs or benefits of

using CAM resources rather than generally available resources to meet VCE's RA need in the forecast have not been explicitly accounted for in this IRP – it is assumed that CAM resources would be priced competitively with RA available in bilateral markets.

f. System Reliability Analysis

VCE's Conforming Portfolios both meet or exceed all Commission requirements regarding RA, procurement of new capacity, replacement of Diablo Canyon resources, storage mandates and RPS requirements. VCE's Conforming Portfolios also contain a resource mix that becomes increasingly diverse over the forecast period and takes advantage of low-cost new utility-scale solar, while also using wind, hydro, and energy storage resources. Furthermore, in Q2 2020, VCE participated in the launch of a joint CCA request for information on long-duration energy storage, which will allow VCE to obtain better information on new resource options that could further aid system reliability in the future as California rapidly increases the amount of variable renewable energy resources on the grid.

VCE's portfolios are planned to a 15% reserve margin, using renewable resources, hydro, and storage, based on the Effective Load Carrying Capability (ELCC) and net qualifying capacity (NQC) numbers provided by the Commission as part of the RSP. VCE's Conforming Portfolios were also selected to be consistent with the Commission's RSP by selecting the volumes of new resources not to exceed VCE's load share of the capacity limits for new resources identified in the RESOLVE model for the RSP, and also by ensuring that VCE's estimated market purchases of short-term energy and capacity do not exceed VCE's proportional share of existing installed baseline capacity. For example, by 2030 VCE's estimated energy procurement corresponds to less than 0.2% of the baseline non-intermittent resources available per the RESOLVE model and VCE's expected RA procurement from the market corresponds to about 0.3% of the available firm non-intermittent and non-storage capacity available in 2030 per the RESOLVE model. VCE's estimated share of 2030 load is about 0.4%.[13] Thus, VCE's Conforming Portfolios will contribute to improve both reliability and the integration of renewables in the 2020-2030 period.

As discussed above in other sections of this report, VCE expects costs for battery storage to decline further over the 2020-2030 period, and VCE therefore expects to add 43 MW of new 4-hour battery storage in its 46MMT Conforming Portfolio and up to 63 MW of new 4-hour battery storage in the 38MMT Conforming Portfolio. In addition, VCE also expects to add about 7 MW of new demand response capacity as early as 2021. This total capacity exceeds regulatory requirements and will ensure that VCE contributes its proportional share and more of its reliability obligations within the CAISO market. As noted above, even though VCE does not have plans to pursue long-duration storage at the moment, it has issued a

[13] Based on comparing VCE's purchases of energy and capacity against the available capacities listed in the RESOLVE model's "RESOLVE_Results_Viewer_2020-03-23" for the RSP.

request for information from market participants together with other CCAs (see subsection h. below for more details). We also note that since VCE is planning to add significant amounts of 4-hour storage in the anticipation that this will be the least cost option for RA, this capacity can also be configured to discharge over longer periods than 4 hours and thus can provide longer duration storage that supports long term low-carbon RA in California.

Table 8 below shows VCE's System Reliability Progress Tracking Table for VCE's 46MMT Conforming Portfolio and Table 9 shows the corresponding table for the 38MMT Conforming Portfolio. In addition to the resources VCE has under contract and has identified in the two resource portfolios, Tables 8 and 9 also include the expected procurement of capacity (or RA) from the market to produce a capacity-balanced portfolio. The Resource Data Templates submitted with this IRP clearly identify the capacity and energy expected to be met by market purchases. As discussed above, VCE's market purchases are expected to be significantly less than VCE's load-share of the installed baseline capacity.

Table 8. 46MMT Preferred Conforming Portfolio System Reliability Progress Tracking Table

