VALLEY CLEAN ENERGY ALLIANCE

Staff Report – Agenda Item 12

TO:	Valley Clean Energy Alliance Board of Directors
FROM:	Mitch Sears, Interim General Manager Olof Bystrom, Sacramento Municipal Utility District (SMUD) Gary Lawson, SMUD
SUBJECT:	Integrated Resource Plan (IRP) and 1-3 Year Action Plan
DATE:	June 6, 2018

RECOMMENDATION

Review draft results of VCE Integrated Resource Plan (IRP) model runs and review 1-3 Year Action Plan.

BACKGROUND

VCE is required by the California Public Utilities Commission (CPUC) to prepare an IRP for the supply of energy in the period from 2018 to 2030. The objective of the IRP is to provide guidance for VCEA's Board, executive management, and the public regarding the relative power supply cost impact of various long-term resource options for meeting electric demand in the 2018-2030 period and to ensure that these options are strategically aligned with VCEA's short and long-term vision. SMUD completed draft model runs and presented the run results in and proposed recommendations on which scenario to identify as the "Preferred Plan" for the CPUC filing. These were reviewed with the Community Advisory Committee at its May 30, 2018 meeting.

The 1 to 3 year Action Plan outlines the actions VCE plans to take to achieve the goals and objectives set out in the IRP. The Action Plan can but is not required to include additional actions contemplated by VCE to achieve its short and long-term vision. The activities documented in the attached Action Plan reflect discussion at the April 26 CAC IRP Workshop. The attached action plan list was presented to the Community Advisory Committee and at its May 30, 2018 meeting.

Between now and July, staff will be finalizing the IRP report, as well as the Action Plan, and the CAC will be providing comments on the plan report and will be discussing prioritization and finalization of the Action Plan. The final draft IRP 1-3 year Action Plan will be reviewed by the CAC at its meeting in July for incorporation into the IRP. The final draft IRP, inclusive of the 1-3 year Action Plan will be presented to the VCE Board of Directors for action at the July Board meeting. With the Board's approval of the final draft, VCE will adopt and submit the IRP to the CPUC by August 1.

In addition to prioritizing the 1-3 year Action Plan, Committee members provided a list of strategic initiatives for long term consideration by VCE. The Strategic Initiative list will be discussed during the CAC update.

Attachments

A. Draft IRP
B. Draft 1-3 Year Action Plan

Attachment A

ATTACHMENT A

Standard LSE Plan

Valley Clean Energy Alliance

2018 INTEGRATED RESOURCE PLAN Draft, June 1, 2018

Contents

Executive Summary

Valley Clean Energy Alliance (VCEA) is a joint-powers authority working to implement a state-authorized Community Choice Energy (CCE) program. Participating VCEA governments include the City of Davis, the City of Woodland and County of Yolo. The purpose of VCEA 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. PG&E would continue to deliver the electricity procured by VCEA and perform billing, metering, and other electric distribution utility functions and services. Customers within the participating jurisdictions would have the choice not to participate in the VCEA program. VCEA's vision as an organization and as adopted by its Board in 2017 is shown in Figure 1.

INSERT SUMMARY OF RESULTS AND RECOMMENDATIONS, INCLUDING SUMMARY OF METHODOLOGY, PREFERRED PORTFOLIO AND ACTION PLAN

Figure 1. VCEA Vision

The near-term vision for VCEA 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 VCEA energy programs and mitigation of future energy costs and risks.

The long -term vision for VCEA is to continuously improve the electricity choices available to VCEA 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; and
- Saving money for ratepayers on their energy bills.
- Remaining open to the participation of additional jurisdictions.

Study Design

The study was designed to inform VCEA, its Board, management, and community on the relative energy supply cost differences between different portfolios that would meet the minimum required to achieve compliance with RPS requirements and the 2030 GHG target established by the Commission for VCEA. Four portfolios were modeled: 1. A conforming portfolio that meets the minimum renewable content and GHG emissions requirement at least cost ("Base"); 2. An alternative scenario to emphasize exceeding the CPUC GHG targets in 2030 through greater renewable resource acquisition than the minimum required by RPS at the lowest cost ("Cleaner Base"); 3. An alternative scenario to emphasize exceeding the CPUC GHG targets in 2030 through greater renewable resource acquisition than the minimum required by RPS by placing more emphasis on procurement of local renewable resources ("Clean Local"); and 4. A scenario that uses VCEA's current load forecast and load shape instead of the 2017 IEPR load forecast of the other scenarios. Except for using a higher load, this portfolio is otherwise very similar to the Cleaner Base Scenario ("Cleaner VCEA").

The IRP study period required by the Commission covers 2018 through 2030. VCEA began operations in June of 2018 and therefore 2018 is modeled for the June 1 – December 31 period. As discussed below, VCEA's approach is based on utilizing current market data for the front years of the IRP study period (2108-2021), and using available data and assumptions from CPUC to the extent possible as a basis for resource planning choices in the 2022-2030 period.

Our modeling approach is based on considering VCEA as a "price taker" in the CAISO market wherein it is assumed that VCEA, 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 prices, as represented by the RESOLVE model results for the 42 MMT case, wherein CO2 allowance prices are implicitly reflected in the CAISO price.

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

a. Objectives

The objective of the IRP is to provide guidance for VCEA's Board, executive management, and the public regarding the relative power supply cost impact of various long term resource options for meeting electric demand in the 2018-2030 period and to ensure that these options are strategically aligned with VCEA's short and long term vision (see Figure 1).

The resource portfolios identified in this IRP showcase tradeoffs in terms of costs and greenhouse gas emissions between different resource options and levels of ambition in terms of the amount of renewable and non-GHG emitting energy used by VCEA to meet its load obligations. Four portfolio scenarios are considered to reflect resource choice alternatives as well as potential outcomes in terms of load – including the use of CEC's updated 2017 IEPR load forecast for the mid AAEE and mid AAPV cases. The cases and resource portfolio choices are discussed in the assumptions section below.

b. Methodology

Based on CEC's IEPR forecasts, annual electric consumption for VCEA in the 2018-2030 period represents less than half a percent of the statewide electric consumption (0.28%). It is therefore expected that VCEA 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, VCEA is a price taker. Under this expectation, VCEA can therefore transact energy, capacity, resource adequacy and enter into short or long term contracts without impacting the overall market prices for these items. This philosophy is reflected in our methodology. In a further effort to make the IRP consistent with CPUC's requirements and assumptions for California as a whole, our methodology for quantifying the costs and greenhouse gas impacts of portfolio alternatives rely exclusively on publicly available data provided by the CPUC to support this IRP process. The only exception is the use of VCEA's own hourly load shape (since none was made available by the CEC) as well as a load-forecast that is used in one of the scenarios that is developed by VCEA and that is used for near term and longer term planning and that reflects a lower level of energy efficiency and behind-the-meter PV compared to the 2017 IEPR forecast.

Four load and resource portfolios are considered in this IRP:

1. Base Compliance Portfolio (aka conforming portfolio)
2. Cleaner Base Portfolio (aka Preferred Portfolio)
3. Clean and Local Portfolio (to reflect more ambitious local resource choices)
4. VCEA Load Portfolio (reflecting the impact of the Preferred Portfolio with a different load)

The detailed assumptions for each portfolio as well as the individual resource components of each portfolio are shown in the Modeling Approach Section below.

i. Modeling Tool(s)

VCEA's resource plan is based on a simplified production cost modeling approach that utilizes publicly available data from the various tools provided by the CPUC. With this data, VCEA developed a spreadsheet model that captures the expected costs of providing electricity to VCEA's customers in the 2018-2030 period under different resource portfolio alternatives. Thus, no formal commercially available production cost model is used, but the analysis is consistent with the data and assumptions of the RESOLVE model, the GHG calculator, and the RPS calculator.

The RESOLVE model provides a simplified representation of the entire 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. In contrast, the spreadsheet model utilized by VCEA assumes that prices and resources are given and treats VCEA as a price taker in the CAISO market, in which VCEA's objective is to minimize costs for meeting its resource needs at given prices for capacity, energy, and new resources. However, the input assumptions used for this model are almost exclusively drawn from the RESOLVE model results and input assumptions. We believe this approach provides a view of VCEA's resource costs and portfolio options in the 2018-2030 period that is consistent with the RESOLVE model.

The main difference between the RESOLVE model and the simplified production cost model used by VCEA in this IRP is the hourly load profile used: Both RESOLVE and the GHG Calculator use a generic hourly load forecast that is not tuned to VCEA's actual expected hourly load shape. As discussed below, we instead rely on a bottom-up forecast for VCEA that is based on an aggregation of meter data in Yolo County which contributes to a more accurate load shape in our modeling. Care should therefore be taken when aggregating the Conforming portfolio in this report into the aggregate model that CPUC has a vision to complete. In addition, VCEA's load forecast and load shape are based on a forecast for all 8760 hours of a normal year. Therefore, in order to be able to use the hourly RESOLVE marginal costs for CAISO power, these were re-calculated to an 8760 price series, whereby the RESOLVE prices were first compacted into a monthly 24h hourly power price and subsequently extrapolated to create an 8760 price series. As an example, this means that with this approach, there are only 24 hourly prices in each month – every first hour of each day has the same price, and so on. While simplified, this approach provides a view of marginal electricity costs in the CAISO market that is consistent with the RESOLVE model results and also captures the impact of carbon prices on the CAISO market price for electricity.

ii. Modeling Approach

The IRP covers the period 2018-2030. However, not every year is modeled. For the first 3.5 years of the forecast, June 1, 2018 through December 31, 2021, our outlook is based on market forecasts and expectations of market prices rather than a production cost model. We feel that this provides a more realistic approach to near term resource costs. We also expect that in the 2018-2021 period, the majority of resources used to meet VCEA's load will be based on short term contracts and market purchases that will cover VCEA's need for energy, capacity and RPS-eligible renewable energy (and/or RECs).

