



Clean Power Alliance

2020 Integrated Resource Plan

September 1, 2020



Turbine from Voyager Wind project that supplies Clean Power Alliance with clean energy

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I. Executive Summary

Clean Power Alliance of Southern California (CPA) is a Load Serving Entity (LSE) and administrator of a Community Choice Aggregation (CCA) program. Formed as a Joint Powers Authority (JPA), CPA's 32 member jurisdictions include the unincorporated areas of Los Angeles and Ventura Counties, as well as the cities of Agoura Hills, Arcadia, Alhambra, Beverly Hills, Calabasas, Camarillo, Carson, Claremont, Culver City, Downey, Hawaiian Gardens, Hawthorne, Malibu, Manhattan Beach, Moorpark, Ojai, Oxnard, Paramount, Redondo Beach, Rolling Hills Estates, Santa Monica, Sierra Madre, Simi Valley, South Pasadena, Temple City, Thousand Oaks, Ventura, West Hollywood, Westlake Village, and Whittier. CPA is governed by a board of directors comprised of elected officials of its member cities and counties, which span a broad territory that is diverse in its geography, climate, and customer demographics.

CPA began offering service to municipal customers of unincorporated Los Angeles County in February 2018 and began service to non-residential customers of unincorporated Los Angeles County, Rolling Hills Estates, and South Pasadena beginning in June 2018. CPA enrolled residential customers from 31 of its member jurisdictions in February 2019 and completed enrollment of its current non-residential customers in May 2019. Both residential and non-residential customer enrollments in Westlake Village, CPA's newest and 32nd member, occurred in June 2020.

As set out in its Joint Powers Agreement, CPA is a mission-driven organization. CPA intends to develop an electric supply portfolio with overall lower greenhouse gas (GHG) emissions than that of the local Investor Owned Utility (IOU), which for CPA's current service territory is Southern California Edison (SCE). CPA's procurement policy encourages the use and development of cost-effective renewable and distributed energy resources and discourages the use of unbundled renewable energy credits (RECs). CPA also intends to manage its energy portfolio and products in a manner that provides cost savings to customers, promotes public health in areas impacted by energy production, supports regional economic benefits and workforce development, and offers customers a choice of differentiated renewable product tiers.

Now in its third year of operations, CPA is relying on short- and long-term procurement to meet the needs of its current customers and offer three renewable product tiers while remaining price competitive and satisfying regulatory requirements. The three supply options that CPA offers to its customers include: Lean Power, which provides 36% renewable power; Clean Power, which provides 50% renewable power; and 100% Green Power, which provides 100% renewable energy. CPA procures electricity for its customers from a variety of resources guided by policies adopted by the CPA Board of Directors (Board), and by regulatory requirements established by the legislature and state regulatory agencies.

Consistent with CPA's governance practices and Public Utilities Code section 454.52, this Integrated Resource Plan (IRP) was approved on August 26, 2020, by the CPA Energy Planning & Resources Committee, the standing committee to whom the Board delegated authority for approval of the IRP through formal action on July 9, 2020. CPA is committed to providing safe, reliable, affordable, and

clean energy to its customers and seeks to collaborate with statewide energy stakeholders to support California's energy goals.

During the previous 2018 IRP cycle, the CPUC expressed concern that individual resource buildout in plans did not sufficiently address renewables integration issues with respect to California's reliability requirements.¹ To address these concerns and improve planning, CPA worked jointly with two and collaborated with several other CCAs to develop their 2020 IRPs. The two CCAs that joined CPA in this effort were Peninsula Clean Energy and San Jose Clean Energy. The three joint CCAs represent approximately eight percent of California's load and 40 percent of CCA load. In this coordinated process, the load, resources, power needs, and expansion plans of all participating CCAs were developed and assessed together to understand interactions between the plans and ensure that the CCAs do not all plan to use or build the same resources. The CCAs also developed disaggregated plans to accommodate local requirements and provide for submission of individual plans as required by the CPUC.

CPA conducted the joint CCA IRP effort with support from a third-party resource planning consultant, Siemens Energy Business Advisory (Siemens), to develop an IRP model that provides low-cost resource procurement trajectories to support CPA in meeting its regulatory requirements and renewables and emissions goals at a reasonable cost to ratepayers. In calculating its emissions, CPA used the CPUC's Clean System Power (CSP) calculator to ensure that CPA's portfolio emissions are at or below the CPUC benchmarks for CPA.

CPA developed two IRP Conforming Portfolios, one for the 46 MMT GHG target and one for the 38 MMT GHG target, using assumptions that are consistent with the California Public Utilities Commission's (CPUC) system modeling. The key differences between the two Conforming Portfolios are the GHG emissions targets for CPA and the additional amounts of renewable resources that CPA needs to meet its GHG-reduction obligations.

Both Conforming Portfolios modeling results in several clean energy procurement trends. In the near-term, the portfolios consist of long-term wind and solar resources, with storage added to promote reliable operation. CPA also includes procurement of existing in-state and out of state hydro resources so that CPA's portfolio consists predominantly of zero- and low-carbon assets. In the longer-term, procurement also includes geothermal resources as the system gets saturated with solar, and wind potential nears exhaustion. CPA's portfolio results are broadly consistent with the trends seen in the CPUC's Reference System Plan. While CPA is complying with the Commissions' request for two Conforming Portfolios, the 38 MMT case is more reflective of the procurement objectives and preferences of CPA's Board and local stakeholders. CPA is presenting the 38 MMT Conforming Portfolio as its preferred portfolio.

The assumptions embedded in the 46 MMT and 38 MMT conforming portfolios are consistent with the filing requirements and the results reflect CPA's goal to provide its customers with clean, reliable, and affordable energy. CPA will align its procurement with these Conforming Portfolios as long as

¹ [D. 19-04-040 p.105](#)

procurement can be conducted consistent with our communities' local goals, and are subject to change based on needs to minimize customer risk, resource availability, changing market conditions, and potential new regulatory obligations. CPA will also maintain a diverse resource mix and minimize curtailment to contribute its share of grid reliability. Beyond the CPUC's mandates within the scope of this IRP proceeding, CPA's internal procurement planning process is driven by CPA Board-established policies and in conjunction with CPA's Community Advisory Committee and other community stakeholders.

Given CPA's obligation to reliably meet customers' needs, the Action Plan calls for significant investment in new build renewable resources as well as strategic use of existing facilities. CPA will also continue to add energy storage resources to its portfolio, which have the capability to quickly dispatch and ramp to support intermittent renewable resources such as wind and solar. CPA intends to include some existing large hydro resources to its portfolio to meet its GHG reduction requirements; while CPA has followed the Commission staff's direction to exclude the potential Greenhouse Gas (GHG)- free resource allocations from the Investor Owned Utilities (IOU) because the CPUC has yet to issue a decision regarding such allocations in the Power Charge Indifference Adjustment (PCIA) proceeding, some of the large hydro resource needs can potentially be met through those allocations in the future. In addition, CPA seeks to establish a resource portfolio that encourages the use and development of cost-effective local renewable and distributed energy resources.

CPA is confident that the recommended Action Plan provides for an optimal combination of expected costs and associated risks, while retaining the flexibility to take advantage of market-driven resource innovations and local stakeholder priorities. It provides CPA an excellent opportunity to deliver safe, clean, reliable, and affordable energy to our customers in an increasingly sustainable way. The Action Plan takes full advantage of technologies and markets to enable a smarter, greener, and more flexible resource portfolio.

II. Study Design

This section describes the process used by CPA to develop its IRP. In this IRP, CPA demonstrates that it has a clear plan to meet its CEC 2019 IEPR load forecast through 2030 with a resource portfolio comprised of carbon free energy and RPS-eligible energy resources.

To develop its IRP, CPA used:

- Inputs that were consistent with the CPUC Reference System Plan
- An IRP model developed by Siemens to determine least-cost resource procurement options to meet CPA's emissions goals and regulatory requirements
- The CSP methodology to calculate its emissions and ensure compliance with the emissions benchmark assigned to CPA

Load Assignments for Each LSE

CPA's electricity load forecast is based on historical meter data which consists of 15-minute and hourly meter usage per customer by end-use classification (i.e., residential, commercial, industrial). As a general rule, residential customers have hourly readings and non-residential customers have 15-minute readings. CPA's long-term load forecast is primarily influenced by the number of customers that CPA serves, energy use, and expected customer participation rates. Typical variables that drive the load forecast are weather, economic cycles, local distributed generation, and changes in customer consumption patterns such as increased use of electric vehicles or energy efficiency savings.