System Reliability Progress Tracking Table (NQC MW) for month of September by contract status, 46 MMT portfolio	ELCC type	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
online	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
online	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
online	biomass	13	6	6	-	-	-	-	-	-	-	-
online	cogen	32	20	22	-	-	-	-	-	-	-	-
online	geothermal	7	7	7	-	-	-	-	-	-	-	-
online	hydro	28	18	18	-	-	-	-	-	-	-	-
online	thermal	70	68	113	62	-	-	-	-	-	-	-
online	battery	-	-	-	-	-	-	-	-	-	-	-
online	nuclear	-	-	-	-	-	-	-	-	-	-	-
online	solar	26	-	-	-	-	-	-	-	-	-	-
online	psh	-	-	-	-	-	-	-	-	-	-	-
online	unknown	22	22	22	22	22	22	22	22	22	22	22
development	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
development	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
development	biomass	-	-	-	-	-	-	-	-	-	-	-
development	cogen	-	-	-	-	-	-	-	-	-	-	-
development	geothermal	-	-	-	-	-	-	-	-	-	-	-
development	hydro	-	-	-	-	-	-	-	-	-	-	-
development	thermal	-	-	-	-	-	-	-	-	-	-	-
development	battery	-	-	3	3	3	2	2	2	2	2	2
development	nuclear	-	-	-	-	-	-	-	-	-	-	-
development	solar	-	-	7	7	6	5	4	4	4	4	4
development	psh	-	-	-	-	-	-	-	-	-	-	-
development	unknown	-	7	7	7	7	7	7	7	7	7	7
review	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
review	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
review	biomass	-	-	-	-	-	-	-	-	-	-	-
review	cogen	-	-	-	-	-	-	-	-	-	-	-
review	geothermal	-	-	-	-	-	-	-	-	-	-	-
review	hydro	-	-	-	-	-	-	-	-	-	-	-
review	thermal	-	-	-	-	-	-	-	-	-	-	-
review	battery	-	-	-	-	-	-	-	-	-	-	-
review	nuclear	-	-	-	-	-	-	-	-	-	-	-
review	solar	-	-	11	11	9	8	7	7	7	7	7
review	psh	-	-	-	-	-	-	-	-	-	-	-
review	unknown	-	-	-	-	-	-	-	-	-	-	-
planned_existing	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
planned_existing	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
planned_existing	biomass	-	-	-	-	-	-	-	-	-	-	-
planned_existing	cogen	-	-	-	-	-	-	-	-	-	-	-
planned_existing	geothermal	-	-	-	-	-	-	-	-	-	-	-
planned_existing	hydro	-	-	-	-	-	-	-	-	7	7	14
planned_existing	thermal	-	-	-	-	-	-	-	-	-	-	-
planned_existing	battery	-	-	-	-	-	-	-	-	-	-	-
planned_existing	nuclear	-	-	-	-	-	-	-	-	-	-	-
planned_existing	solar	-	-	-	-	-	-	-	-	-	-	-
planned_existing	psh	-	-	-	-	-	-	-	-	-	-	-
planned_existing	unknown	-	-	-	98	163	166	165	166	141	142	118
planned_new	wind_low_cf	-	-	-	-	-	-	4	4	4	4	8
planned_new	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
planned_new	biomass	-	-	-	-	-	-	-	-	-	-	-
planned_new	cogen	-	-	-	-	-	-	-	-	-	-	-
planned_new	geothermal	-	-	-	-	-	-	-	-	-	-	-
planned_new	hydro	-	-	-	-	-	-	-	-	-	-	-
planned_new	thermal	-	-	-	-	-	-	-	-	-	-	-
planned_new	battery	-	-	-	10	10	10	10	10	29	29	40
planned_new	nuclear	-	-	-	-	-	-	-	-	-	-	-
planned_new	solar	-	-	-	-	-	-	-	-	-	-	3
planned_new	psh	-	-	-	-	-	-	-	-	-	-	-
planned_new	unknown	-	-	-	-	-	-	-	-	-	-	-
TOTAL supply, NQC MW		198	148	215	219	219	221	221	223	224	225	226
Load (MW)		191	189	190	190	191	192	193	193	194	195	197
Load +15% PRM (MW)		220	218	218	219	219	221	221	223	224	225	226
Supply minus load: Shortfall (-) or Surplus (+), in MW		-22	-70	-3	0	0	0	0	0	0	0	0

Table 9. 38MMT Conforming Portfolio System Reliability Progress Tracking Table

System Reliability Progress Tracking Table (NQC MW) for month of September by contract status, 38 MMT	ELCC type	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
online	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
online	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
online	biomass	13	6	6	-	-	-	-	-	-	-	-
online	cogen	32	20	22	-	-	-	-	-	-	-	-
online	geothermal	7	7	7	-	-	-	-	-	-	-	-
online	hydro	28	18	18	-	-	-	-	-	-	-	-
online	thermal	70	68	113	62	-	-	-	-	-	-	-
online	battery	-	-	-	-	-	-	-	-	-	-	-
online	nuclear	-	-	-	-	-	-	-	-	-	-	-
online	solar	26	-	-	-	-	-	-	-	-	-	-
online	psh	-	-	-	-	-	-	-	-	-	-	-
online	unknown	22	22	22	22	22	22	22	22	22	22	22
development	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
development	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
development	biomass	-	-	-	-	-	-	-	-	-	-	-
development	cogen	-	-	-	-	-	-	-	-	-	-	-
development	geothermal	-	-	-	-	-	-	-	-	-	-	-
development	hydro	-	-	-	-	-	-	-	-	-	-	-
development	thermal	-	-	-	-	-	-	-	-	-	-	-
development	battery	-	-	3	3	3	3	3	2	2	2	2
development	nuclear	-	-	-	-	-	-	-	-	-	-	-
development	solar	-	-	7	7	6	5	4	4	3	3	2
development	psh	-	-	-	-	-	-	-	-	-	-	-
development	unknown	-	7	7	7	7	7	7	7	7	7	7
review	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
review	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
review	biomass	-	-	-	-	-	-	-	-	-	-	-
review	cogen	-	-	-	-	-	-	-	-	-	-	-
review	geothermal	-	-	-	-	-	-	-	-	-	-	-
review	hydro	-	-	-	-	-	-	-	-	-	-	-
review	thermal	-	-	-	-	-	-	-	-	-	-	-
review	battery	-	-	-	-	-	-	-	-	-	-	-
review	nuclear	-	-	-	-	-	-	-	-	-	-	-
review	solar	-	-	11	11	9	8	6	6	5	4	3
review	psh	-	-	-	-	-	-	-	-	-	-	-
review	unknown	-	-	-	-	-	-	-	-	-	-	-
planned_existing	wind_low_cf	-	-	-	-	-	-	-	-	-	-	-
planned_existing	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
planned_existing	biomass	-	-	-	-	-	-	-	-	-	-	-
planned_existing	cogen	-	-	-	-	-	-	-	-	-	-	-
planned_existing	geothermal	-	-	-	-	-	-	-	-	-	-	-
planned_existing	hydro	-	-	-	-	-	-	-	-	7	7	24
planned_existing	thermal	-	-	-	-	-	-	-	-	-	-	-
planned_existing	battery	-	-	-	-	-	-	-	-	-	-	-
planned_existing	nuclear	-	-	-	-	-	-	-	-	-	-	-
planned_existing	solar	-	-	-	-	-	-	-	-	-	-	-
planned_existing	psh	-	-	-	-	-	-	-	-	-	-	-
planned_existing	unknown	-	-	-	98	163	166	165	167	139	141	89
planned_new	wind_low_cf	-	-	-	-	-	-	4	4	4	4	8
planned_new	wind_high_cf	-	-	-	-	-	-	-	-	-	-	-
planned_new	biomass	-	-	-	-	-	-	-	-	-	-	-
planned_new	cogen	-	-	-	-	-	-	-	-	-	-	-
planned_new	geothermal	-	-	-	-	-	-	-	-	-	-	-
planned_new	hydro	-	-	-	-	-	-	-	-	-	-	-
planned_new	thermal	-	-	-	-	-	-	-	-	-	-	-
planned_new	battery	-	-	-	10	10	10	10	10	34	33	65
planned_new	nuclear	-	-	-	-	-	-	-	-	-	-	-
planned_new	solar	-	-	-	-	-	-	-	-	-	-	3
planned_new	psh	-	-	-	-	-	-	-	-	-	-	-
planned_new	unknown	-	-	-	-	-	-	-	-	-	-	-
TOTAL supply, NQC MW		198	148	215	219	219	221	221	223	224	225	226
Load (MW)		191	189	190	190	191	192	193	193	194	195	197
Load +15% PRM (MW)		220	218	218	219	219	221	221	223	224	225	226
Supply minus load: Shortfall (-) or Surplus (+), in MW		-22	-70	-3	0	0	0	0	0	0	0	0