For the period 2022-2030, VCEA relies on the materials available from the CPUC as described under Modeling Tools above as well as in the assumptions section of this chapter. As a result, only the years 2022, 2026 and 2030 are analyzed into hourly detail and only for these years are the detailed portfolio choices considered.

Resource Portfolio Alternatives Considered

VCEA considered four alternative resource portfolios to obtain a range of potential outcomes that will help guide future procurement and illustrate trade-offs in terms of costs and the amount of energy bought in the CAISO market. All four resource portfolios are designed to comply with California's 2030 RPS goals as well as with the CPUC GHG emissions benchmark of 129,000 tons by 2030.

The four scenarios considered were constructed around shifting three policy parameters that are important to VCEA: The overall carbon footprint of the portfolio, the amount of RPS-eligible renewable energy, and the resource mix, including the amount of energy that is sourced from locally available renewable energy sources. Note that since VCEA currently does not have any resources under ownership or long term contracts, the IRP portfolio alternatives are purely for illustration of options and potential trade-offs. One of the portfolios, VCEA Cleaner Base, uses VCEA's load forecast rather than the IEPR to illustrate the potential range of capacity that must be procured to meet energy and capacity needs.

As discussed in the Action Plan section of this report, we expect that the actual resource trade-offs and costs will be discovered only following more detailed studies and evaluation of actual offers for long term supply. Table 1 below provides an overview of the Resource Portfolios.

Table 1 Resource Portfolios

Portfolio	Portfolio Aspect	2018	2022	2026	2030
Base	Load Forecast	IEPR			
	Resource Mix	Least cost California resources. Local renewables if cost effective.			
	RPS	42%	42%	45%	50%
	Carbon Free	75%	75%	75%	75%
Cleaner Base	Load Forecast	IEPR			
	Resource Mix	Least cost California resources.			
	RPS	42%	60%	70%	80%
	Carbon Free	75%	100%	100%	100%
Cleaner VCEA	Load Forecast	VCEA (Higher than IEPR due to omission of AAEE and AAPV)			
	Resource Mix	Least cost California resources.			
	RPS	42%	60%	70%	80%
	Carbon Free	75%	100%	100%	100%
Clean Local	Load Forecast	IEPR			
	Resource Mix	Expand local wind, biomass, geothermal and solar from 2022.			
	RPS	42%	60%	70%	80%
	Carbon Free	75%	100%	100%	100%

VCEA plans to secure RPS resources from RPS-eligible California resources as well as through PCC1 RECs. Carbon free resources are expected to be purchases under long or short term contracts that do not qualify for RECs but are otherwise carbon free, such as large scale hydro resources from California or the Pacific Northwest. The resource mix under each of these portfolios is shown in separate Excel files that are submitted together with this IRP. It should be noted, that for near term supply, VCEA will rely on available generic non-resource-specific power in the CAISO market for energy and capacity and on RECs to meet RPS requirements.

Modeling Approach Details

For the 2018-2021 period, VCEA models costs and resource portfolio impacts for each year based on expected market conditions, as described by currently available price in bilateral markets for energy and capacity as well as electric power futures from the Intercontinental Exchange (ICE) for NP15. Electric demand is based on CEC's 2017 IEPR Baseline Electric Mid Demand Mid AAEE and AAPV forecast, as published in April 2018[1]. Since CEC does not publish hourly demand profiles for VCEA, we elected to use an hourly demand forecast based on VCEA's own hourly load forecast to convert and shape the electric demand in the IEPR to an hourly forecast.

For the 2022-2030 period, VCEA relies on data from the GHG calculator and the RESOLVE model's updated results for the 42MMT case, as made available by the CPUC in April 2018[2]. The main RESOLVE model results and assumptions used include: hourly CAISO market price forecast, levelized costs of new entry of renewable energy capacity and lithium ion batteries, resource potential for new capacity in California.

The spreadsheet model was developed based on existing tools and data from the CPUC and uses renewable energy profiles and the IRP portfolio selection to calculate the "clean net short" for each hour of the forecast period. The gap between renewable energy generation in each hour is then expected to be filled with CAISO energy purchases at prices made available through RESOLVE. To calculate the clean net short for VCEA, we use the renewable energy profiles from CPUC's GHG Calculator version 1.3[3]

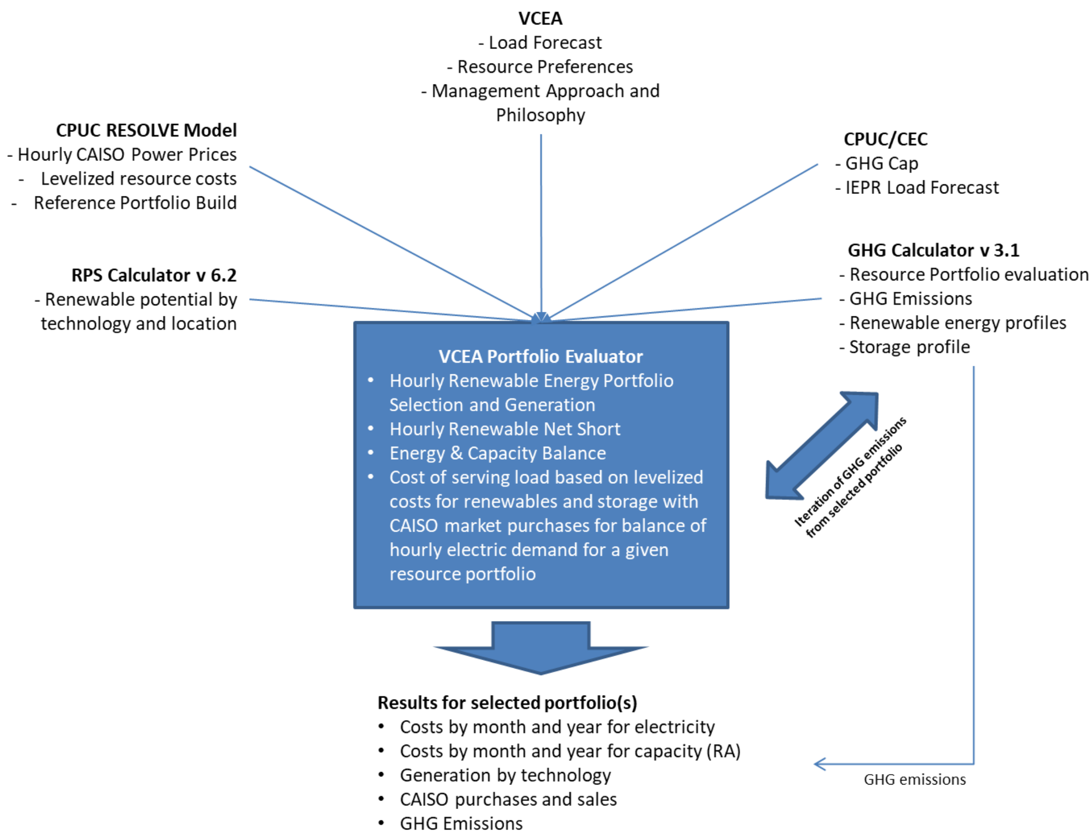
Figure 2 below provides an overview of the modeling methodology used in this IRP.

[1] https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=17-IEPR-03

[2] http://cpuc.ca.gov/General.aspx?id=6442457210

[3] While largely the same as the RESOLVE renewable energy profiles, the GHG calculator provides for full 8760h per year renewable energy profiles that are more useful for VCEA's mode.

Figure 2. Modeling Methodology



iii. Assumptions

Load

VCEA uses two load forecasts to assess a total of four resource portfolios in this IRP: The first is the "mid Baseline mid AAEE mid AAPV" version of Form 1.1c of the CEC's adopted 2017 IEPR forecast, that was published in February of 2018 (henceforth IEPR forecast). This is the main forecast used in this IRP. The annual energy demand in this forecast is shown in Table 2, below. No modification was made to this forecast other than adding an hourly load shape (not available from CEC).

Due to the fact that the IEPR forecast published in February by the CEC does not include any hourly forecast of electric demand for VCEA, we used an hourly load shape based on VCEA's own forecast of hourly demand that is based on historical meter data for the VCEA service territory (described below and in Appendix 1) to estimate the annual peak load for VCEA for the IEPR forecast. The estimated annual peak load using this approach is also shown in Table 2. We estimate that using VCEA's forecasted load shape will lead to a slightly lower load factor (peakier load) compared to using the hourly load shape for PG&E as a whole, considering that VCEA's load is not moderated by coastal weather to the same extent as PG&E.