CPA developed its load forecasts in a manner consistent with the 2019 California Energy Commission (CEC) Integrated Energy Policy Report (IEPR) projections. The expected load forecast projected by CPA for 2030 were approved in an Administrative Law Judge (ALJ) ruling on May 20, 2020 ("Finalizing ALJ Ruling").² Under the Finalizing ALJ Ruling, CPA's 2030 load forecast is 11,867 GWh.

CPA's annual base load forecast and load modifiers were derived from the "mid Baseline mid AAEE" version of Form 1.1c of the CEC's IEPR 2019 release. CPA's load was modeled in AURORA to include all load modifiers. The reason for this approach is due to the inability to disaggregate load modifiers provided by CPUC down to individual LSEs, as the data provided by the CPUC is aggregated by Transmission Access Charge (TAC) area.

In order to develop CPA's annual base load forecast into monthly and hourly data, historical hourly metered data was utilized. The process for translating the annual energy forecast from Form 1.1c into hourly load inputs is described below:

² Administrative Law Judge's Ruling Correcting April 15, 2020 Ruling Finalizing Load Forecasts and Greenhouse Gas Emissions Benchmarks for Individual 2020 Integrated Resource Plan Filings, issued on May 20, 2020. CPA's load forecast is on page 4.

1. Extracted annual energy forecasts from 2020-2030 from the “mid Baseline mid AAEE” version of Form 1.1c of the CEC 2019 IEPR Release
2. Developed monthly average load shapes from historic metered data and near-term modeling data from CPA. The monthly average load shapes were then applied to the annual energy forecasts to provide average demand on a monthly basis.
3. Developed monthly peak load shapes from historic metered data and near-term modeling data from CPA. The monthly peak load shapes were then applied to the monthly average energy forecasts to provide peak demand on a monthly basis.
4. Developed hourly load shapes from historic metered data and near-term modeling data from CPA. The hourly load shapes were then applied to the monthly average energy and monthly peak energy to provide load on an hourly basis.

The process used to derive hourly load from the CEC’s IEPR data ensures that the total annual energy volumes for load remains consistent with CPA’s assigned forecast, as shown in Table 1 below:

Table 1: Load Forecast

CPA	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Load Forecast (GWh)	11,639	11,626	11,616	11,663	11,675	11,693	11,708	11,733	11,775	11,820	11,867
Peak Forecast (MW)	2,910	2,914	2,912	2,924	2,919	2,931	2,935	2,941	2,944	2,963	2,975

Required Portfolios

CPA’s IRP presents a strategy for meeting CPA’s energy and capacity needs and is guided by the goals and policies established by CPA’s Board and the State’s procurement requirements for load-serving entities. Notably, this includes California’s renewable portfolio standard (RPS) and GHG emission obligations. CPA has established electricity supply goals and policies as described in the Objectives section below. In applying the goals and policies to CPA’s portfolio, in partnership with its consultant Siemens, CPA analyzed different options for electricity supply procurement over a planning horizon from 2020-2040.

For the purpose of this 2020 IRP Filing, CPA has developed the Conforming Portfolios. All the portfolios developed and use the “mid Baseline mid AAEE” version of Form 1.1c of the CECs 2019 IEPR demand forecast and use inputs and assumptions consistent with those used by the staff to develop the Reference System Portfolio (RSP).

CPA is not submitting additional Alternative Portfolios.

GHG Emissions Benchmark and GHG Accounting

CPA developed and evaluated its portfolios using its specific GHG emissions benchmark as assigned in the Finalizing ALJ Ruling (2.113 MMT for the 46 MMT Conforming Portfolio and 1.746 MMT in the 38 MMT Conforming Portfolio). CPA used the CSP methodology and CSP Calculator Tool for GHG

accounting and determining the emissions associated with each CPA's Conforming Portfolio. CPA determined that its portfolio emissions were aligned as closely as possible with the GHG emissions benchmark, net of behind-the meter combined heat and power, assigned to it under the CSP methodology. This resulted in both portfolios with emission benchmarks under the assigned values by no more than 1%. The table below shows GHG emissions benchmark, net of behind-the meter combined heat and power, and CPA Conforming Portfolio 2030 results.

Table 2: CPA Portfolio 2030 GHG Results

Metric	2030 GHG Emissions (46 MMT)	2030 GHG Emissions (38 MMT)
Emission Benchmark for CPA	1.785	1.417
CPA Portfolio 2030 Results	1.782	1.409

a. Objectives

CPA is committed to comply with the CPUC's IRP process to meet its obligation of serving customers affordable and reliable electricity and meeting or exceeding California's emissions reductions goals. CPA intends to comply with all statutory and regulatory goals and requirements, including SB 350, SB 100, and Resource Adequacy.

CPA's approach was intended to adhere to the two Conforming Portfolios, consistent with CPUC's adopted assumptions. In addition, CPA's portfolios reflect two key priorities of CPA's communities:

- Beyond the state's minimum renewable procurement requirements, CPA's Board has established additional requirements for renewable procurement via its product offerings and community default rate selections, which pursue aggressive renewable energy targets. As described in the Executive Summary, CPA offers its customers the options of Lean, Clean, and 100% Green rates, which correspond to various renewable energy content percentages (minimum RPS compliance, 50%, and 100%, respectively). Approximately one-quarter of CPA's customers receive service at the 100% Green rate, which means that CPA serves these customers with 100% RPS-certified energy. Due to this additional voluntary procurement to meet its customers' demand for renewable energy resources, CPA is expecting to meet its SB 100 target of 60% renewable energy starting as early as 2020, much earlier than the 2030 RPS compliance target. CPA assumes a modest growth in RPS portfolio content over time as demonstrated in its IRP Conforming Portfolios. A substantial driver of the increase in CPA's contracted new renewable capacity is reflective of CPA's transition from meeting renewable energy demand from short-term contracts with existing resources to long-term power purchase agreements with new build renewable resources, which is a priority for CPA's communities.
- Per its Joint Powers Agreement, CPA has a goal of achieving overall lower GHG emissions than that of the local IOU. In order to achieve this internal GHG target, beyond the renewable energy

procurement CPA conducts to meet its customer demand obligations, CPA also procures non-RPS carbon free resources from existing large hydro resources. Assumptions about this procurement is described in more detail in the Methodology section.

Table 3: CPA Internal RPS and GHG-Free Targets by Year

CPA	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RPS	60%	61%	61%	61%	62%	62%	63%	65%	67%	69%	70%
GHG-Free	63%	64%	63%	65%	67%	69%	71%	78%	82%	86%	90%

CPA's portfolio was developed and optimized around these internal RPS and GHG-free goals, and then resources were removed or added to arrive within one percent of the CPUC GHG MMT target for the respective case. In addition, CPA selected the portfolios that minimize negative impacts and emphasizes benefits for Disadvantaged Communities (DACs) and reduce market risks for energy procurement through long-term acquisition of renewable resources at fixed price.

b. Methodology

CPA utilized the CPUC Reference Plan as the framework to create the CPA Conforming Portfolios and developed a methodology for evaluating these portfolios. CPA designed these portfolios to comply with regulatory requirements while still achieving CPA's community procurement objectives.