As of 2020, VCE has procured all of its capacity needs in accordance with CAISO's and the Commission's requirements for RA. VCE will continue meeting these RA requirements going forward, and will thus procure a substantial amount of its capacity needs in bilateral markets at least three years in advance of the load serving period covered by the capacity.

Through its long-term contracting for renewable wind and solar resources as well as by contracting for storage capacity, VCE expects to cover about 40% of its capacity needs over the 2020-2030 period for the summer peak period. VCE also expects another 10% of peak capacity to be provided by CAM resources (based on maintaining 2021 allocations). The balance of about 50% of VCE's capacity needs and about 45% of its electricity needs will be sourced in CAISO and/or bilateral markets for capacity and electricity, respectively. Since VCE is contributing its proportional share and more to new resource and capacity development in the CAISO, VCE supports reliability and expects to continue to meet its resource needs partially through market purchases 2020-2030 period. Finally, it is not yet clear how the recently adopted procurement mechanism for local RA as provided in D.20-06-002 will impact VCE's capacity procurement or costs, but VCE will naturally comply with this and future RA regulations and will continue to seek to minimize costs for its ratepayers of providing reliable energy and capacity.

g. Hydro Generation Risk Management

VCE's portfolios include only one small-scale hydro resource that is expected to be contracted for during the whole 2020-2030 period, namely the Indian Valley station that provides 6.4 GWh of energy per year and is an RPS-eligible renewable resource. This corresponds to about 0.8% of VCE's load. This is expected to have a negligible impact on costs, GHG emissions and reliability. While having a small overall impact on VCE's portfolio and expected costs, there are four distinct risks and potential impacts associated with this resource related to drought:

- **Energy.** VCE expects to know ahead of the impacted year what the impact of a drought will be on production. Any energy shortfall will be addressed through CAISO spot market purchases.
- **Capacity**. VCE's existing hydro contracts are only for energy, so capacity risk is not applicable.
- **RPS**. VCE expects to maintain a balance of RECs that exceeds the statutory requirements in the 2024-2030 period, which means any shortfall will likely not affect the RPS compliance for VCE. If a shortfall is observed in the 2021-2024 period, VCE may compensate with market purchases of RECs, depending on the significance of the shortfall relative to statutory requirements.
- **GHG**. A shortfall of energy in 2030 will reduce the amount of carbon-free energy in VCE's portfolio and could put its 2030 GHG target at risk. Indian Valley hydro's impact on VCE's GHG emissions is, however, small, and VCE expects to be able to make up for any shortfall in bilateral short-term markets.

In the longer term, both Conforming Portfolios also include large-scale hydro as a means to achieve VCE's 2030 GHG benchmark emissions targets for the 46MMT and 38MMT Conforming Portfolios. The 46MMT Conforming Portfolio includes a total of 20 MW of large-scale hydro that may be sourced from in-state and/or out-of-state resources. Similarly, the 38MMT Conforming Portfolio includes 34 MW of large-scale hydro resources. VCE chose to limit its dependence on large-scale hydro to no more than 34 MW across both scenarios so as not to exceed VCE's load-share of the total currently available large-scale hydro capacity from in-state and out-of-state resources as reported in the RSP (i.e., VCE's planned use of hydro as a percentage of the installed capacity in comparison to VCE's load in comparison to the total load for all California LSEs).

A drought could reduce the delivery of carbon-free energy from hydro resources and therefore put the achievement of VCE's target at risk. To mitigate this risk, VCE may increase the amount of solar PV in its portfolio and thereby reduce expected emissions to less than the benchmark GHG amounts. Higher levels of solar PV in VCE's portfolios may also help reduce the overall costs of electricity for VCE's customers. However, the Commission required that LSEs provide a Preferred Conforming Portfolio for the 46 MMT target that meets (rather than beats) the individual LSE 2030 GHG targets established in the ALJ Ruling. Since additional solar PV would reduce VCE's GHG emissions below the CPUC-mandated level of 2030 emissions for VCE, VCE's 46MMT Conforming Portfolio did not select additional solar PV. If there is a risk of drought causing a shortfall of carbon-free energy, VCE may also seek to find other out-of-state hydro resources to compensate for shortfalls in California hydro resources caused by a drought, including seeking to secure such resources under longer-term contracts to increase the likelihood that they will be available to VCE when needed.