The second load forecast is used as an alternative to illustrate the impact of a more limited expansion of energy efficiency and behind-the-meter solar PV, and is used by VCEA in its short term load forecasts and resource procurement (henceforth VCEA forecast). This forecast is also what VCEA filed with the CEC as part of the IEPR process. It represents a detailed bottom-up view of expected hourly generation that utilizes hourly metering data for all VCEA-eligible customers that were rolled up into an aggregate hourly forecast. A detailed overview of VCEA's load forecast methodology is available in Appendix 1 to this report. One key difference between the IEPR forecast and the VCEA forecast is that the unlike the IEPR forecast used in this IRP, the VCEA forecast does not include any incremental energy efficiency, behind-the-meter solar resources or other demand changing measures beyond what is already reflected in the historical statistical trends used as a basis for the forecast. The expected annual energy and peak demand with the VCEA forecast is shown in Table 2.

Table 2. Updated IEPR forecast and VCEA load forecast. (Annual Energy and Peak Demand) under the updated 2017 IEPR forecast Mid AAEE, Mid AAPV case

	2018	2019	2020	2021	2022	2026	2030
2017 IEPR forecast Mid AAEE, Mid AAPV case	456	762	756	753	752	738	726
Expected annual peak load in IEPR forecast (MW)	217	231	229	228	228	224	220
VCEA load forecast (GWh)	504	793	797	798	801	813	826
VCEA annual peak load (MW)	236	238	239	240	241	244	248

Expected Power Market Prices and Resource Costs

2018-2021

In the early part of the IRP planning horizon, covering the 2018-2020 period, VCEA expects to rely mainly on short-term contracted resources to meet resource needs. By 2021, VCEA will need to have in place long term renewable supply contracts of terms at least 10 years in duration for at least 65% of its minimum RPS obligations. Those long term contracts are expected to begin phasing in during 2020. For the short term resource supply, VCEA expects to procure them at current market prices and that these market prices will remain relatively stable in the 2018-2021 period. For this period, our estimates of costs for generation are therefore based on current market conditions for electricity and RA.

For the 2020-2021 period, we use the ICE power forwards for NP15 as a guidance to expected spot market prices. We also expect RA costs to remain stable. The latter assumption is supported by forecasts by CAISO and NERC that suggest that California reserve margins will remain above California's 15% planning reserve margin until at least 2024 when the Diablo Canyon nuclear facility retires. Table 3, below shows the expected electricity prices, resource adequacy and REC prices for the 2018-2021 period.

Table 3. Power, RA, REC and Carbon Free Prices 2018-2021

	2018	2019	2020	2021
Wholesale electric power prices ($/MWh)	29.5	29.5	31.9	35.0
Resource Adequacy ($kW-yr)	44.3	44.3	44.3	65.4
PCC1 RECs ($/MWh)	16.0	16.0	16.0	16.0

Carbon Free Price Premium ($/MWh)	2.3	4.0	4.0	4.0

For modeling purposes VCEA does not expect that the long term renewable supply contracts put in place to meet the 2021 requirement that will start delivery of substantial quantities of energy enter into any ownership or long term PPAs that will have a material impact on power supply in the 2018-2020 period.

2022-2030

From 2022 onwards, the IRP relies on results and assumptions from the RESOLVE model as an approximation of expected market conditions, including CAISO power prices, value of additional capacity to meet planning reserve margins and local capacity margins, and the cost of new entry for new capacity with which VCEA is assumed to be able to contract. Table 3 summarizes the annual expected values for power, RA, RECs, and the estimated price Premium for Carbon Free key energy.

For new or existing renewable energy capacity that VCEA will enter into contracts for in the 2018-2030 period, VCEA relies on the RESOLVE model's cost of new capacity entry. As part of the Action Plan described in Section 4 of this report, VCEA expects to conduct a solicitation for new resource in 2018 and in 2019. As part of that process, it is anticipated that more detailed insights will be gained regarding near term costs for new capacity that will eventually replace the RESOLVE model assumptions used in this report. Note that VCEA only performs a detailed assessment of resource needs and resource portfolios for the years that were covered in the RESOLVE model, namely 2022, 2026 and 2030.

Table 4. Power, RA, REC and Carbon Free Prices 2022-2030

	2022	2026	2030
Wholesale electric power prices ($/MWh)	36.8	47.9	99.1
Resource Adequacy ($kW-yr)	83.6	116.4	110.2
PCC1 RECs ($)	16.0	16.0	16.0
Carbon Free Price Premium ($/MWh)	4.0	4.0	4.0

VCEA Market Modeling Assumptions

There are several assumptions that may influence the results of the IRP as shown in this study. For example, per the instructions offered in the guidelines to this IRP template provided by the CPUC as attachment A to R.16-02-007 COM/LR1/lil/jt2, load serving entities (LSEs) are directed to "*.. assume that other LSEs procure in a manner consistent with the Reference System Plan*" . VCEA is a small LSE that represent only 0.28% of the anticipated CAISO electricity consumption in the 2018-2030 period. It is therefore assumed that VCEA's resource decisions will not impact market prices for power, capacity, or new renewable energy resource costs during the 2018-2030 period. Thus, if other LSE perform in accordance with the Reference System Plan, then VCEA will be able to buy and sell power at the prices modeled in RESOLVE (as a price taker) and will be able to enter into long term contracts at the levelized cost levels shown in the RESOLVE model's results for the Reference System plan.

The RESOLVE model Reference System Plan suggests that planning reserve margins in California will exceed 15% for the entire 2022-2030 period. As a result we can expect that sufficient capacity is available for procurement of resource adequacy as well as energy in the 2022-2030 period from the market.

VCEA's resource plan assumes that its resource portfolio will include only RPS-eligible renewable energy resources, and that the balance of its electricity and resource adequacy supply will be procured in CAISO electricity markets. Consistent with VCEA's long term vision of increasingly procuring local resources and contributing to the development of new capacity, VCEA expects its portfolio of resources to be located primarily in northern California. It is also assumed that any additional capacity needed to meet electric demand in any hour during the 2022-2030 period can be met with RA and energy resources that are available in the CAISO market. Thus, all resource portfolios envision contracting for less than 100 percent of VCEA's total anticipated energy and capacity need.

Planning Reserve Margins, Local RA, and Flexible Resource needs

All resource portfolios in this IRP are based on contracting and procuring energy and capacity to meet the annual energy demand as well as the expected monthly capacity need, including a 15% planning reserve margin to meet resource adequacy needs. It is also assumed that in procuring capacity to meet a 15% reserve margin, the procured capacity will be able to also meet local and flexible ramping needs. As a result, no additional capacity is envisioned to meet this need. This is consistent with the modeling results of RESOLVE for the Reference System Plan, which suggests that sufficient capacity will be available in CAISO and in the North Bay area without additional procurement (by VCEA or other LSEs) of additional new thermal capacity.

Inflation

Unless otherwise indicated, all cost impacts shown in this IRP are in constant 2016 dollars. For the purpose of estimating nominal costs or for converting nominal dollars to real, the IEPR deflator posted on CPUC's IRP website was used[4].

Greenhouse Gas Planning Price and Emissions Benchmark

The greenhouse gas planning price is not explicitly used in this IRP since all of the resources identified by VCEA are renewable resources not emitting any greenhouse gas. Instead, we utilize as an estimate of future prices, RESOLVE's hourly CAISO prices for the Reference System Plan, in which the Greenhouse gas planning price should be reflected implicitly and therefore does not need to be considered separately.

This IRP includes three conforming resource plan options, of which VCEA's Board has adopted the Cleaner Base Portfolio as its Preferred Portfolio. All of the resource portfolios show that the expected greenhouse gas emissions are lower than the Greenhouse Gas Emissions Benchmark for VCEA of 129,000 metric tons by 2030. This is a result of focusing mainly on renewable energy and storage as well as the stated policy of VCEA to be at least 75% carbon free – a goal that is expected to be achieved by a cost-effective combination of contracted renewable energy resources, RECs, and procurement of energy from carbon free resources that are not eligible for the RPS such as existing large scale hydro facilities. Enclosed with this IRP, VCEA also submits the GHG calculator tool showing the estimated 2030 emissions from its 2030 Preferred Portfolio.

Pursuant to the April 3 ruling by the CPUC regarding GHG Benchmarks, VCEA calculated its estimated greenhouse gas emissions for 2030 using the Clean Net Short method by utilizing version 1.3 of the GHG Calculator tool.

[4] http://cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/IEPR_dollar_deflator_series_2018-04.xlsx

3. Study Results

This section shows study results for the four different IRP portfolios that were considered by VCEA. Detailed portfolio selection results are shown in Excel spreadsheets that were filed together with this IRP. However, we emphasize the tentative and hypothetical nature of this IRP. Due to the fact that VCEA just started its operations in June of 2018 and the fact that VCEA has not yet entered into long term contracts for new or existing resources, the identified resource portfolios should be seen as tentative and expressing a broad direction rather than a precise result. VCEA expects that its resource and contracts portfolio will evolve significantly in the 2018-2021 period.

a. Portfolio Results

Four resource portfolios were considered by VCEA in this IRP in order to obtain directional insights on future resource investment alternatives that are aligned with VCEA's long term vision for how to serve its customers in the future. Since VCEA does not yet have any resources under contracts spanning beyond 2019, the results shown in this section as well as in the attached spreadsheets that provide details on the portfolio selection, are necessarily approximations that should be viewed as options and guidance on general direction rather than providing specific detailed procurement targets. VCEA expects that in the next 1-3 years, as it conducts additional studies and gains operational experience, it will develop more detailed procurement plans for short and long term contracting of resources. These planned activities are described in Section 4 of this report.