i. Modeling Tool

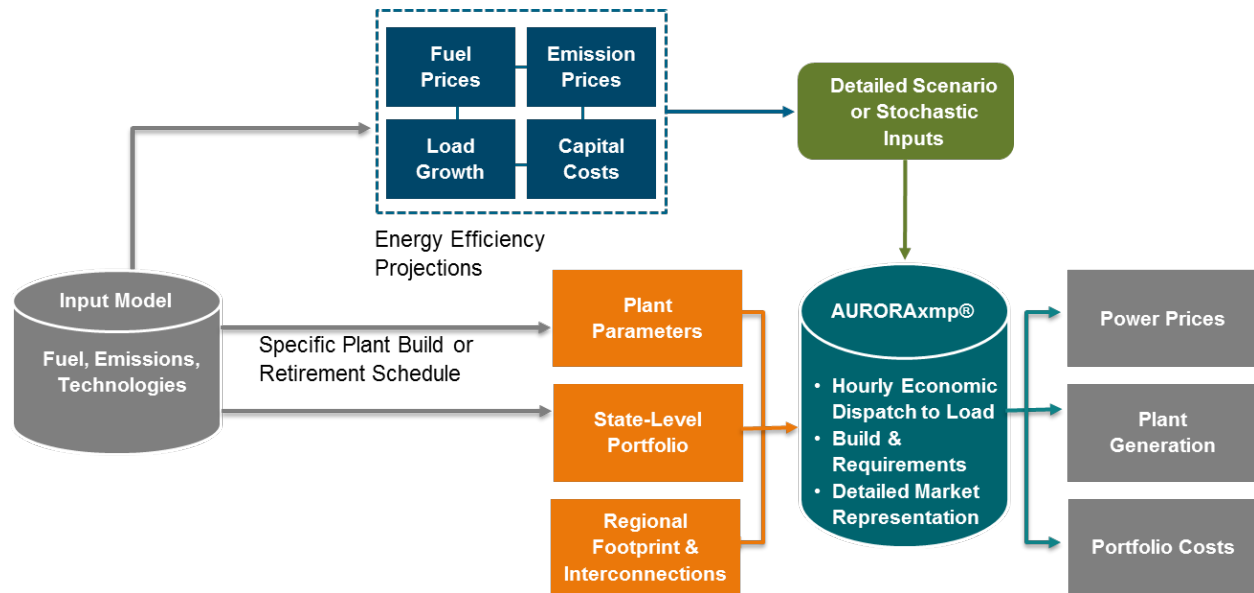
The modeling software used to develop the IRP was Energy Exemplar's Aurora Forecasting Software (AURORA). The version used is 13.4.1024, released on March 10, 2020. AURORA is a chronological unit commitment model, which works to simulate the economic dispatch of power plants within a competitive market framework. The model uses a mixed integer linear programming (MIP) approach to capture details of power plant and transmission network operations, while observing real world constraints. Constraints include items such as emission reduction targets, transmission and plant operating limits, renewable energy availability and mandatory portfolio targets. AURORA is widely used by electric utilities, consulting agencies, and other stakeholders for the purpose of forecasting generator performance and economics, developing IRPs, forecasting power market prices, assessing detailed impacts of regulatory and market changes impacting the electric power industry, and to generate financially optimized generating portfolios. The model can assess the potential performance and capital costs of existing and prospective generation technologies and resources, and make resource addition and retirement decisions for economic, system reliability, and policy compliance reasons on a utility system.

The CPUC uses RESOLVE to develop the RSP, which identifies the new resources that meet the GHG emissions planning constraint. As opposed to AURORA, which models each generator independently, the RESOLVE model groups together resource categories with similar operational characteristics (e.g.

nuclear, coal, gas CCGT, gas peaker, renewables) and models them collectively. RESOLVE uses a linearized unit commitment where the commitment variable for each class of generators is a continuous variable rather than an integer variable. AURORA models the operating cost and performance parameters on a plant-level basis, where the optimization method uses a mixed MIP to determine unit commitment. Based on public documents, RESOLVE is run for a sampled 37 days in a year and only for a few years, therefore, only representative load and renewable profiles were selected to reflect system conditions. CPUC uses SERVIM as a separate tool to examine system reliability and simulate production cost. AURORA is both a long-term capacity expansion tool (LTCE) and a production cost model. In the long-term capacity expansion process, Siemens used a sampling of 104 days and every other hour for each year of the 20-year study horizon (2020-2040). In the final simulation of the system (production cost simulation), AURORA simulates plant operating and market conditions for every hour, day, and year of the study horizon.

A summary of the methodology with key inputs, algorithms, and outputs is shown below:

Figure 1: Market Analysis Methodology



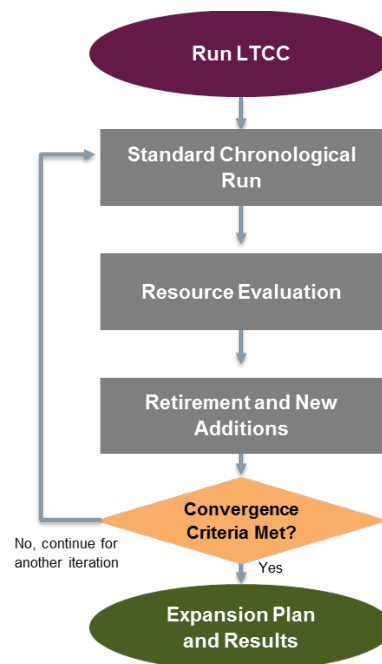
AURORA is an hourly, chronological production cost model with an integrated LTCE feature that produces a resource expansion plan given resource options and constraints around those options. The options can include supply and demand generic resources, including storage, for inclusion in the expansion plan, existing resources and existing resources for economic retirement as desired. The full set of standard operational and cost parameters for new and existing resources are considered in the LTCE, providing a robust framework from which to evaluate different technologies with different operational (intermittent vs. baseload) cost and incentive profiles. The LTCE considers constraints such as reserve margin targets or requirements, renewable portfolio standards, carbon limits, and ancillary service constraints.

Siemens' long-term capacity expansion logic is illustrated in the Figure below. The LTCE makes use of an iterative logic to develop a regional capacity expansion plan. At the end of any given iteration, it has the information it needs to take retirement actions on existing uneconomic resources and to select economically viable new resource options. Convergence criteria reduce the total number of resource alternatives which are considered by the LTCE through the iterations, with a converged solution being defined as one in which system prices remain stable even with change in resource alternatives. In other words, the solution reflects an expansion plan that is at once both economically rational and stable.

AURORA uses a dynamic simulation of adding, or retiring, economic capacity with optimization logic to forecast LCTE resources and retirements. With this approach, AURORA performs an iterative future analysis where:

1. Resources that have negative going-forward value (revenue minus costs) are retired;
2. Resources with positive values are added to the system on a gradual basis, whereby a set of resources with the most positive net present value is selected from the set of new resource options and added to the study;
3. AURORA then uses the new set of resources to compute all the values again; and
4. The process of adding and retiring resources is continually repeated until the system price stabilizes, indicating that an optimal set of resources has been identified for the study.

Figure 2: Long-Term Capacity Expansion



AURORA and RESOLVE both optimize dispatch for a system under a given set of inputs. RESOLVE is a linear optimization model, which assesses dispatch based on representative days over a defined forecast horizon. AURORA differs in that it is a mixed integer program and hourly chronological dispatch simulation. RESOLVE generally focuses on a single market, reflecting high level interties and market

interaction with neighboring regions. Aurora can be set up in several different ways. For this analysis, AURORA was run for the entire western interconnect.

Both RESOLVE and AURORA identify the optimal resources to meet needs based on the technology options offered including generation and storage. Both models also allow for the incorporation of different types of market and portfolio constraints including renewable generation, carbon emissions (or emission rates), reserve margin, and timing of new build requirements.

ii. Modeling Approach

For this IRP, AURORA was used to develop a 20-year IRP that simultaneously satisfies system reliability constraints, RPS and GHG targets and minimizes the Net Present Value (NPV) of the sum of investment cost and operation cost over a 20-year planning horizon.

Inputs

CPA's 2019-2020 IRP inputs and assumptions reflect those of the CPUC's 2019-2020 Inputs and Assumptions document. The following are the same: load forecast, fuel prices, emissions costs, technology costs and operational specifications, baseline and candidate resources and resource availability (see Table 4), transmission constraints, state's RPS target, and 46 MMT GHG emissions target or 38 MMT GHG emissions target, depending on case, for the electric sector by 2030.

Table 4: Candidate Resource First Available Online Year

Resource Type	First Available Year
Solar PV	2020
Wind (CA onshore)	2022-2023
Wind (OOS onshore)	2026
Wind (offshore)	2030
Geothermal	2024-2026
Biomass	2020
Long-duration Storage	2026
Battery Storage	2020

The REC and GHG-free prices were developed based on S&P Platts North American Emissions Special Report, as show in Table 5.

Table 5: PCC1 Renewable Energy Certificates and Carbon Free Attribute Price Forecast (2020-2030)

Year	PCC 1 RECs	CA Carbon Price
	2016\$/MWh	2018\$/MWh
2020	15.12	6.0
2021	15.36	6.1
2022	15.60	6.3
2023	15.84	6.6
2024	16.08	7.0
2025	15.36	7.1
2026	15.12	7.1
2027	14.40	6.8
2028	13.44	6.0
2029	12.24	4.9
2030	9.60	3.1

Post Processing

As part of the 2019-2020 IRP filing, CPA developed several post-processing calculations that were used to generate metric for the portfolio. The post-processing calculations encompassed cost metrics, reliability metrics, emissions metrics and a few other miscellaneous metrics. Almost all the calculations were based off outputs from the AURORA model. Notable exceptions include PCC 1 prices, GHG-free prices and system capacity prices.. Critical post-processed calculations are discussed below.

To provide deeper insights into portfolio costs several variations of cost to serve load on a \$/MWh basis were developed. Additional cost metrics included were:

- Weighted Average Cost New Capacity (\$/MWh)
- Weighted Average PPA Costs (\$/MWh)
- Weighted Average Cost of Short-term Contracts (\$/MWh)
- Weighted Average Cost of Spot Purchases (\$/MWh)
- Weighted Average Cost of RA Capacity Purchases (\$/kW-year)
- Weighted Average Cost of RPS Attributes
- Weighted Average Cost of GHG-Free Attributes

To provide deeper insights into reliability metrics and procurement activities metrics regarding reserve margin and open RA balance were calculated. Notably, Siemens applied a 15% planning reserve margin (PRM) to peak demand and reported CPA's system capacity MW surplus / shortfall on an annual basis.