VCE's hedging of supply risk is focused on the next 12-24 months and includes securing a variety of resources to ensure delivery at stable costs of all the attributes needed in VCE's portfolio, including energy, RA, GHG emissions, and RPS requirements. Due to their shorter-term nature, hedging decisions are not directly part of the IRP or able to address hydro delivery risk towards the end of the forecast period. However, if at the time leading up to 2030, VCE's carbon goals are deemed to be at risk, the hedging policy will seek to minimize that risk by procuring additional capacity from carbon-free resources up to 24 months in advance.

h. Long-Duration Storage Development

While VCE's Conforming Portfolios did not select any long-duration storage resources over the 2020-2030 timeframe, VCE together with 12 other CCAs conducted a request for information (RFI) from California market participants and developers with the objective of

learning more about available technologies, costs and market readiness.[14] Responses to the RFI were due in July 2020, and the CCA group is currently in the process of analyzing the responses. The results will be used to inform future procurements that may lead to revisions of VCE's resource plan in the future. Depending on the response and the associated costs and lead-times estimated by respondents, VCE may pursue longer duration storage resources than it currently has in its Conforming Portfolios, which are currently limited to 4-hour lithium-ion battery storage. VCE may collaborate with other LSEs to procure such resources in the future if it determines that such a collaboration could mitigate project risk, provide benefits to VCE customers, and address specific reliability or renewable energy integration challenges.

It should be noted however, that in the 46MMT Conforming Portfolio, VCE is planning to install up to 43 MW of new battery storage with a duration of at least 4 hours during the forecasting period. This far exceeds VCE's procurement obligations, and the procurement will be pursued on the expectation that battery storage will be cost-competitive with other capacity resources from about 2025. These batteries are also an option to use for longer duration of 8 hours or more since VCE does not expect to have any constraints with respect to using the batteries at full capacity and a duration of 4 hours, or at 50% of capacity with a duration of 8 hours. Batteries can therefore also provide the flexibility of being used as a longer duration storage resource in addition to providing short-term storage. Based on an initial review of the RFI responses for long-term storage, VCE expects it would be less costly and less risky to consider using batteries for long-duration storage as well as short term storage. Batteries also have the advantage that they are scalable and modular, making them easier to manage from a cost and risk perspective than larger scale projects such as pumped storage hydro.

Traditional long-term storage options such as pumped storage hydro are likely to be very challenging for VCE to undertake on its own, since traditionally such projects are very capital intensive, are large scale and have long lead times, all of which would be barriers for VCE in developing this type of storage given VCE's relative size. While VCE may consider collaborating with other LSEs on such projects in the future if it determines such a resource would be in the interest of its customers, VCE views new pumped hydro storage options as containing significant risks, costs, and timelines that make this option unlikely to be pursued by VCE in the 2020-2030 period. These potential barriers to long-term storage are also discussed under Barriers in Section IV.c.

[14] Clean Power Alliance of Southern California, CleanPowerSF, East Bay Community Energy, Marin Clean Energy, Monterey Bay Community Power, Peninsula Clean Energy, Pioneer, Redwood Coast Energy Authority, San Jose Clean Energy, Silicon Valley Clean Energy, Sonoma Clean Power, Valley Clean Energy and Western Community Energy.

i. Out-of-State Wind Development

VCE has a preference for local resources because it believes local resources will better support local reliability and will bring other benefits such as local jobs. Despite this preference VCE recognizes that the potential for new in-state wind development, perhaps particularly in Northern California, is limited. At the same time, wind is an attractive resource for VCE's portfolio because of costs and its ability to meet load even during non-solar hours. VCE therefore includes a mix of in-state and out-of-state resources in the resource plans for both the 46MMT and the 38MMT Conforming Portfolios. In its future procurement solicitations, VCE expects to continue to express a preference for in-state and local wind resources, but is open to pursuing contracts with out-of-state wind resources if they were to be offered at competitive prices and reasonable lead times during VCE's future resource solicitations. Of course, whether to pursue in-state or out-of-state resources is also a question of availability – if VCE cannot source sufficient wind resources from California sources, it will also seek wind resources from out-of-state. Although out-of-state resource are expected to require longer lead times and be of bigger scale than VCE needs, these resources may also be attractive as a complement to VCE's portfolios. These resources could potentially provide more consistent generation at non-daylight hours and potentially higher capacity factors than in-state resources, helping VCE to better balance its load. Expanding the CAISO footprint as currently considered with the EDAM market could help make out-of-state wind resources more attractive. As part of its future RFOs for new capacity to come online after 2025, VCE will therefore make sure to also invite bids from out-of-state wind developers.

j. Transmission Development

Since the finalization of the baseline list of plants for the IRP, VCE has completed a contract for one new solar project. VCE will have a 50 MW share of the Aquamarine Solar project, which is located in Kings County. It has completed its interconnection agreement and no additional transmission is expected to be needed. VCE is also negotiating for additional new renewable capacity to replace a PPA that was cancelled in August 2020 and that it anticipates will result in one or more long-term contracts to be executed by the end of 2020. VCE is seeking this capacity on an expedited basis and is only considering projects that are under development, have executed interconnection agreements, and are able to reach COD by mid-2022 at the latest.