Table 5 below shows a summary of resource portfolio results for each of the four portfolios considered. Except for the portfolio entitled Cleaner VCEA, all resource portfolios shown in Table 5 could be considered Conforming Portfolios, i.e. they meet all CPUC and regulatory requirements. VCEA's Board utilized these alternative portfolios in its consideration of future resource policy. The portfolio entitled Cleaner Base was selected as VCEA's Preferred Portfolio and Section 3b provides a detailed overview of this portfolio and how it complies with regulatory and statutory requirements. The detailed resource choices for each portfolio are also shown in the following Excel files that were submitted together with this IRP:

- LIST OF XLS FILES FOR NEW AND EXISTING RESOURCES – TWO FILES FOR EACH PORTFOLIO IN CPUC FORMAT

Table 5. Portfolio results summary (MW Nameplate Capacity)

	Base				CleanerBase				CleanLocal				Cleaner VCEA			
	2018	**2022**	**2026**	**2030**	**2018**	**2022**	**2026**	**2030**	**2018**	**2022**	**2026**	**2030**	**2018**	**2022**	**2026**	**2030**
Wind	0	49	33	46	0	51	55	5	0	31	20	30	0	51	55	50
BTM Solar	0	39	52	65	0	39	52	65	0	39	52	65	0	0	0	0
Solar	0	69	91.5	91.5	0	120	140	173	0	85	89	104.5	0	121	150	190.5
Local Solar	0	0	0	0	0	0	0	0	0	36.5	36.5	36.5	0	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0	6	6	6	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0	0
4 hour Li-Ion Battery Storage	0	0	3	20	0	3	7	20	0	3	7	20	0	3	7	20
Percent RPS Delivered	42	42	45	50	42	60	70	80	42	60	70	80	42	60	70	80
Percent Carbon Free	75	75	75	75	75	100	100	100	75	100	100	100	75	100	100	100

b. Preferred Portfolio

VCEA's Board of Directors at its meeting on July [TBD], 2018, approved this resource plan, including the Cleaner Base Portfolio which was selected by the Board as its Preferred Portfolio. This portfolio represents an ambitious combination of renewable and carbon free energy that will allow VCEA to reach an 80% RPS level by 2030 and to become carbon neutral by 2022 through a combination contracted renewable energy resources REC purchases and procurement of energy from carbon free resources such as large scale hydro. A summary of the resource choices in this portfolio is shown in Table 5, above. The resulting generation from the Preferred portfolio as well as the estimated annual electric demand is summarized in Table 6, below. Portfolio details for the Preferred Portfolio are also shown in the Excel files TBD and TBD.

Table 6. Summary of annual electric demand and generation by resource group for the Preferred Portfolio Cleaner Base (MWh).

	2018	2022	2026	2030
Wholesale Energy Demand	488,226	804,926	789,678	776,575
ST Contracted Energy	351,040			
CAISO Energy	(10,154)	54,597	57,954	73,786
Carbon Free Energy[5]	147,340	296,472	221,312	142,081
Wind	-	141,461	153,647	139,579
Solar	-	314,176	363,075	444,342
Storage	-	(1,780)	(6,309)	(23,213)
RPS Delivered (% of Retail load)	42	60	70	80
Percent Carbon Free Supply (of Retail Load)	75	100	100	100
Estimated Portfolio GHG Emissions (MT 000)	N/A	61	78	97

The portfolio generation summarized in Table 6, above, shows the performance of a tentative resource portfolio for VCEA that is consistent with VCEA's long term vision while at the same time meeting CPUC and statutory requirements as well as delivering a cost-effective portfolio. The resource choices are based on estimated short term and long term costs for energy, capacity, renewables and carbon-free energy.

VCEA'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.

The main renewable resource available to VCEA for new development is solar PV. In Yolo County and its surrounding areas, there are very few options for other types of renewable energy such as wind, biomass, and geothermal energy. VCEA expects to explore such supply options opportunistically depending on what prices and terms can be obtained from new and/or existing RPS-eligible resources.

[5] Carbon Free Energy is supply of electricity that is certified to be carbon free but typically not RPS eligible or synced with hourly load for VCEA. Sources likely include in state or out of state large hydro facilities

Based on the levelized cost estimates that were included in the RESOLVE model, VCEA expects solar PV along with wind to be the lowest cost supply alternative for supply from existing and new sources in the 2018-2030 period. As part of VCEA's action plan that is described in Section 4 of this report, we plan to conduct solicitations for near term and long term renewable energy supply, which we expect result in PPAs for VCEA's future supply, As part of this process, we also expect to develop a deeper understanding of what resources can be developed locally and the estimated costs for such resources. It should therefore be emphasized that the specific resource groups identified in the Excel files submitted with this IRP (Large Hydro, Northern California Solar, etc) are only indicative sources of potential supply that may change depending on availability and price of resources – if VCEA were to have the opportunity to secure lower cost renewable energy supply from other sources, those would most likely be considered and perhaps used for contracting.

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 also suggest that in the next ten years, batteries are likely to become the most cost-effective means of meeting VCEA's resource adequacy needs, surpassing traditional gas-fired generation in terms of resource costs. Therefore, the Preferred portfolio includes up to 20MW of battery capacity by 2030, far surpassing the statutory mandate of 1 percent of VCEA's demand. If battery storage costs decline faster than anticipated, VCEA may consider to increase its reliance on batteries, and conversely, if battery costs remain at close to 2018-2020 levels, then VCEA is likely to rely more on market purchases for its RA needs.

The estimated Greenhouse gas emissions from the Preferred portfolio are far below the 2030 Greenhouse Gas Emissions Benchmark that was mandated by CPUC in its April 3, 2018 ruling on GHG benchmarks, which stipulated a GHG Emissions Benchmark for VCEA of 129,000 tons per year. There are two reasons why VCEA's GHG emissions are expected to be significantly below this benchmark. First, the modeling performed by VCEA suggests that higher RPS levels can be achieved at little or no incremental cost compared to other more carbon intensive portfolios. This result is of course a direct result of the expected market prices for energy and the expected levelized costs for new renewable energy resources - should costs change significantly, VCEA expects to also re-prioritize its portfolio. Second, VCEA already delivers electricity that is 75% carbon free. By increasing its procurement of carbon free energy, VCEA expects to be able to be carbon neutral by 2022 and offset 100 percent of its retail energy sales with RPS eligible energy or carbon free resources. Procurement of carbon free (non RPS) resources manifests itself in the GHG Calculator as procuring energy from "Large Hydro" as a proxy for generic carbon free energy. We also note that RPS levels and the estimated clean net short estimated through the GHG calculator differ somewhat from VCEA's own calculations and modeling using the methodology described in section 2 of this report. We expect that a leading cause of such discrepancies is the load shape applied to VCEA's load – the load shape in the GHG calculator appears to be more generic than the VCEA-specific shape used by VCEA for developing its portfolio.

Statutory Requirements under PUC 454.52 (a) (1)

Section 454.52 (a) (1) of the Public Utility Code sets out a number of requirements which LSE's must demonstrate that they meet the following requirements in their IRP:

- **Meet GHG emissions reduction targets established by the State Air Resources Board.** VCEA's Preferred Resource Portfolio shows estimated GHG emissions of 97,000 metric tons per year by 2030, which is well below the 129,000 per year planning target established for VCEA. In fact, when taking VCEA's planned procurement of carbon free resources such as hydro and its planned 80% RPS level into account, VCEA plans to become carbon neutral by 2022.
- **Procure at least 50 percent eligible renewable energy resources by December 31, 2030.** All portfolios considered in this IRP will meet the statutory RPS requirements. The Preferred Portfolio will significantly exceed the RPS by getting to an 80 percent RPS by 2030. As noted above, the actual level achieved is subject to continuous evaluation by VCEA and will depend on how market

conditions and prices for renewable energy evolve. While VCEA has a strong commitment to a clean local supply of energy, maintaining competitive retail electric prices are also a key consideration in the balancing of priorities for VCEA.