- Planning Reserve Margin (15%)
- Surplus/Short MW over Planning Reserve Margin Requirement (PRMR)

- Reserve Margin %
- Capacity Open Balance

To provide deeper insights into the generation and emission profiles of the portfolio, several metrics were developed to test compliance with CPUC and CPA Internal requirements. Calculations were applied to determine the percentage of the portfolio covered from long-term contracts to test compliance to SB 350's long-term contracting requirement. Additionally, post-processing calculations were considered for the RPS and GHG-free positions of the portfolio. The AURORA model did not include the ability for CPA to procure attribute only contracts to meet RPS and GHG-free internal targets. As a result, a post-processing calculation was created to identify any additional PCC 1 and/or GHG-free attribute only products that would be required to procure to meet/exceed the CPUC RPS requirements and meet internal requirements.

- Long-term Contracting Requirements (MWh)
- Pre-Procurement RPS % of Load
- Pre-Procurement GHG-free % of Load
- Additional PCC 1 Purchases
- Additional GHG-free Purchases

Geographic Resource Profile Selection

The AURORA model utilized in-house renewable generation profiles for certain assets and AURORA's built in storage logic to administer charging and discharging on an hourly basis. The renewable generation profiles were derived from NREL. A deeper discussion of the derivation for these shapes can be found in the Generic Resources section below. In order to comply with CPUC requirements to provide contracted/built resources tied to the geographic regions represented in the CSP, specifically wind and solar resources, CPA applied the geographic distribution from the 46 MMT RSP to its portfolios.

In order to determine the allocation of resources for the preferred portfolio submissions CPA intended to match the distribution of resources from the 46 MMT RSP adopted in the CPUC Final Decision. The RESOLVE results viewer was used to extract the incremental capacity built from the RESOLVE model. Specifically, the 46MMT_20200207_2045_2GWPRM_NOOTCEXT_RSP_PD case was used. Data was extracted from the "Portfolio Analytics" tab and using the CSP to RESOLVE areas mapping listed in the Resource Data Template tab "cns_mapping" translated RESOLVE geographic areas to CSP geographic areas. However, the Baja_California_Wind RESOLVE location was not included in the cns_mapping tab and includes a resource that should have been tied to the Southern_CA_Desert_Southern_NV_Wind CSP category. As a result, this incremental expansion was excluded from the distribution calculations.

As a result of resources not being reported in the years 2025, 2027, 2028 and 2029, CPA applied the average distribution over the IRP planning horizon.

Table 6: Geographic Distribution Assumptions

Solar	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Avg.
Greater_Kramer_Solar	0%	0%	7%	5%	5%		5%				4%	4%
Sacramento_River_Solar	0%	0%	0%	0%	0%		0%				0%	0%
Southern_CA_Desert Southern_NV_Solar	60%	30%	34%	29%	29%		29%				39%	36%
Southern_PGE_Solar	0%	0%	2%	24%	24%		24%				19%	13%
Tehachapi_Solar	40%	70%	57%	43%	43%		43%				38%	48%

Wind (OnShore)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Avg.
New_Mexico_Wind		0%	0%	0%	0%		0%				21%	4%
Sacramento_River_Wind		100%	74%	74%	67%		67%				51%	72%
Southern_CA_Desert_ Southern_NV_Wind												
Southern_PGE_Wind		0%	12%	12%	20%		20%				18%	14%
Tehachapi_Wind		0%	14%	14%	13%		13%				10%	11%

CPA then adjusted geographic distributions to account for locations of known planned resources.

Short Term Contracts

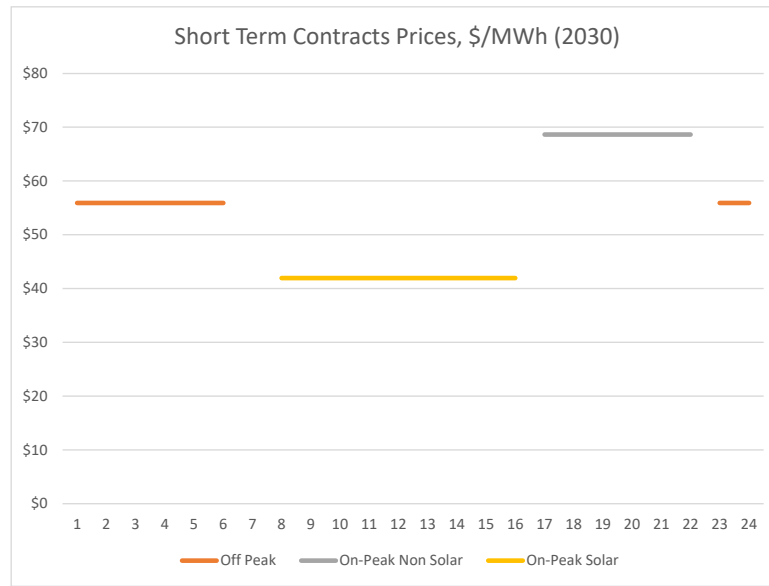
In order to account for CPA's ability to engage in short-term contracts with existing resources to reduce portfolio risk and fill short-term gaps in meeting load and/or meeting RPS and GHG-free targets, the analysis included three blocks of clean energy contracts that could be procured as part of the long-term capacity expansion. Under the LTCE simulations, short-term contract options were included as alternatives for new capacity to meet load and/or environmental targets along with long-term wind, solar, geothermal, pump storage and battery storage among others. However, unlike new capacity contracts, the short-term contracts were set-up to be procured in 1-year increments. The simulations displayed that contracting long-term assets is the least cost portfolio for CPA and is effective at reducing market exposure and risks to the portfolio. However, the short-term contracts did penetrate and helped to fulfill short-term gaps in serving load or meeting compliance targets. In particular, the short-term contracts were useful in the first three years of the forecast period when CPA is still building the portfolio.

The products are representations of block energy purchases that follow the energy profile of underlying assets that can be used to serve electricity and RPS needs in the future. The three blocks of products include hours pertaining to the: Solar Peak, Non-Solar Peak and Off Peak. The energy blocks were priced at forecast annual spot prices + forecasted PCC 1 prices on an annual basis.

The three one-year duration short-term contract options included were: Solar Peak, Solar Non- Peak and Off-Peak, with Solar peak defined as the period comprising of HE 08-16, Solar Non-peak for HE 07 & HE 17-22, and Off-peak for HE 01-06 & HE 23-24 plus all hours during weekends.

Chart 3 illustrates the annual price of each contract option type in 2030 under the 46 MMT Compliance Case.

Figure 3: Short-term Contracts



Contracted Resources

To date, CPA's Board has approved 10 long-term clean energy contracts, with hundreds of additional megawatts of new clean energy resources under negotiation:

Table 7: Executed Long-term Contracts

Project	Resource Type	Status	Commercial Operation Date	Term (Years)	Renewable MWs	Storage MWs
Voyager	Wind	Online	12/28/2018	15	21.6	
Kaweah	Hydro	Online	7/1/2020	10	20.09	
Isabella	Hydro	Contracted	12/8/2020	10	11.95	
Mohave	Wind	Contracted	12/31/2020	20	300	
Golden Fields	Solar	Contracted	3/31/2021	15	40	
Luna	Storage	Contracted	7/31/2021	15		100
Sanborn	Storage	Contracted	8/1/2021	15		100
High Desert	Solar + Storage	Contracted	8/1/2021	15	100	50
Arlington	Solar	Contracted	12/31/2021	15	233	
Azalea	Solar + Storage	Contracted	12/31/2022	15	60	38
Total					786.64	288

CPA provided a list of long-term power purchase agreements (PPAs) currently under contract in the Resource Data Template. The information provided included technology, term, contracted generation, price and hourly shapes, among other items. All CPA's executed PPAs were included in the simulations in the AURORA model along with new capacity selected by the LTCE.

Generic Resources

As part of the simulation, the Siemens team utilized representative hourly generation shapes for wind and solar assets in Northern and Southern California derived from the 2018 NREL ATB report. The shapes differ to some extent with the location specific shapes available in the CSP calculators. The Figures below shows a comparison of the average hourly capacity factors for the representative solar shapes used in the AURORA model compared to the location specific solar shapes in the CSP calculators and an equivalent comparison of the average hourly capacity factors for wind resources.