In the first half of 2020, VCE also conducted an RFO for local capacity and an RFP for RA, as discussed in other parts of this report. VCE is currently working through the selection of vendors and negotiations of the possible purchase agreements resulting from these solicitations. VCE does not expect that any of these projects will require new transmission.

Likewise, in the longer term, VCE's portfolio includes additional solar, wind and storage capacity in the 2026-2030 period. Specific units have not yet been identified for these resource additions but VCE expects to pursue a combination of local and CAISO-wide capacity and would expect these to include new transmission only insofar as the cost of

such projects would remain competitive with offers that do not require new transmission. VCE's resource choices as reflected in Table 3 reflect the expectation of contracting mainly for Northern California resources. However, depending on availability and price, these could also be substituted for other resources in CAISO or capacity and energy that is deliverable into CAISO.

IV. Action Plan

VCE's Action Plan is focused on managing risks around resource availability, contracting and procurement in the 2020-2030 time period. VCE's Action Plan therefore focuses on securing resources under long-term contracts and monitoring their progress during development and construction. It also includes analyzing responses from the joint CCA long-duration storage RFI, monitoring battery energy storage pricing, and considering collaborative voluntary procurement opportunities with other LSEs that could benefit VCE's customers while contributing to grid reliability and renewable energy integration. Actions also include conducting resource solicitations for new supply to come online in the 2025-2030 period. Finally, the Action Plan also includes activities to manage the resource portfolio and to adjust the portfolio to ensure costs and risks are matched so that VCE maintains attractive rates and provides a reliable supply of clean energy to its customers in compliance with all state law and regulations.

a. Proposed Activities

VCE's most immediate procurement actions are to secure new RA capacity to meet its procurement mandate of 12.6 MW by 2023 in accordance with D.19-11-016. VCE plans to meet this requirement by executing 3 contracts for new capacity, one of which has been completed and two of which VCE expects to execute by the end of September 2020. First, VCE has executed one PPA to procure 50 MW from the Aquamarine Solar facility, which started construction in July 2020. The expected COD of this project is in 2021, and VCE expects that the ELCC associated with this new solar resource will provide 7 MW of September RA by 2022 at the latest. Second, as a result of a 2020 joint RFP with RCEA, VCE is negotiating for a total of 9.5 MW of new capacity, comprised of 7 MW of new demand response capacity to come online at the latest by August 1, 2021, and 2.5 MW of 4-hour battery storage to come online by August 2022 at the latest. VCE expects to finalize PPAs with the developers of these resources by the end of September 2020.

As with all new-build resources, there is the potential for delay from numerous development related risks. VCE is managing the risks of its long-term contract by contracting with a relatively mature project that has an interconnection agreement in place, and by closely monitoring progress of the project with the developer. VCE plans to manage risk for additional solar capacity it intends to procure by working with experienced project developers.

VCE's ability to meet RPS requirements relies more on the certainty and timely development of its long-term renewable resources under development than it does on the variation of actual generation deliveries. Because of this, VCE chooses to focus more of its efforts around the potential impact of project development delays. VCE incorporates guaranteed COD clauses in its long-term PPAs. Guaranteed CODs have financial penalties associated with failure to achieve them, which make them more conservatively estimated commitments. For planning purposes, VCE uses guaranteed CODs as its assumptions when assessing its risk for RPS Procurement purposes.

With a focus on project development risk, VCE approaches its risk assessment by calculating its ability to meet RPS requirements under the worst-case scenario to understand when it must make decisions on alternative options to maintain compliance. For example, the project VCE has a long-term contract with has a COD date in 2021. VCE uses models incorporating RNS methodologies to calculate the longest delay in COD it could tolerate before violating the 65% long-term RPS contracting requirement (Pub. Util. Code § 399.13(b)). VCE's analysis suggests that the COD for all long-term projects could be delayed until close to the end of the Q2 2022 before VCE is at risk of not meeting its long-term requirement for Compliance Period 4 (2021-2024). To manage this risk, VCE is closely monitoring the development status of its long-term project under development. Depending on the type of delay that might be introduced, VCE plans on supplementing with additional short-term purchases from existing renewable resources and if necessary, long-term commitments as well.

Continuously managing performance and risk

While the resource plan is mainly focused on identifying supply to a given load, there are also significant risks and uncertainties associated with load, including impacts of COVID-19, load migration, net metering impacts and the growth of behind-the-meter devices such as solar PV, EV adoption and battery storage. To control supply risks, VCE's suppliers are obligated to provide regular reports on development progress and potential issues with their projects. Although VCE has not received official notice of anticipated disruption on its solar project under development, supply chain disruption from the pandemic remains a significant concern. VCE is closely monitoring the status and working with its developer to stay on top of any potential issues in order to react accordingly. VCE's objective is to contribute to California's renewables goals by building incremental resources onto the grid. Should there be force majeure-level impacts to projects under development, VCE may consider using the purchase of renewable energy from existing resources to supplement its power supply.

VCE is also continuously monitoring and tuning its power supply portfolio to ensure an optimal balance between short-term power purchases and longer-term contracts. With the preferred 46MMT Conforming Portfolio, VCE expects to rely on short-term power purchases for about 50% of its load. VCE believes this portfolio reflects a balanced approach of ensuring that all statutory requirements are met while at the same time balancing short-

and long-term contracts to remain flexible to react to changes in market conditions and to changes in load.