- **Enable each electrical corporation to fulfill its obligation to serve its customers at just and reasonable rates.** Although technically not applicable to VCEA as it is a CCA and not an electrical corporation, VCEA's goal is to keep its rates competitive with PG&E (see Figure 1). As an example, VCEA in 2018 adopted rates that were set to be 2.5 percent below PG&E's for the generation portion of customers' generation portion of the bill.
- **Minimize impacts on ratepayers' bills.** See section 3.b.ii below.
- **Ensure system and local reliability.** Since VCEA is not a distribution utility, most of the obligations in this area do not apply. However, VCEA, in its resource plan have incorporated the need for providing system and local RA at 115% of the expected monthly peak load for VCEA. The estimated costs for such capacity is incorporated in the resource costs for all portfolios, including the Preferred Portfolio. Additionally, VCEA will incorporate into its long-term power purchase agreements with intermittent renewable resources the ability to curtail output in the face of negative market prices.
- **Strengthen the diversity, sustainability, and resilience of the bulk transmission and distribution systems, and local communities.** VCEA is not responsible for the transmission and distribution systems and this requirement is therefore not applicable to VCEA.
- **Enhance distribution systems and demand-side energy management.** At this point in its short existence VCEA has not taken any action regarding demand side energy management. As highlighted in the Action Plan in section 4 below, VCEA plans to conduct studies regarding commencing programs that could include energy efficiency, demand response and other incentives for VCEA customers, once VCEA accrues sufficient financial reserves to start such activities. Until such time that VCEA starts any demand or efficiency programs, all such activities and programs will be the responsibility of PG&E as the distribution utility for VCEA.
- **Minimize localized air pollutants and other greenhouse gas emissions, with early priority on disadvantaged communities identified pursuant to Section 39711 of the Health and Safety Code.** See section 3.b.i below.

i. Local Air Pollutant Minimization

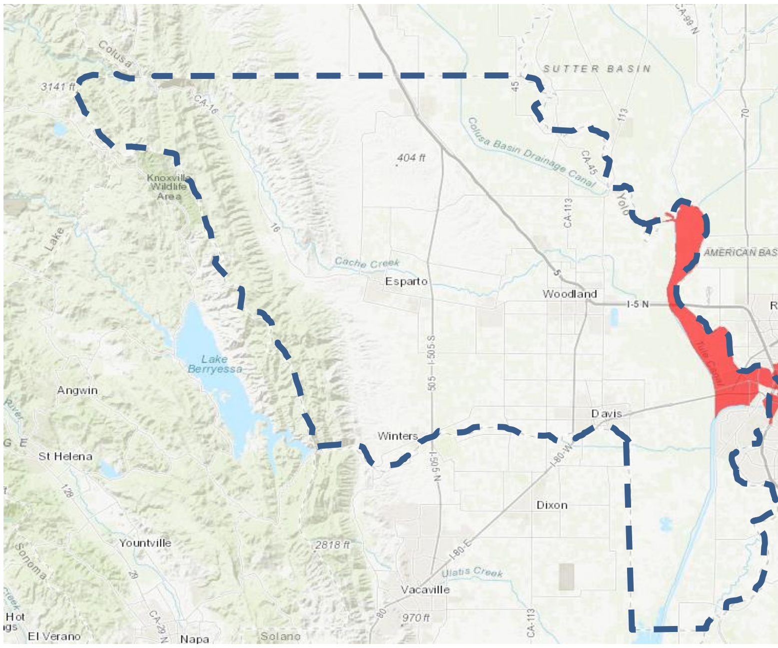
VCEA's Preferred Portfolio includes only renewable energy resources. These will be supplemented by additional market purchases of energy and resource adequacy to ensure a complete supply portfolio. VCEA's contract portfolio is therefore not expected to include any resources that adversely impact local air pollution.

CalEnviroScreen 3.0 shows that within Yolo county there are four census tracts that meet the CPUC's criteria of identifying the top 25% of impacted areas. Of these, only one, namely area 101.02 is partially located in VCEA's service territory. The total number of households in this census tract is 2,436. Based on a cross-comparison with VCEA customer addresses in this area, we estimate that less than 100 VCEA customer service accounts are located within this impacted area. According to the CalEnviroscreen 3.0 tool[6], 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 area. It should also be noted that the impacted areas are situated close to major transportation hubs that likely contribute to the rating.

[6] https://oehha.ca.gov/media/downloads/calenviroscreen/document/ces3results.xlsx

VCEA owns no fossil fuel-fired generation, has no plans to procure energy under long term contract from, or to construct and own, fossil fuel-fired generation. Instead, VCEA will be procuring resources with a focus on renewable and carbon free energy which are not expected to have a significant impact on the census tracts identified by the CalEnviroScreen. To the extent there are any impacts we expect those to be beneficial through an overall focus on cleaner energy.

Figure 3. CalEnviroScreen 3.0 Results for Yolo County



VCEA's rate are designed to provide economic benefits for all rate payers, including disadvantaged communities. As part of the Action Plan described in chapter 4, we also plan to conduct studies to determine suitable programs and incentives that can be launched once VCEA accumulates sufficient financial reserves and cash flow to be able to run programs. We note that PG&E will continue to make its programs for energy efficiency and demand response available to VCEA customers.

ii. Cost and Rate Analysis

VCEA's cost and rate analysis includes only an assessment of generation costs. VCEA recognizes that while areas such as transmission, distribution and programs are very important for the overall energy cost for VCEA customers , PG&E is responsible for the energy delivery infrastructure and any costs associated with this will likely be covered in PG&E's IRP filing.

Figure 4, shows a comparison of the estimated generation costs for VCEA in each of the years, 2018, 2022, 2026 and 2030 for the Preferred Portfolio as well as the other portfolios considered. The Figure also contrasts the estimated costs for VCEA's generation supply with the expected generation costs reported in the RESOLVE model's Reference Portfolio. The results for VCEA's portfolios were derived by using the CPUC provided tools, including the GHG Calculator and the RESOLVE modeling results and assumptions, as described in Section 2, above. Table 7 shows these results in Table format.

Figure 4. Estimated annual generation costs by resource portfolio (2016 $/MWh)

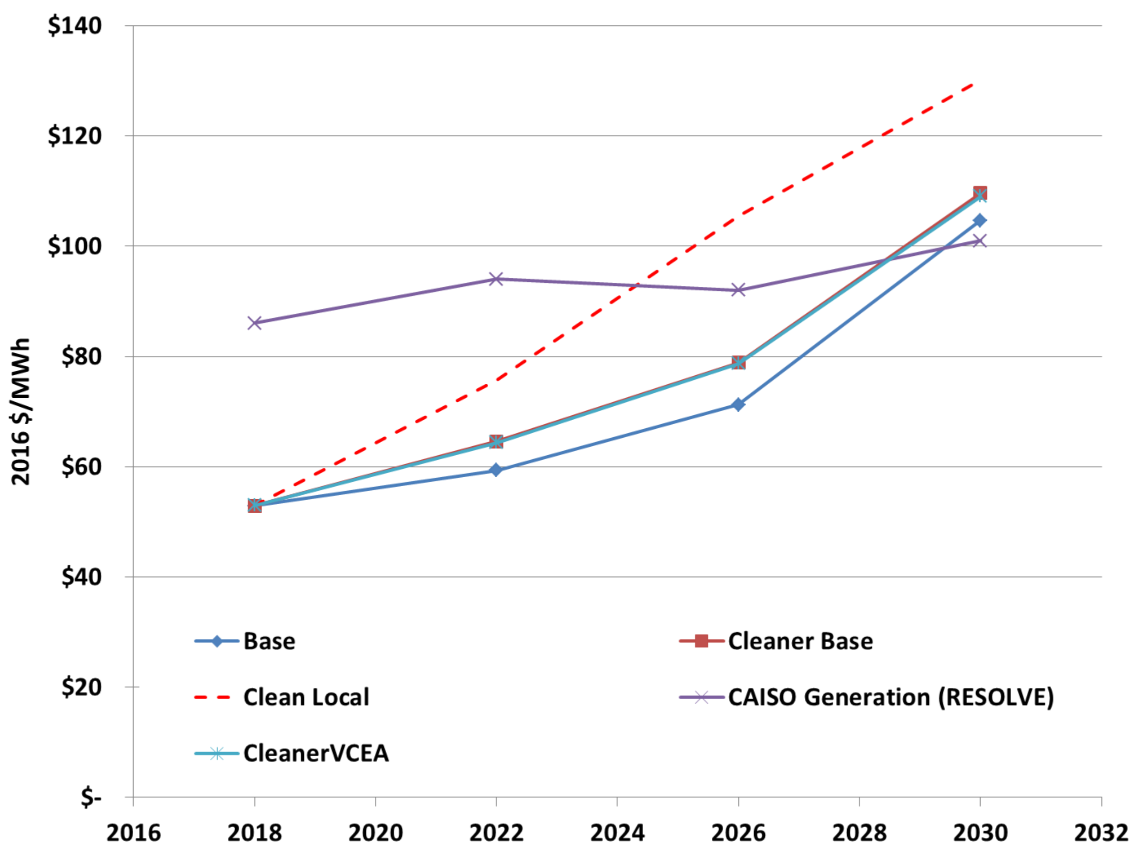


Table 7. Estimated annual generation costs ($/MWh)

Resource Portfolio	2018	2022	2026	2030
Base	$52.91	$59.36	$71.27	$104.66
Cleaner Base (Preferred Portfolio)	$52.91	$64.61	$78.82	$109.65
Clean Local	$52.91	$75.73	$105.41	$130.20
Cleaner VCEA	$52.91	$64.38	$78.68	$109.01
CAISO Generation (RESOLVE)	$86.00	$94.00	$92.00	$101.00

Table 7 and Figure 4 show that the Preferred Portfolio will remain below the RESOLVE model's estimated generation costs for the Reference Portfolio except in the year 2030 when the Preferred portfolio will be slightly above the Reference Portfolio's modeled generation costs. The main reason that VCEA's estimated portfolio costs exceed the results of the RESOLVE model, is likely that VCEA's model assumes that new capacity and RA will be procured at costs that are at or close to the levelized fixed cost of new storage whereas the RESOLVE model appears to have a (near) zero value for capacity in 2030. This implies that if electricity markets get constrained to the point of needing new investments in capacity by 2030, market prices could be substantially higher than those approximated by the RESOLVE curve. Conversely, if the electricity market remains over-supplied with capacity as a result of declining demand and/or investments in capacity that are not motivated by reserve margin needs, the estimated costs for VCEA's portfolio alternative could go down to levels that are at or below the RESOLVE model generation cost benchmark.