Figure 4: Solar Tracking Shapes

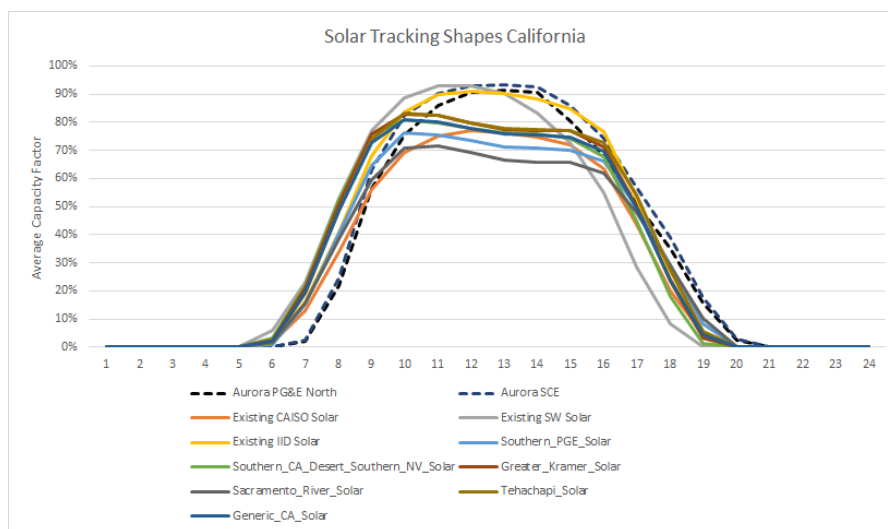
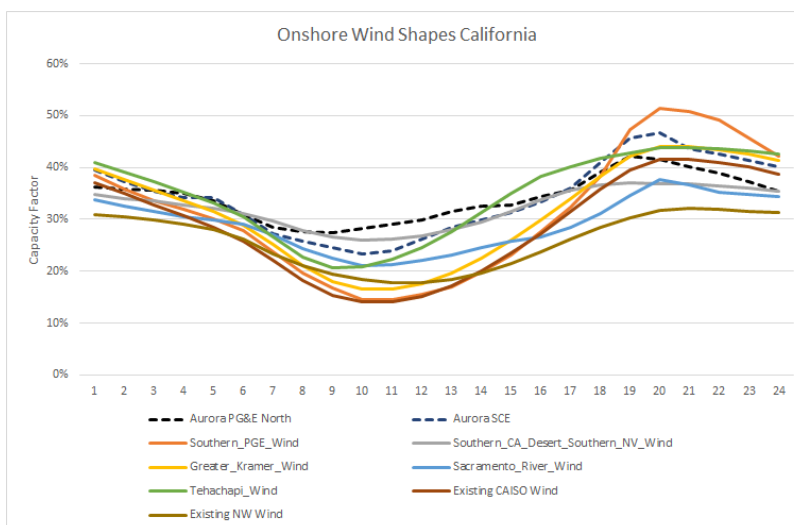


Figure 5: Comparison Wind Profiles



In addition to the executed PPAs, CPA provided information on existing resource adequacy contracts and environmental products (short-term RECs and carbon free products) which were included in the modeling environment.

Hydro

Hydro assumptions relied on the CPUC's 2019-2020 IRP assumptions on availability and contracting price of hydro resources. The analysis followed the RSP Plan to determine out-of-state and in-state hydro availability for CPA's in absence of available public information on contracted hydro or expected to be contracted in the future. The RSP Plan shows 2,852 MW of available imported hydro in 2020-2030, and 7,070 MW of in-state large hydro during the same time period. For imported hydro, CPA considered BPA and WAPA as potential counterparties.

The analysis assumed that CPA would have an amount of hydro to procure equivalent to its relative share of load in California or the regions of California with direct interties to the Pacific Northwest. CPA's corresponding share is approximately 295 MW and is reflected in Table 9.

For large in-state hydro, the potential procured capacity is assumed to be equivalent to the CPA's share of the total California load, assuming that CPA can procure hydro from anywhere in California. CPA's corresponding share is approximately 320 MW and is reflected in Table 10.

In-state and out of state hydro resources follow the generation profiles provided in the CSP calculators with annual capacity factors for imported hydro in the 44% levels and in-state at 31%. It was also assumed contracted hydro prices for each type based on information obtained from Energy Division on forecasts operational costs, see Table 11.

Table 8: Available Large Hydro per New RSP Plan

Annual Availability	2020-2030
In State Hydro - MW	7,070
Hydro (Scheduled Imports) - MW	2,852

Table 9: Potentially Available Hydro Imports (MW)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CPA	294	295	294	294	292	291	290	289	288	288	288

Table 10: Potentially Available In-State Large Hydro (MW)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CPA	324	324	323	322	320	319	317	316	315	314	313

Table 11: Assumed Contract Prices for Hydro (2016\$/MWh)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
In-State Hydro	37.17	37.77	37.29	34.32	35.18	36.04	36.90	44.39	51.88	59.37	66.86
Import Hydro	30.71	31.56	31.85	31.76	32.64	33.09	33.54	42.05	50.56	59.07	67.58

For hydro resources CSP hourly shapes for in-state and imported hydro were used for new hydro contracts while the storage component was modeled independently using the AURORA chronological storage dispatch logic.

Curtailment

The AURORA model determines curtailments for solar, wind and other non-dispatchable resources on an hourly basis based on load requirements, battery storage charging and economics. During a specific hour of the day, for instance during solar hours, if there is excess generation, the AURORA model determines how much of that excess generation is used to charge batteries and how much would be curtailed. Results of curtailment are presented in the System Reliability section.

III. Study Results

This section summarizes the results from the analytical work described in Section II.

a. Conforming Portfolios

CPA evaluated several Conforming Portfolios and selected the 46 and 38 MMT portfolios that balance procurement flexibility in the near-term and a resource mix that minimizes costs to ratepayers based on NPV, while meeting regulatory requirements and emissions goals. Table 12, Table 13, Figure 6, Figure 7 provides summary of the resources provided in the Resource Data Template for each case.

Table 12: Summary of 46 MMT Portfolio

46 MMT	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Contracted Resources											
Solar	0	100	300	433	433	433	433	433	433	433	433
Wind (CA onshore)	33	33	33	22	22	22	22	22	22	22	22
Wind (OOS onshore)	0	0	300	300	300	300	300	300	300	300	300
RPS Hydro	32	32	32	32	32	32	32	32	32	32	32
Battery Storage	0	250	288	288	288	288	288	288	288	288	288
Planned Resources											
Existing Large Hydro (In State)	0	45	45	75	90	120	120	240	240	240	240
Existing Large Hydro (Out State)	0	45	45	75	90	120	120	200	200	200	200
Battery Storage (Li-Ion)	0	0	62	162	362	462	562	662	662	712	762
Long Duration Storage	0	0	0	0	0	0	0	0	0	0	0
Flow Battery	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	35	35	70	105	105
Solar PV	0	0	240	940	1,440	1,440	1,440	1,440	1,440	1,440	1,440
Wind (CA onshore)	0	0	0	100	200	400	400	400	400	400	400
Wind (Offshore)	0	0	0	0	0	0	0	0	0	0	0
Wind (OOS onshore)	0	0	0	0	0	0	0	0	0	0	0
Solar Peak	0	355	650	150	0	0	0	0	0	0	0
Non-Solar Peak	0	0	0	50	0	0	0	0	0	0	0
OffPeak	0	0	0	0	0	0	0	0	0	0	0

Table 13: Summary of 38 MMT Portfolio

38 MMT	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Contracted Resources											
Solar	0	100	300	433	433	433	433	433	433	433	433
Wind (CA onshore)	33	33	33	22	22	22	22	22	22	22	22
Wind (OOS onshore)	0	0	300	300	300	300	300	300	300	300	300
RPS Hydro	32	32	32	32	32	32	32	32	32	32	32
Battery Storage	0	250	288	288	288	288	288	288	288	288	288
Planned Resources											
Existing Large Hydro (In State)	0	45	45	75	90	120	120	240	300	300	300
Existing Large Hydro (Out State)	0	45	45	75	90	120	120	240	290	290	290
Battery Storage (Li-Ion)	0	0	62	162	362	462	562	662	662	712	762
Long Duration Storage	0	0	0	0	0	0	0	0	0	0	0
Flow Battery	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	70	70	105	140	175
Solar PV	0	0	240	940	1,440	1,440	1,440	1,440	1,440	1,490	1,540
Wind (CA onshore)	0	0	0	100	200	400	400	400	400	400	400
Wind (Offshore)	0	0	0	0	0	0	0	0	0	0	100
Wind (OOS onshore)	0	0	0	0	0	0	0	0	0	0	0
Solar Peak	0	270	650	150	0	0	0	0	0	0	10
Non-Solar Peak	0	0	0	100	0	0	0	50	0	0	0
OffPeak	0	100	0	0	0	0	0	0	0	0	0

CPA is expecting to bring a significant number of new clean resources to California, 3,750 MW in the 46 MMT ton case and 4,020 MW 38 MMT ton case, as shown in Figures 6 and 7 below.