As part of its actions, VCE plans to closely monitor performance of its portfolio under contract, including risks of drought for its small-scale hydro projects and curtailment risks for solar resources. Over the course of the RPS compliance periods, the risk of underperformance is expected to be very small and VCE also has performance guarantees as part of its long-term contracts. Any RPS shortfalls over the compliance periods will be addressed with procurement of PCC1 RECs. Additional procurement activities and barriers are discussed further in the sections below.

Outreach and inputs from disadvantaged communities

VCE will continue outreach activities to all customers, including the limited areas within its service territory identified as DACs Customers in DACs, like all VCE customers, are able to participate in VCE Board and stakeholder meetings, which VCE publicizes on its website. During the resource solicitations and subsequent discussion in VCE's Community Advisory Committee (CAC) and Board meetings that are open to the public, VCE has not received any feedback on its proposed procurement activities from individuals who have identified themselves as members of DACs or organizations that are engaged in DACs.

Activities to minimize air pollutants with a priority on disadvantaged communities

Per the CalEnviroScreen tool and as discussed in Section III.d.ii, VCE estimates that less than 0.15% of its customers reside in DACs. VCE's balanced and renewables-focused portfolio will help reduce VCE's reliance on fossil fuels and could thus contribute to lower emissions also in the DACs in Yolo County. Over the 2020-2030 period, VCE will also reduce its overall reliance on CAISO market purchases, which will contribute to a cleaner power mix in general, although the impact of VCE's activities will likely have a negligible impact on the DACs in VCE's service territory. There are no fossil fuel plants located in DACs in VCE's service territory. VCE is also reducing its reliance on fossil-fuel plants located in DACs outside of its service territory by planning to procure a greater proportion of its RA requirements from renewable energy and energy storage resources in lieu of natural gas resources.

b. Procurement Activities

VCE plans to continue its efforts to contract for new resources through an open and transparent process, following the procurement policy that VCE has developed since the 2018 IRP filing. In the past two years, VCE has undertaken two RFOs from renewable energy providers, in Q3 of 2018 (long-term renewables RFO) and in Q2 of 2020 (local renewables RFO). VCE plans to continue soliciting resources through RFOs going forward. Also in 2020, VCE has also conducted joint solicitations with other CCAs, including one RFP for RA capacity with RCEA, and one RFI for long-duration storage with 12 other CCAs, as discussed above.

To date, VCE's 2018 RFO has resulted in 50 MW of new solar capacity that will come online before 2022 through one long-term PPA that was signed in the first half of 2020.

The following procurement activities are underway or planned to support the implementation of VCE's preferred 46MMT Conforming Portfolio. Procurement activities, including the timing of activities, are expected to be the same between the 46MMT Conforming Portfolio and the 38MMT Conforming Portfolio. However, if the 38MMT Conforming Portfolio was to become the main portfolio to be implemented, it would require more resources to be procured in future procurement events compared to the preferred 46MMT Conforming Portfolio.

Resource Adequacy RFP. In April of 2020, VCE and RCEA issued a joint RFP for up to 20 MW of incremental RA capacity targeted to come online by August 1, 2021. This is a very tight timeline in order to ensure that VCE can meet its resource procurement mandates for 2021 and beyond. As a result of this RFP, VCE is in the process of finalizing contracts covering 7 MW of new demand response capacity that will come online no later than August 1, 2021 and 2.5 MW of 4-hour battery storage capacity that will come online no later than August 1, 2022, and will bring these contracts for VCE Board approval at its September 2020 meeting. Together with the 50 MW Aquamarine Solar PPA that VCE completed in 2020, and the procurement of local capacity described below, these projects together will exceed VCE's 12.6 MW procurement mandate under D.19-11-016.

2020 RFO for local renewable energy. In April 2020 VCE issued an RFO for local renewable resources wherein VCE is seeking projects of up to 25 MW to come online by the end of 2023 at the latest. VCE is currently in the process of evaluating offers and expects to complete one or more PPAs for new local capacity by the end of 2020. These resources are reflected in both of VCE's Conforming Portfolios as new local solar capacity and energy storage being added in 2023.

Negotiate long-term solar PPA(s) for near term renewable energy expansion. VCE is negotiating for additional new solar capacity to replace a PPA that was cancelled in August 2020 due to lack of progress with permitting and failure of the developer to reach construction stage as required by the PPA. VCE expects to complete contract negotiation for replacement of this contract by the end of 2020. VCE is seeking this capacity on an expedited basis and is only considering projects that are under development, have executed interconnection agreements and are able to reach COD by mid-2022 at the latest. This is depicted in VCE's Conforming Portfolios as 75 MW of new solar coming online in 2022.

Long-duration storage RFI. Together with 12 other CCAs, VCE issued a RFI on long-duration storage in June of 2020. In the remainder of 2020, VCE plans to analyze the responses to this RFI. After 2020, VCE intends to monitor the long-duration storage market and related opportunities. VCE anticipates long-duration storage could be considered after 2025 if proven feasible and cost-effective. Currently, new long-duration storage resources are not reflected as selected resources in VCE's Conforming Portfolios during the next decade, as

explained in more detail above, but VCE plans to monitor developments in this area to identify any opportunities that would benefit its customers, renewable energy resource integration, and grid reliability goals. See Section 3.h. above for more details.