VCEA's estimated costs include the estimated levelized costs for resource under contract. We have assumed that all renewable resources, existing or new, can be contracted at the estimated levelized costs for new resources of the RESOLVE model. It further assumed that VCEA will get access to all attributes of resources that are under contract – energy, RA, RECs, and local RA. VCEA plans to rely on market purchases for all energy and capacity needed beyond the renewable energy and capacity that will be under contract.

For market purchases, it is assumed that in the 2018-2021 period, energy and RA will be available at prices indicated through current RA prices in bilateral or OTC markets. Energy is expected to be available at prices corresponding to ICE's power futures prices for NP15. In the 2022-2030 period it is assumed that energy can be procured at the estimated hourly CAISO price reported for RESOLVE's Reference Portfolio. 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 Gas-fired combustion turbine and the emerging capacity resource - 4-hour lithium ion batteries. Cost estimates displayed in the RESOLVE model suggests that from 2022 onwards, 4 hour battery storage capacity will be a lower cost alternative than conventional gas fired generation. We note, however, that 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 night time and winter energy demand.

When compared to the RESOLVE model's results, the Preferred portfolio compares favorably in terms of generation costs and by extension also rate impacts over the forecast period. However, the difference in the estimated costs of VCEA's portfolio and the RESOLVE model results suggests that if true, most or all of California's LSE's would prefer finding a lower cost solution similar to the one identified by VCEA. 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. VCEA recommends that the CPUC looks into this potential outcome to better understand overall results when aggregating individual LSE IRPs.

We also note that the generation cost estimates shown in Figure 4 and Table 7 do not include PCIA. The PCIA is an important component of VCEA's generation that will significantly influence VCEA's ability to meet all statutory requirements versus its customers in line with 454.52.(a)(1).

The 2018 Year Ahead CAM List Final Allocation published by the CPUC, indicates that there is a total of 1375.36MW of CAM resources available for the month of August[7]t. Using the estimated VCEA load share for 2030 published by the CPUC in its 2030 GHG Benchmark ruling, VCEA would benefit from 0.9% of this capacity, or about 12MW, which in turn corresponds to about 5% of VCEA's anticipated RA requirement in the 2018-2030 period[8]. The financial costs or benefits of using CAM resources rather than generally available resources to meet VCEA's RA need in the forecast has not been accounted for in this IRP, but it is anticipated that the difference in cost should be small.

b. Deviations from Current Resource Plans

At the time this report was prepared, there were no deviations from any other filed plans, considering that VCEA commenced operations only in June of 2018.

[7] http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454905
[8] http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M214/K459/214459514.PDF

d. Local Needs Analysis

VCEA is not located in a defined Local Capacity Area. Furthermore, the CAISO's 2017-2018 Transmission Plan as well as the most recent local capacity assessment by the CAISO, suggests that the Central Valley where VCEA is located will not have any shortage of local capacity for the 2018-2027 period. However, VCEA will continue to procure its share of Resource Adequacy from defined constrained Local Capacity Areas as required by Resource Adequacy mandates. This may include Resource Adequacy available from renewable projects that VCEA may procure the output of that happen to be located in Local Capacity Areas within the NP-15 zone. VCEA expects that sufficient local capacity and flexible capacity will be available in the market throughout the forecast period.

4. Action Plan

VCEA only started to serve load for its customers on June 1, 2018. Initial operations are entirely based on energy and capacity procurement under short term contracts. VCEA also does not yet administer any programs relating to energy efficiency, demand response, or programs to stimulate electrification. Due to its short operational tenure to date, it is therefore imperative to perform a number of studies and resource solicitations to firm up VCEA's long term planning, procurement and strategy. In particular, key issues such as what resource types to focus on, the importance of a local resource supply and potential trade-offs between resource costs and other portfolio attributes still remain to be completed. The action plan items below highlights the key near term actions to be taken in the next 1-3 years, including activities to be performed in 2018.

a. Proposed Activities

i. Long Term Renewable Procurement

VCEA will be conducting a long term solicitation in 2018 in which it will be seeking renewable power from RPS-qualifying renewable energy projects, with an expectation that power purchase agreements will be executed in early 2019. In support of this solicitation, VCEA will:

- Develop criteria for project siting preferences;
- Develop criteria for acceptable renewable technologies;
- Make a policy determination of whether long term renewable supply may be sourced from out-of-state projects;
- Develop a definition of "local" for the purposes of having some preference for local renewable projects; and
- Determine whether to accept renewable project proposals that include integrated battery storage.

As part of the siting criteria established for the solicitation, VCEA will require that bidders identify whether their projects are located in areas with disadvantaged communities. For proposed projects located in disadvantaged communities, as defined in PUC 399.13(a)(7)(A-B), that can demonstrate that their project will provide environmental and economic benefits to that community, additional credit will be given in the selection scoring and ranking.

This long term renewable procurement directly supports achievement of the Preferred Portfolio.

ii. Establish Long Term Renewable and GHG Targets for 2030

VCEA's Preferred Portfolio is presented as a planned target for VCEA to achieve compliance with RPS requirements and the Commission's GHG emissions target and go beyond statutory mandates. One of VCEA's long term goals is to exceed the renewable portfolio content and have lower GHG emissions intensity that PG&E, the host utility. VCEA will continue to assess the most cost-effective ways to achieve a cleaner supply portfolio and plan on using the results from resource solicitations to discover the local cost of renewable energy options and storage in Yolo County and surrounding areas. This activity will also involve conducting studies and analysis to evaluate in more detail the costs and ability of VCEA to achieving greater than 50% RPS by 2030, and when carbon neutrality might be able to be achieved.

iii. Key Portfolio Performance Indicators

Develop metrics to track aspects of the portfolio performance relative to a baseline/comparison metrics. These indicators are also intended to facilitate member jurisdiction's work on their own policy such as Climate Action Plans.

iv. Evaluate Impacts of Climate Change on Load Forecast

Evaluate methods for incorporating the impacts of climate change on expected future loads (particularly peak loads).

v. Evaluate Options for Assuming Responsibility for Energy Efficiency/Demand Side Programs from PG&E

VCEA will evaluate the scope of effort and potential benefits of assuming control over funds that are collected under CPUC authorization to support energy efficiency and demand side management programs. In particular, demand side management programs, if viable, may become a cost-effective complement to battery storage to better integrate renewable energy.

vi. Evaluate Non-Battery Storage Options

Investigate other storage technologies and their cost effectiveness.

b. Barrier Analysis

VCEA does not own, nor does it have any Long Term power purchase agreements with existing facilities. VCEA expects to enter into long term contracts for renewable energy capacity in 2018 and 2019 to meet its resource needs in line with the Preferred Portfolio identified in this report. It is anticipated that sufficient competitive offers are submitted. If costs are higher or resource offers fewer than anticipated, this could trigger changes in the Preferred Portfolio.

One of the challenges for VCEA as a recently formed JPA is to obtain and manage the financial security required by counterparties to successfully enter into the amount of long term contracts for renewable energy required by SB350 (399.13 (b)). This cost will be factored in the evaluation of proposed projects during the solicitation process.

An ongoing risk for VCEA as well as all parties entering into long term contracts in line with the requirement in PUC Section 399.13 (b) is falling costs of new renewable energy and battery storage. If costs for new resources continue to fall in line with historical trends, there is a risk that VCEA and other CCAs entering into long term contracts will eventually encounter above-market costs in their contracted portfolios that need to be accounted for through the PCIA or similar mechanism by which CCA customers opting out of a CCA program can be subject to PCIA charges in the same manners as IOUs use the PCIA today.

VCEA does not anticipate to secure all of its resource needs through long term contracts. In fact, VCEA plans to only contract for renewable energy resources and procure the remaining balancing capacity and energy needed for its load through short term contracts and spot market purchases of energy, RECs, and capacity. This exposes VCEA to market price risks. In line with the results shown in the RESOLVE model as well as recent work by the CAISO for RA, VCEA expects sufficient energy and capacity resources to be available throughout the 2018-2030 period. Natural gas market forecasts also suggest that gas prices (and thereby marginal power prices) are expected to remain low over the foreseeable future, which means electric power prices also should remain low or moderate. Should market conditions tighten, for example through gas price increases or faster than expected tightening of the supply and demand balance in California's power markets, this could result in higher costs for meeting load and therefore also higher rates. VCEA plans to manage this risk by continuously assessing risks and opportunities associated with contracting in line with its risk policy.

c. Proposed Commission Direction

Not Applicable. VCEA is not seeking direction from the CPUC at this time

5. Data

To be completed

[3] Available at: http://www.cpuc.ca.gov/irp/filingtemplates/.