Figure 6: CPA Expansion Plan (Proposed PPAs for the 46 MMT Conforming Portfolio)

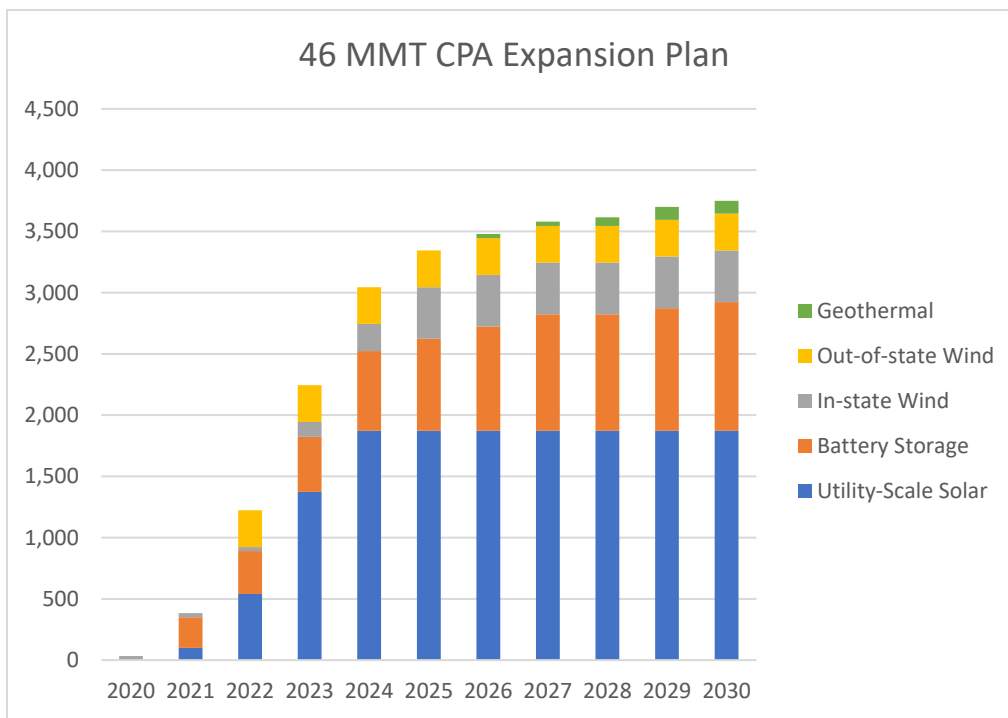
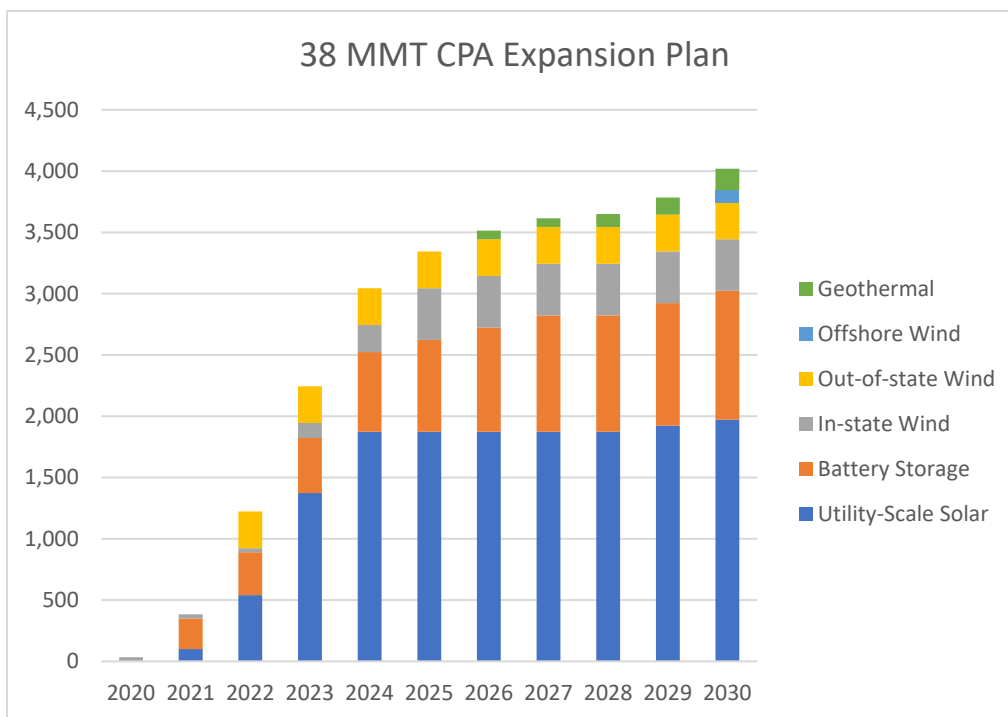


Figure 7: CPA Expansion Plan (Proposed PPAs for the 38 MMT Conforming Portfolio)



Comparison of CPA Conforming Portfolios vs. the RSP

Deviations between the proportional share of the RSP and the conforming portfolios are shown in the tables 14 and 15 below. For CPA, overall, there are more new resources selected than the proportional share of the RSP since only renewable resources were considered in the candidate resources. Existing fossil and nuclear generation were not allowed in the portfolio.

Table 14: RSP Comparison for 46 MMT Preferred Conforming Portfolio

CPA Proportional Share of the 46 MMT Proposed RSP (MW)							CPA 46 MMT Capacity (MW)				Difference (RSP Share - CPA Plan)			
Resource	MW	Type	2020	2022	2026	2030	2020	2022	2026	2030	2020	2022	2026	2030
2-hr Battery Storage	MW	Storage	26	27	48	329	-	-	-	-	(26)	(27)	(48)	(329)
4-hr Battery Storage	MW	Storage	64	203	394	264	-	350	850	1,050	(64)	147	456	786
Pumped Storage	MW	Storage	78	78	126	126	-	-	-	-	(78)	(78)	(126)	(126)
Large Hydro	MW	Large Hydro	345	345	345	345	-	45	120	240	(345)	(300)	(225)	(105)
Imported Hydro	MW	Large Hydro	139	139	139	139	-	45	120	200	(139)	(94)	(19)	61
Geothermal	MW	Geothermal	90	90	90	90	-	-	35	105	(90)	(90)	(55)	15
Small Hydro	MW	Small Hydro	48	48	48	48	20	20	20	20	(27)	(27)	(27)	(27)
Candidate Wind Resources														
Southern_PGE_Wind	MW	Wind	-	11	21	25	-	-	54	54	-	(11)	33	29
Southern_CA_Desert_Southern_NV_Wind	MW	Wind	-	-	29	29	-	-	-	-	-	-	(29)	(29)
Greater_Kramer_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Sacramento_River_Wind	MW	Wind	-	70	70	70	-	-	290	290	-	(70)	220	220
Tehachapi_Wind	MW	Wind	-	13	13	13	-	-	42	42	-	(13)	29	29
Generic_CA_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Wyoming_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
New_Mexico_Wind	MW	Wind	-	-	-	30	-	-	14	14	-	-	14	(16)
NW_Ext_Tx_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
SW_Ext_Tx_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Humboldt_Bay_Offshore_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Diablo_Canyon_Offshore_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Candidate Solar Resources														
Southern_PGE_Solar	MW	Solar	-	7	93	102	-	3	171	171	-	(4)	78	69
Southern_CA_Desert_Southern_NV_Solar	MW	Solar	58	101	113	212	-	196	624	624	(58)	95	511	412
Greater_Kramer_Solar	MW	Solar	-	19	19	19	-	13	46	46	-	(6)	27	27
Sacramento_River_Solar	MW	Solar	-	-	-	-	-	-	-	-	-	-	-	-
Tehachapi_Solar	MW	Solar	39	166	166	205	-	188	759	759	(39)	22	593	554
Generic_CA_Solar	MW	Solar	-	-	-	-	-	-	-	-	-	-	-	-

CPA's 46 MMT preferred conforming portfolio calls for: 1050 MW of 4-hour storage, comparing with 593 MW of short-duration storage and 126 MW of long-duration storage allocation from the RSP; 440 MW large hydro resources, comparing with 485 MW from load allocation in the RSP; 105 MW geothermal resources align with the RSP; 400 MW total wind resources comparing with 168 MW of allocated RSP wind resources; 1600 MW total solar resources comparing with 538 MW allocated RSP solar resources.