Procurement of renewable energy and energy storage in 2025 and beyond. Following the expected addition of new renewable local capacity in 2023 in response to VCE's 2020 RFO, new resources are not expected to be needed until 2026 or 2027. Given its size, VCE is not eager to take technology risks in its resource portfolio and will therefore seek new-build resources only from established and reliable renewable technologies such as wind, solar, and battery storage. In seeking such new capacity VCE does not foresee any VCE-specific barriers to securing new capacity other than the small scale of VCE's load which may necessitate collaboration with other LSEs in order to pursue some development efforts. VCE's joint RFO with RCEA for new RA capacity and our participation in a joint RFI for new long-duration storage are examples of how VCE plans to overcome barriers with respect to scale. However, as with all development of new resources, there is risk. This risk applies equally to all LSEs in California. VCE seeks to address development risks by its procurement practices, which prioritize financially secure and mature projects and counterparties.

Both of the Conforming Portfolios call for new wind resources to be added in 2026, as well as new solar and storage capacity before 2030 to help ensure VCE meets both its RPS and its GHG targets. In addition, over the 2025-2030 period, VCE expects to ramp up its use of storage to 43 MW by 2030 under the 46MMT Conforming Portfolio and to 63 MW under the 38MMT Conforming Portfolio. To facilitate this growth of the resource portfolios, VCE plans to conduct open resource solicitations or RFOs about every two years in in the 2022-2030 period. Table 10 below shows the tentative approximate timing of future RFOs and expected online dates for the resources sought.

Table 10. Tentative schedule for VCE resource solicitations for new resources in the 2020-2030 period

Approximate RFO Timing (Year)	Resources Sought	Expected online dates (Year)
2023	New Wind	2026
2025	New Battery Storage (or comparable clean RA capacity)	2027-2028
2025	Local Solar, including solar plus storage hybrids	2028-2030
2026	New wind from in-state and/or out-of-state locations	2028-2030
2028	New Battery Storage (or comparable clean RA capacity)	2030

If during these planned solicitations, VCE were to receive offers from existing renewable generators and/or different technologies than envisioned in this IRP, those would be considered alongside other offers and would need to go through the same validation and qualification process before being finalized in a PPA. It should be noted, however, that the exact timing of future resource solicitations is uncertain, especially considering the unprecedented situation facing VCE as well as California as a whole from the COVID-19 pandemic. It is possible that electric demand will decline significantly in the recession, which in turn could cause VCE to delay its procurement of new resources to match the pace of electric demand growth over the 2020-2030 period.

Procurement of large-scale hydro resources. In addition to procuring renewable resources as shown in Table 3, VCE also expects to need 20-35 MW of carbon-free large-scale hydro resources in the portfolios in order to meet VCE's 2030 GHG emission benchmarks. In keeping with VCE's current practices, these resources are expected to be secured on a bilateral basis under contracts with an expected duration of 2-5 years. Depending on the availability of and cost of other technologies, VCE may pursue longer hydro contracts or may switch to other technologies while still adhering to the GHG limitations set by the Commission and VCE's Board.

Program Administration. As discussed in Section III.d.ii of this report, VCE has initiated program activities focused on EE and a TEP. In the future, load management programs such as demand response and managed charging of EVs could potentially become cost-competitive ways of ensuring that VCE's capacity needs are met. VCE will continue to explore programs that can be offered in parallel with PG&E's customer programs.

c. Potential Barriers

VCE does not anticipate encountering specific barriers associated with either of its Conforming Portfolios. In fact, one of the reasons for the resource choices and timing in the Conforming Portfolios is the feasibility and maturity of the technologies selected and how they fit with VCE's overall resource portfolio preferences.

While the Conforming Portfolios have no specific barriers, there could be significant barriers associated with two considerations that the Commission has requested LSEs to address: (1) long-duration storage and (2) replacement of Diablo Canyon, both of which suggest the need for long-term RA. VCE may face barriers in procuring long-duration storage due to costs and scale. The traditional long-duration storage technology, pumped storage hydro, is expected to both be of much larger scale than VCE needs, take a long time to develop, and have significantly higher costs than shorter duration storage technologies. If VCE were to pursue this type of long-duration storage it would incur significant development risk and financial commitments that could adversely affect rates. VCE would also likely need to develop such capacity in collaboration with other LSEs, which could further aggravate development risks since the success of the project will also depend on the success of the coalition of partners developing the project.

Similarly, VCE may also face barriers in its efforts to find a replacement for Diablo Canyon capacity because VCE is a small LSE and will likely need to procure capacity jointly with other California LSEs. VCE believes it has addressed the risks and barriers associated with Diablo Canyon's replacement by planning to incrementally procure RA in battery-storage and renewables that could also be configured to provide long duration RA and support integration of renewable energy.