[4] Available at: http://www.cpuc.ca.gov/irp/filingtemplates/.

a. Baseline Resource Data Template

To be completed

b. New Resource Data Template

To be completed

Form #	Form Description	IOU	CCA	ESP
	RETAIL SALES OF ELECTRICITY BY CLASS OR SECTOR	X		
	RETAIL SALES OF ELECTRICITY BY CLASS OR SECTOR	X		
Form 1.2	DISTRIBUTION AREA NET ELECTRICITY FOR GENERATION LOAD (GWh)	X		
	LSE COINCIDENT PEAK DEMAND BY SECTOR	X		
Form 1.4	DISTRIBUTION AREA COINCIDENT PEAK DEMAND	X		
	ENERGY EFFICIENCY - CUMULATIVE INCREMENTAL	X		
	DISTRIBUTED GENERATION - CUMULATIVE	X		
	DEMAND RESPONSE - CUMULATIVE INCREMENTAL	X		
Form 4	REPORT ON FORECAST METHODS AND MODELS	X	X	
	UNCOMMITTED DEMAND-SIDE PROGRAM	X		
Form 7.1	ESP DEMAND FORECAST			X
Form 7.2	CCA DEMAND FORECAST		X	

Each LSE should save a separate file for each portfolio in the format of "Data_LSEname_NewRsrc_Identifier_yyyymmdd.xlsx" where the field "LSEname" is replaced with the LSE name (e.g. "MCE" or "PGE"), the field "Identifier" is replaced with Conforming, TE, Alternate1, Alternate2, etc, and "yyyymmdd" is replaced with the date the file is submitted to the Commission. Spaces are not allowed in the file name. Special characters are not allowed, except for underscore ("_") and dash ("-").

c. Other Data Reporting Guidelines
To be completed

6. Lessons Learned
To be completed

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 Plan. Any deviations from the Conforming Portfolio must be explained and justified.

Conforming Portfolio – Each LSE must produce a “Conforming Portfolio” that is demonstrated to be consistent with the Reference System Portfolio according to the following criteria: (1) use of either the GHG Planning Prices or the LSE-Specific 2030 GHG Emissions Benchmark, and (2) use of input assumptions matching those used in developing the Reference System Portfolio

Data Template – Data provided by the LSE should be reported in the “Baseline Resource Data Template” and the “New Resource Data Template” provided by the Commission. “Baseline” means existing resources and costs, including resources already contracted but not yet online. “New” means any new (incremental to the baseline) resources and costs associated with a particular LSE portfolio.

Disadvantaged Communities – For the purposes of IRP, and consistent with the results of the California Communities Environmental Health Screening Tool Version 3 (CalEnviroScreen 3.0), “disadvantaged communities” refer to the 25% highest scoring census tracts in the state along with the 22 census tracts that score in the highest 5% of CalEnviroScreen’s pollution burden, but which do not have an overall CalEnviroScreen score because of unreliable socioeconomic or health data.

GHG Emissions Benchmark – Each LSE filing a Standard LSE Plan must use either the GHG Emissions Benchmark or GHG Planning Price in developing its Conforming Portfolio. The LSE-specific benchmarks and calculation method are provided in Table B. If the total emissions attributable to the LSE’s preferred portfolio exceed its GHG Emissions Benchmark for 2030, the LSE must explain the difference and describe additional measures it would take over the following 1 - 3 years to close the gap, along with the cost of those measures.

GHG Planning Price –The GHG Planning Price is equivalent to the marginal cost of GHG abatement associated with the 42 MMT Scenario for the years 2018 to 2026 (i.e., a curve that slopes upward from

~$15/ton to ~$23/ton), followed by a straight-line increase from ~$23/ton in 2026 to $150/ton in 2030,

as shown in Table A. Each LSE must use either the GHG Planning Price or GHG Emissions Benchmark in developing its Conforming Portfolio.

IRP Planning Horizon – The IRP Planning Horizon will typically cover 20 years. However, for the purposes of this IRP 2017-18 cycle, the IRP Planning Horizon will cover only up to the year 2030.

Long term – 10 or more years (unless otherwise specified)

Portfolio – A portfolio is a set of supply and/or demand resources with certain attributes that together serve a particular level of load.

Preferred Portfolio – Among all the portfolios developed by the LSE, the LSE will identify one as the most suitable to its own needs, deemed its “Preferred Portfolio.” Any deviations from the Conforming Portfolio must be justified and explained.

Reference System Plan – The Reference System Plan refers to the Commission-approved integrated resource plan that includes an optimal portfolio (Reference System Portfolio) of future 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 Reference System Plan refers to the Commission-approved portfolio that is responsive to statutory requirements per Pub. Util. Code 454.51; it is part of the Reference System Plan.

Scenario – A scenario is a portfolio together with a set of assumptions about future conditions.

Short term – 1 to 3 years (unless otherwise specified)

Standard LSE Plan – A Standard LSE Plan is the type of integrated resource plan that an LSE is required to file if its assigned load forecast is ≥ 700 GWh in any of the first five years of the IRP planning horizon.

Standard LSE Plan Template – Each LSE required to file a Standard LSE Plan must use the Standard LSE Plan Template according to the instructions provided herein.

(End of Attachment A)

APPENDIX 1. Load Forecast Methodology

The VCEA retail sales and load forecasts presented in this report are based on the historical retail billed sales (PG&E Item 16) and hourly loads (PG&E Item 17) SMUD received from PG&E. The data includes billing and load data by customer account for the cities of Davis and Woodland and the unincorporated portion of Yolo County. Regression models are used to normalize both retail sales and loads for variations in monthly electricity use and temperatures. The VCEA forecasts are based on normalized sales, and loads are scaled to reflect the growth in customer accounts. It is assumed that 10 percent of VCEA's customers may opt out and revert back to PG&E service. This is likely an aggressive value but was chosen to capture the risk of revenue attrition due to opt outs.

Forecast Methodology

VCEA forecast models utilizes statistical regression techniques which normalize electricity use for variation in temperatures, seasonal use, and number of customer accounts. The forecast is based on four regression models:

1) daily system energy,
2) daily system peak,
3) system hourly loads (24 separate hourly equations), and
4) retail class sales

For each model, the dependent variables for loads and retail sales are normalized by customer accounts.

The daily energy and peak models serve as the foundation for the load forecast. These models normalize VCEA retail loads for variations in daily temperatures, weekdays and weekends, months, seasons and holidays. The system hourly load equations provide a daily load shape which is calibrated to daily energy and peak model estimates with the following restrictions:

- Maximum of estimated hourly loads for day (i) = estimated peak for day (i) for each day of the forecast year.
- Sum of the estimated hourly estimate loads for day (i) = estimated daily energy for day(i) for each day of the forecast year.

The predicted values from these models are:

- kwh/day/account,
- peak kW/day/account, and
- kW/hour/account.

The retail sales model includes separate regression equations for each major rate class served by the VCEA. They are:

- Residential (rate schedules E1 to E9)
- Small Commercial (A1 and A6)
- Medium Commercial (A10)

- Large Commercial (E19, all service voltages)
- E20S
- E20P
- Agricultural (AG)
- Street lighting (LS, OL1, and T)
- Standby (STOU)

The dependent variable for the sales models is monthly kWh/customer per billing period. The regression model normalized class sales for variations in monthly use and temperature conditions. The temperature variables are billing month heating and cooling degree days. The predicted values are kWh/billing month for each rate class.

Retail Sales History

The retail sales historical billing file includes city, service point id, service agreement id, customer information, service address, rate schedule, meter number, and monthly billing kWh, and direct access provider. The historical period is from 2014 to 2016.

Interval Data History

The interval data historical file includes interval loads, service area, service point id, service agreement id, date, and rate schedule. Load intervals include both 15 minute reads and 60 minute reads. The historical period is from 2015 to 2016.

Billing and interval data was also available for a portion of 2017 but was not used for the data analysis.

Weather Data

Daily high and low temperatures were extracted from the NOAA website for weather station Davis 2WSW Experimental Farm. The temperature data covers the period from 1998 to September 2017.

VCEA Customer Growth

Customer growth for the VCEA was based on the population, housing units, and employment forecast from the Sacramento Area Council of Government (SACOG) 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). Modeling projections for 2012, 2020, and 2036. February 18, 2016. (https://www.sacog.org/post/sacog-2016-mtpscs-modeling-projections-2012-2020-and-2036)

Data Editing

The billing data was edited to include customer accounts who were full service PG&E customers for the 12 monthly billing periods for each year. In the PG&E billing files, each account is a separate record. In cases where there were 2 or more accounts for the same premise (that is, a tenant moves out, and another moves in during the same billing month), the accounts are consolidated to avoid double counting of the premise. Direct access customer are omitted from the analysis and assumed to remain direct access customers for the forecast period.

The interval data included both 15 minute reads and 60 minutes reads. The accounts with 15 minute reads were aggregated in 60 minute interval reads. The data analysis and forecasts were based on hourly interval reads. The interval data included both hourly loads delivered to full service customers and hourly loads that were returned to PG&E. The returned loads are behind the meter surplus PV or CHP generation. The data analysis and forecast were based on the delivered loads provided by PG&E.

For forecasting purposes, the billed sale data was aggregated to the VCEA rate classes and the interval data was aggregated to the VCEA full service retail service level.

Weather Data

Daily high temperatures and cooling and heating degree days with a base temperature of 65 degree Fahrenheit were used directly in the regression models.

For the class sales models, cooling and heating degree days for each billing month were calculated based on the PG&E's billing cycle definition. The start date for a billing cycle begins on the 16th day of the previous month and the ends by the 14th day of the next month. For example, the cooling degree day for the July billing month starts on June 16 and ends on August 14. The cooling degree month is the sum of the daily cooling degree days during this period.

VCEA Historical Data

The following tables presents historical figures for customer accounts, sales by rate class, monthly peaks for full service accounts and direct access accounts. While direct access account represents less than 1 percent of the total population, the majority of the accounts are medium and large commercial accounts. For the VCEA service territory, the direct access customers represent 10 percent of total sales and seven percent of the annual peak.