Table 15: RSP Comparison for 38 MMT Preferred Conforming Portfolio

CPA Proportional Share of the 38 MMT Proposed RSP (MW)							CPA 38 MMT Capacity (MW)				Difference (RSP Share - CPA Plan)			
Resource	MW	Type	2020	2022	2026	2030	2020	2022	2026	2030	2020	2022	2026	2030
2-hr Battery Storage	MW	Storage	26	27	48	262	-	-	-	-	(26)	(27)	(48)	(262)
4-hr Battery Storage	MW	Storage	64	203	341	372	-	350	850	1,050	(64)	147	509	678
Pumped Storage	MW	Storage	78	78	156	156	-	-	-	-	(78)	(78)	(156)	(156)
Large Hydro	MW	Large Hydro	345	345	345	345	-	45	120	300	(345)	(300)	(225)	(45)
Imported Hydro	MW	Large Hydro	139	139	139	139	-	45	120	290	(139)	(94)	(19)	151
Geothermal	MW	Geothermal	90	90	90	90	-	-	70	175	(90)	(90)	(20)	85
Small Hydro	MW	Small Hydro	48	48	48	48	20	20	20	20	(27)	(27)	(27)	(27)
Candidate Wind Resources														
Southern_PGE_Wind	MW	Wind	-	11	25	25	-	-	54	54	-	(11)	29	29
Southern_CA_Desert_Southern_NV_Wind	MW	Wind	-	22	51	51	-	-	-	-	-	(22)	(51)	(51)
Greater_Kramer_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Sacramento_River_Wind	MW	Wind	-	70	70	70	-	-	290	290	-	(70)	220	220
Tehachapi_Wind	MW	Wind	-	13	13	13	-	-	42	42	-	(13)	29	29
Generic_CA_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Wyoming_Wind	MW	Wind	-	-	-	73	-	-	-	-	-	-	-	(73)
New_Mexico_Wind	MW	Wind	-	-	-	73	-	-	14	14	-	-	14	(59)
NW_Ext_Tx_Wind	MW	Wind	-	26	26	73	-	-	-	-	-	(26)	(26)	(73)
SW_Ext_Tx_Wind	MW	Wind	-	-	-	24	-	-	-	-	-	-	-	(24)
Humboldt_Bay_Offshore_Wind	MW	Wind	-	-	-	-	-	-	-	-	-	-	-	-
Diablo_Canyon_Offshore_Wind	MW	Wind	-	-	-	-	-	-	-	100	-	-	-	100
Candidate Solar Resources														
Southern_PGE_Solar	MW	Solar	-	6	91	171	-	3	171	184	-	(3)	80	13
Southern_CA_Desert_Southern_NV_Solar	MW	Solar	60	102	147	190	-	196	624	660	(60)	94	477	470
Greater_Kramer_Solar	MW	Solar	-	19	19	19	-	13	46	49	-	(6)	27	30
Sacramento_River_Solar	MW	Solar	-	-	-	-	-	-	-	-	-	-	-	-
Tehachapi_Solar	MW	Solar	38	166	166	205	-	188	759	807	(38)	22	593	602
Generic CA Solar	MW	Solar	-	-	-	-	-	-	-	-	-	-	-	-

CPA's 38 MMT preferred conforming portfolio calls for: 1050 MW of 4-hour storage, comparing with 634 MW of short-duration storage and 156 MW of long-duration storage allocation from the RSP; 590 MW total hydro resources, comparing with 485 MW from load allocation in the RSP; 175 MW geothermal resources align with the RSP; 500 MW total wind resources comparing with 404 MW of allocated RSP wind resources; 1,700 MW total solar resources comparing with 585 MW allocated RSP solar resources.

b. Preferred Conforming Portfolios

CPA is presenting the two Conforming Portfolios, one for the 46 MMT GHG target and another for the 38 MMT GHG target, for Commission approval or certification. While CPA is complying with the Commissions' request for two Conforming Portfolios, the 38 MMT case is more reflective of the procurement objectives and preferences of CPA's Board and local stakeholders. A comparison of the two cases is shown in Table 16.

Table 16: Conforming Portfolios Comparison

2030 Portfolio Comparison	Capacity (MW)	Capacity (MW)
Resource	46 MMT	38 MMT
Utility-Scale Solar	1,873	1,973
Battery Storage	1,050	1,050
In-state Wind	422	422
Out-of-state Wind	300	300
Offshore Wind	-	100
Geothermal	105	175
RPS Hydro	32	32
Large Hydro (in State)	240	300
Large Hydro (Out of State)	200	290

Both portfolios achieve and exceed RPS compliance requirements for the entire study period, as shown in Figure 8 and 9 below.

Figure 8: 46 MMT RPS Compliance

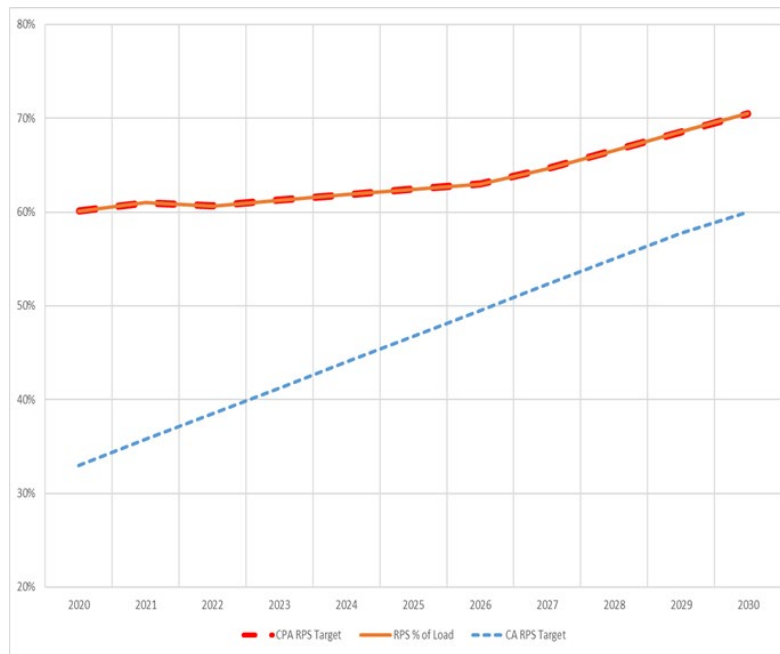
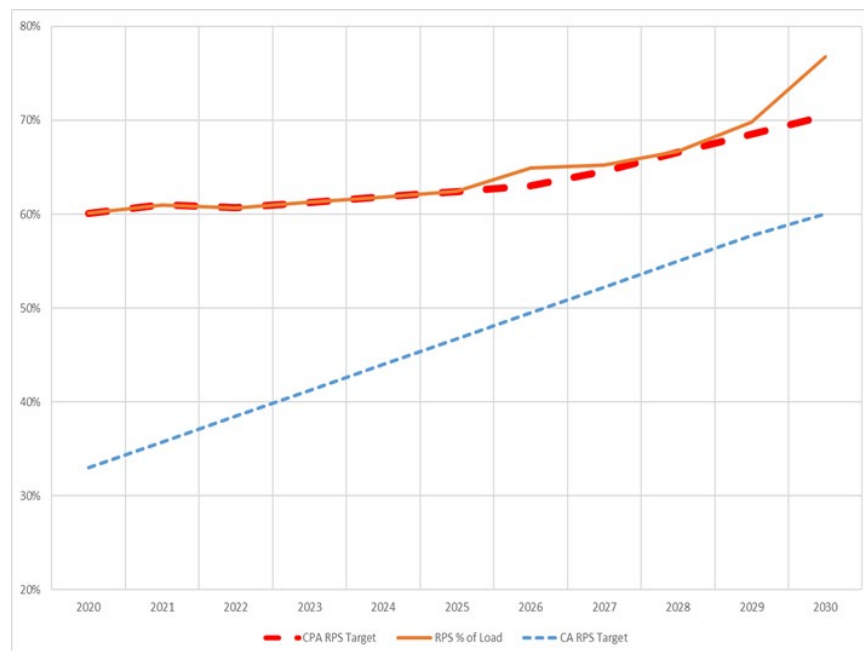


Figure 9: 38 MMT RPS Compliance



Both portfolios achieve SB 350 long-term contracting requirements. CPA's long-term renewable procurement exceeds the compliance requirement in every compliance period, as show in Table 17 and 18 below.