There are also other barriers that add risk to VCE's long-term resource plan such as the permitting process for new plants. As an example, VCE in August of 2020 VCE was forced to terminate one of its PPAs for new capacity since the project's developer was not able to

obtain all necessary permits in time to commence construction. These risks are common to all LSEs in California and streamlining the development and permitting process from a regulatory perspective could help facilitate a more efficient and reliable process for long term power supply.

d. Commission Direction or Actions

VCE does not seek any direction or action from the Commission at the moment other than to certify its IRP pursuant to statute.

e. Diablo Canyon Power Plant Replacement

Based on the Commission's Resource Data Template spreadsheet, VCE's share of Diablo Canyon is 11.3 MW (0.49% load share of 2,300 MW Diablo Canyon capacity). Over the course of the 2020-2030 period, VCE's Conforming Portfolios include new capacity that cover the procurement mandate under D.19-11-016, the Diablo Canyon resource replacement, the RPS requirements, and the 2030 GHG goals. In terms of new generation capacity, Table 5 as well as Tables 8 and 9 show that VCE plans to add 25 MW of local solar capacity in 2023, likely combined with 10 MW of battery capacity, and 20 MW of wind capacity in 2026 or 2027. Over the forecast period, VCE expects to add a total 43 MW of battery storage in the 46MMT Conforming Portfolio and a total of 63 MW of battery storage in the 38MMT Conforming Portfolio. The combined effect of new local solar capacity, energy storage and wind capacity will provide new capacity in California that exceeds VCE's share of reliability resources to replace Diablo Canyon, even after accounting for other energy storage and demand response aggregation procurement driven by D.19-11-016.

The resource combinations shown in VCE's conforming portfolios that combine battery storage with renewable energy sources will help provide substitutes for Diablo Canyon that support reliability and also do not increase GHG emissions. As noted in other parts of the IRP, while VCE does not expect to add new baseload renewable energy technologies, mainly due to cost and resource availability, it remains open to procuring such capacity if it is offered at competitive prices. It should also be noted that the 43 MW of incremental 4-hour storage planned for the 46MMT Conforming Portfolio and the 63 MW planned for the 38MMT Conforming Portfolio could also be considered as 23 MW and 31 MW, respectively, of long-duration 8-hour storage, thus meeting all requirements for both Diablo Canyon consideration and long-duration storage.

If the RA market gets tight, RA prices should increase significantly in the 2020-2025 period, which could trigger VCE to accelerate its procurement to ensure sufficient capacity comes online even prior to Diablo Canyon's retirement. We also note that there is no shortage of potential storage projects under development that could at least partially replace the RA from Diablo Canyon. According to the Commission's Resource Data Template spreadsheet, there is about 2,300 MW of battery storage in CAISO's interconnection pipeline with executed interconnection agreements, and another 1,200 MW of battery capacity under development with interconnection agreements in progress. This suggests that there are sufficient candidate resources that could be procured and finalized on relatively short

notice to replace Diablo Canyon in case load grows quickly and capacity market prices increase. However, considering the COVID-19 pandemic in 2020 and its longer term effects on California load growth, VCE expects that load is more likely to be slower than expected and that new capacity may not be needed until the after the timelines shown in VCE's Conforming Portfolios.

V. Lessons Learned

There is a significant opportunity to consolidate reporting, data and databases between the IRP and RPS Procurement Plan processes. Both of these require detailed reporting and plans to cover resource procurement to 2030. While the scope is slightly different, the RPS procurement plan can be nearly completely covered by the plans detailed in the IRP, especially for LSEs like VCE that expect to rely only on contracted renewables, storage, large scale hydro, and market purchases for its future resource supply. VCE therefore encourages the Commission to continue looking for opportunities to consolidate data and reporting from these programs. VCE also expects that there could be significant opportunities to coordinate data and databases between the IRP and the RA processes. By having more complete, coordinated and cross-cutting resource databases for the processes under IRP, RA and RPS, the efforts for both LSEs and the Commission could be reduced in terms of preparing and reviewing compliance filings. This would help reduce inadvertent errors and inconsistencies between the various reports on resource plans, energy supply, capacity and renewables associated with the timing of reporting requirements and minor differences in questions and templates

VI. Note on supplemental file submissions

Together with this IRP report, VCE also provides spreadsheets with its detailed resource plans for the 38MMT Conforming Portfolio and the 46MMT Conforming Portfolio. These plans are contained in the Resource Data Template files provided by Commission staff and were completed in accordance with available instructions. To help facilitate the understanding of these files VCE notes the following:

- The portfolios show only resources that VCE has contracted for and resources VCE expects to enter into contracts for in the 2020-2030 period. These expected resource additions do not cover the full energy needs for VCE in the 2020-2030 period. In addition to the resources shown in the submitted spreadsheets, VCE also expects to rely on spot market purchases of energy.

- For RA, the resource portfolios reflect the RA expected in the resource portfolios over the forecast period, as well as the RA capacity VCE already has covered in short-term contracts over the next 1-3 years. In order to provide a balanced RA view in Tables 8 and 9 above, and to provide the Commission with an estimate of how much RA VCE expects to buy in short-term capacity markets, the resource data templates include a place-holder for RA purchases that reflect the estimated monthly RA needs in the 2020-2030 period.

VCE also submits the Clean System Power Calculator template for each of the resource portfolios to demonstrate compliance with GHG benchmarks and the expected pollutant emissions for each portfolio.

Glossary of Terms

Alternative Portfolio: *LSEs are permitted to submit "Alternative Portfolios" developed from scenarios using different assumptions from those used in the Reference System Portfolio. 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.*

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, formerly "Clean Net Short") methodology*: the methodology used to estimate GHG 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*: 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*: 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.*

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.*

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.*

Net Qualifying Capacity: *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.*

Reference System Portfolio: *the Commission's integrated resource plan that includes an optimal portfolio (Reference System Portfolio) of resources for serving load in the CAISO balancing authority area and meeting multiple state goals, including meeting GHG reduction and reliability targets at least cost.*

Reference System Portfolio*: the multi-LSE portfolio identified by staff for Commission review and adopted/modified by the Commission as most responsive to statutory requirements per Pub. Util. Code 454.51; part of the Reference System Portfolio.*

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).*