Figure 5. VCEA Service Territory Retail Electricity sales for Full Service and Direct Access Customers 2014-2016 (MWH)

	2014	2015	2016
Full Service Sales	860,378	839,708	814,333
Direct Access Sales	91,926	90,733	88,314
Total Sales	952,303	930,441	902,647

Figure 6. VCEA Monthly Billed Sales by Full Service and Direct Access Customer for 2016 (MWh)

MWH	Full Service	Direct Access	Total
January	59,328	6,010	65,337
February	54,003	6,148	60,151
March	49,906	5,890	55,796
April	56,227	6,422	62,649
May	71,613	6,877	78,489
June	88,932	7,362	96,294
July	95,736	9,523	105,259
August	88,033	12,058	100,091
September	72,774	10,034	82,808
October	60,374	6,249	66,623
November	57,942	6,210	64,153
December	59,465	5,530	64,995
Annual	814,333	88,314	902,647

Figure 7. VCEA Monthly Peaks by Full Service and Direct Access Customers 2016 (kW)

MW	Full Service	Direct Access	Total
January	106,344	8,837	115,181
February	103,685	8,519	112,204
March	94,948	8,619	103,567
April	111,750	10,128	121,878
May	205,911	12,651	218,562
June	227,888	12,833	240,721
July	224,344	17,688	242,032
August	195,837	18,355	214,193
September	185,128	17,229	202,356
October	114,942	10,105	125,047
November	106,198	8,467	114,665
December	114,079	8,953	123,031

Load and Retail Sales Forecast

The sales and load forecast combines the forecasted normalized sales and the forecasted customer count.

The customer forecast is based on SACOG demographic forecast for Yolo County. The SACOG growth assumptions were applied to the Residential, Small and Medium Commercial customer classes. Large Commercial was based on their historical growth. Lighting was based on a moving average of historical lighting accounts. Customer counts for E20, Agr, and Standby were assumed to be constant over the forecast period. These customer classes illustrated very lumpy growth and therefore the SACOG growth assumptions were not applicable.

Sales and load forecast with Attrition

For purposes of developing a forecast of sales and load for the VCEA service territory, an attrition rate of 10 percent was assumed for customer's choosing to either return to PG&E firm service or direct access provider. The tables below show the annual sales and peaks for full service accounts net of attritions.

Figure 8. Annual retail sales and peak load forecast for VCEA, net of estimated attrition

	Sales (MWH)	Peak (MW)	Customers Accounts
2018	754,457	214	58,626
2019	756,404	215	58,823
2020	760,328	215	59,084
2021	761,396	216	59,411
2022	764,073	217	59,741
2023	766,788	218	60,076
2024	771,325	218	60,409
2025	772,192	219	60,745
2026	774,904	220	61,082
2027	777,643	221	61,422
2028	782,290	221	61,767
2029	785,089	223	62,115
2030	787,903	224	62,464

Future Research to Improve Forecast Accuracy

PG&E Data Sources

The data that was provided by PG&E was a very limited data time series covering the periods 2014-2017 for billing data and 2015-2017 for interval data. At the time the forecast was develop, 2017 data included the months of January to June. For modelling purposes, 10 years of data would be preferred in order to understand if any trends in electricity use could be observed. That is, it would be helpful to see if over this periods, if sales or loads per account were decreasing or increasing.

Distributed Energy Resource (DER) Program Impacts

The sales and load forecast for VCEA participants reflects the current trend in electricity use which includes embedded energy efficiency, behind the meter PV, and EV battery charging. The forecast does not incorporate incremental DER impacts for energy efficiency programs, building and appliance standards, behind the meter PV, electric vehicle battery charging, and electrification. While net metering customer information was provided by PG&E, information on energy efficiency participation and electric vehicle charging was not provided. In previous research done at SMUD, customers who participate in utility programs are more likely to participate in future programs which would allow for forecasting participation rates and therefore program impacts. Demographic information such as type of dwelling (single family vs. multi-family), home ownership, age of house, and other demographic information would also be useful to understand the take rates for future program participation.

Current appliance saturations, average age of appliances, and the efficiency of appliances are embedded in the current forecast. Changes to equipment saturations and efficiencies are not incorporated into the forecast and therefore may overestimate the forecast loads and sales in the long run.

For future forecasting projections, incorporating these DER impacts would greatly enhance the forecast from both a behavioral and policy perspective.

Temperature Data and Climate Change

The statistical models to weather normalize electricity use were based on average daily temperatures from1998 to 2016. If climate change occurred during this period, they are captured as the average impact. Future climate changes, however, were not included in the long term VCEA forecast.

For forecasting purposes, we do not have sufficient information on daily variations in temperature due to future climate change, to adjust the normal temperature patterns for the long term forecast. While this research is ongoing at many research institutions, we have found that the results of climate change research are not sufficient to develop the future day to day temperature variations needed to forecast electricity using the current modelling methodology. Additional research is needed to make this link between long term climate change trends and the impact on daily temperatures changes.

Attachment B

VCEA Integrated Resource Plan

Listing of Possible Action Plan Activities/Proposed Prioritization

5/31/18

Priority	**Title**	**Description**
1	**Long Term Renewable Procurement**	Conduct a solicitation and evaluation of proposals for the purchase of energy from existing or new RPS qualifying renewable energy resources. Additional Related Action Plan: 1. Develop criteria/information requests to evaluate new renewable ~~for~~ projects implementing responsible siting practices (both environmental and land use). Develop associated evaluation criteria. 2. Develop Criteria for Acceptable and Preferred renewable technologies and locations (e.g. local v. remote). 3. Develop criteria and position on defining limits on which states ~~to~~ VCEA will source~~procure~~ long term renewables from. 4. Develop a position on the definition of "local" for renewable resource procurement. 5. Determine whether to include ~~(or not)~~ battery or other storage options in solicitation. 6. Develop criteria for assessing the portfolio content of local versus non local for short-list selection.

VCEA Integrated Resource Plan

Listing of Possible Action Plan Activities/Proposed Prioritization

5/31/18

Priority	Title	Description
2	**Establish Renewable and GHG Targets for 2030**	Conduct studies to evaluate in more detail the costs and ability of VCEA to achieving greater than 50% RPS by 2030, when carbon neutrality might be able to be achieved. Establish the LT Targets for VCEA. Additional Related Action Plan: 1. Assess whether VCEA should bifurcate its portfolio to meet the varying sustainability goals of its Members. 2. Conduct Document review of other entities' climate action plans to inform on extent of aggressive goals established by other entities. 3. Develop policy proposal for tradeoffs between costs, GHG emissions, local renewable content, etc.
3	**Key Portfolio Performance Indicators**	Develop a list of desired metrics to track aspects of the portfolio performance relative to a baseline/comparison metric.
4	**Evaluate Impacts of Climate Change on Load Forecast**	Evaluate methods for incorporating the impacts of climate change on expected future loads (particularly peak loads).
	Evaluate impacts of electrification on load forecast	Evaluate methods for incorporating electrification initiatives (e.g., all electric buildings, clean local mobility services, ag pumping conversion) on expected future loads (load profiles as well as peak loads).

VCEA Integrated Resource Plan

Listing of Possible Action Plan Activities/Proposed Prioritization

5/31/18

Priority	Title	Description
5	**Evaluate Options for Assuming Responsibility for Energy Efficiency/Demand Side Programs from PG&E**	Evaluate the scope of effort to assume control of energy efficiency and demand side management programs required by CPUC~~/regulatorily required energy efficiency and demand side management programs~~, and what kinds of programs VCEA would implement if we get control.
6	**Evaluate Non-Battery Storage and Demand Response Options**	Investigate ~~other~~ demand response program options and non-battery storage technologies and their cost effectiveness. 1. Identify trends that may impact VCEA's long term demand forecast and/or load shifting opportunities 2. Determine program options or investments consistent with market and technology trends and cost of service goals.

VCEA Integrated Resource Plan

Listing of Possible Action Plan Activities/Proposed Prioritization

5/25/18
Logic for Proposed Prioritization

Priority	Title	Description
1	Long Term Renewable Procurement	This is the highest priority because of the need to get long term contracts in place so long-term renewable supply from these can begin in or prior to 2021. A task for this long term procurement process has been signed.
2	Establish Renewable and GHG Targets for 2030	Determining VCEA's long term goals is important to inform the procurement effort on what level of procurements above minimum levels will be required as part of the long term renewable procurement process. This would involve additional analysis.
3	Key Portfolio Performance Indicators	This is probably not a lengthy discussion. In addition, KPPIs can evolve over time. A few of the KPPIs would relate to the 2030 targets established.
4	Evaluate Impacts of Climate Change on Load Forecast	This would primarily be a literature research and review on forecast local climate impacts over time. Then would need to determine how to incorporate climate change impacts into the actual load forecasting process.
5	Evaluate Options for Assuming Responsibility for Energy Efficiency/Demand Side Programs from PG&E	Assuming operational responsibility for these programs from PG&E is a long-term proposition. The opportunity will remain
6	Evaluate Non-Battery Storage Options	Many non-batter storage options are likely to be customer-sited, which means that they will fit into the demand response category. VCEA initiating responsibility for demand response programs is a longer-term proposition.