Table 17: SB 350 Compliance, 46 MMT Case

Calendar Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Retail Sales (MWhs)	11,638,526	11,626,141	11,616,135	11,662,943	11,674,928	11,692,635	11,708,167	11,733,036	11,774,535	11,819,588	11,866,630
RPS Requirement (MWhs)	3,840,714	4,040,084	4,239,889	4,461,076	5,136,968	5,378,612	5,854,083	6,101,179	6,358,249	6,618,969	7,119,978
(A) Annual RPS Targets %	33%	35%	37%	38%	44%	46%	50%	52%	54%	56%	60%
(B) 65% Requirement	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%
(A*B) Long Term Contracting Compliance Requirement	21%	23%	24%	25%	29%	30%	33%	34%	35%	36%	39%
RPS Compliance from Long Term Contracts	290,036	1,448,535	2,776,115	4,832,356	6,357,411	6,944,951	7,300,833	7,274,284	7,554,144	7,816,473	7,806,148
CPA RPS under LT Contract (% Load)	2%	12%	24%	41%	54%	59%	62%	62%	64%	66%	66%
CPA RPS Under LT Contract	2%			33%			61%			65%	
Compliance Period Requirement				25%			32%			37%	

Table 18: SB 350 Compliance, 38 MMT Case

Calendar Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Retail Sales (MWhs)	11,638,526	11,626,141	11,616,135	11,662,943	11,674,928	11,692,635	11,708,167	11,733,036	11,774,535	11,819,588	11,866,630
RPS Requirement (MWhs)	3,840,714	4,040,084	4,239,889	4,461,076	5,136,968	5,378,612	5,854,083	6,101,179	6,358,249	6,618,969	7,119,978
(A) Annual RPS Targets %	33%	35%	37%	38%	44%	46%	50%	52%	54%	56%	60%
(B) 65% Requirement	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%
(A*B) Long Term Contracting Compliance Requirement	21%	23%	24%	25%	29%	30%	33%	34%	35%	36%	39%
RPS Compliance from Long Term Contracts	290,036	1,447,659	2,773,737	4,821,711	6,338,692	6,921,033	7,543,141	7,520,671	7,800,136	8,196,447	9,007,196
CPA RPS under LT Contract (% Load)	2%	12%	24%	41%	54%	59%	64%	64%	66%	69%	76%
CPA RPS Under LT Contract	2%			33%			63%			70%	
Compliance Period Requirement				25%			32%			37%	

c. GHG Emissions Results

The 46 and 38 MMT Conforming Portfolios' 2030 emissions, calculated using the CSP methodology from the CPUC's GHG Calculator, are below the emissions benchmark set by the CPUC. This is illustrated in Table 19.

Table 19: CPA 2030 Portfolio Emissions

Metric	2030 GHG Emissions (46 MMT)	2030 GHG Emissions (38 MMT)
Emission Benchmark for CPA	1.785	1.417
CPA Portfolio 2030 Results	1.782	1.409

CPA utilized a custom production profile in the CSP to account for executed contracts, for which CPA has 8760 profiles, and to account for short-term contracts, including Solar Peak, Non-Solar Peak, and Off Peak products described in further detail in Section (II)(b)(ii) as well as purchases of short-term RECs and carbon free attributes. Contracts for which CPA did not have information on delivery profiles were input as baseload 24x7 blocks.

d. Local Air Pollutant Minimization and Disadvantaged Communities

i. Local Air Pollutants

In order to calculate local air pollutants, the analysis attributes the emission rates for PM_{2.5}, SO_x and NO_x for each of the existing contracts and new technology builds. The emissions for the analysis were primarily due to unattributed spot market purchases and CPA's allocation of CAISO combined heat-and-power resources. GHG emissions from spot purchases reflect the CPUC assumption for generic purchases of 0.428 metric tons per MWh. The total emissions for PM_{2.5}, SO₂, and NO_x are shown below in Table 20.

Table 20: CPA 2030 Portfolio Emissions (PM_{2.5}, SO₂, NO_x)

Metric	2030 Emissions (46 MMT)	2030 Emissions (38 MMT)
PM _{2.5} (tonnes/yr)	80	64
SO ₂ (tonnes/yr)	8	6
Nox (tonnes/yr)	159	125

ii. Focus on Disadvantaged Communities

Per its Joint Powers Agreement, CPA intends to provide and manage its energy portfolio and products in a manner that promotes public health in areas impacted by energy production, including Disadvantaged Communities (DACs). It offers several service options that benefit the DACs and low-income communities it serves. Utilizing the CalEnviroScreen 3.0 dataset, CPA has determined that 34% of the 294 zip codes within its service territory either entirely or partially contain census tracts identified as Disadvantaged Communities.³

One of CPA's long-term program objectives to minimize local air pollutants is to provide to its customers clean energy through the renewable and GHG-free power procurement, and CPA intends to contract exclusively with renewable or GHG-free generation resources, pursuant to its program objective and SB 100 mandate. To promote cost savings and risk management for our ratepayers, CPA will continue to rely on some unspecified CAISO system power for short-term energy needs beyond its long-term contracts. In 2020, CPA's generation portfolio will achieve a 63 percent GHG-free and 60 percent renewable energy mix, resulting in an energy supply that possesses both a greater renewable content and a lower GHG emission rate than that of the incumbent utility. CPA's long-term energy procurement policy is not expected to negatively impact local air quality.

Utilizing the U.S. EPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT) data, CPA has identified four power plants within its territory that are classified as large emitters, two of which are

³ Disadvantaged Community is defined as any community statewide scoring in the top 25 percent statewide or in one of the 22 census tracts within the top five percent of communities with the highest pollution burden that do not have an overall score, using the most recent version (CalEnviroScreen 3.0) of the California Environmental Protection Agency's CalEnviroScreen tool.

located within a zip code containing Disadvantaged Communities. While these two plants are currently retired, they may retain deliverability. To the extent practical, CPA is committed to identifying opportunities to support the replacement of retired facilities with renewable resources to reduce the pollution burden in these communities through its procurement activities. As determined by CPUC D.18-06-027, CPA has filed a Tier 3 Advice Letter to develop and implement Disadvantaged Communities (DAC) Green Tariff and Community Solar Green Tariff programs (DAC Community Solar). CPA expects that a portion of the generic solar PPA capacity will be constructed in Disadvantaged Communities areas.

Based on CPA's [Local Programs for Clean Energy Future](#) Strategic Plan, which was developed through a community outreach process and subsequent Board direction, CPA plans to deploy air pollution mitigation programs in Disadvantaged Communities within its territory, in the following three strategic program areas:

- Resiliency and grid management, including clean back-up power for essential facilities, demand response from behind the meter energy storage, and peak management pricing
- Electrification, including incentives for public electric vehicle charging and building electrification codes
- Local procurement, including the DAC Community Solar program (pending the CPUC's approval of CPA's Tier 3 Advice Letter)

CPA is also currently piloting its Power Response Program, a Distributed Energy Resource (DER) platform. During up to five events per month, participating Power Response customers with behind the meter smart energy technologies are asked to modify their energy usage to relieve strain on the grid during periods of high demand. Both residential and commercial customers receive enrollment incentives for signing up as well as annual participation incentives that are dependent on customer event response. To broaden the reach of this program in Disadvantaged Communities, CPA's Power Response program offers a residential behavioral option that does not require smart technology to participate. CPA also provides higher enrollment and participation incentives for customers that are in Disadvantaged Communities.

CPA makes available higher tiers of renewable product offerings to all its customers, including its customers that receive rate assistance through the California Alternative Rates for Energy (CARE), Family Electric Rate Assistance (FERA), and Medical Baseline programs. CARE, FERA, or Medical Baseline customers located in jurisdictions that have selected CPA's 100% renewable as their default energy product are defaulted into CPA's 100% renewable product at a rate that matches the overall bill cost those customers would pay on SCE's discounted bundled rate, inclusive of PCIA and their existing discounts. The incremental cost of including customers on discount programs in the 100% renewable default without raising their rates is shared by all other customers, both residential and commercial, in those jurisdictions. This voluntary subsidy provides equitable access to renewable energy options for customers that might otherwise have difficulty accessing other traditional renewable energy programs and avoids automatically increasing generation costs for CPA's most vulnerable customers. CPA provides this default 100% renewable energy benefit to approximately 38,000 of its 235,000 residential

customers that take service on CARE, FERA, and Medical Baseline rate assistance programs. Customers in these three rate assistance programs comprise approximately 27% of CPA's residential customer accounts.

In 2019 CPA launched its first Community Based Organization Outreach Grant (CBO Grant) to prioritize engaging residents and small businesses in Disadvantaged Communities and other underserved areas in its territory on CPA's clean energy programs and available financial incentives and assistance. The current CBO Grant program supports the CBOs' work in the following focus areas:

- Enhance customer understanding of CPA's service, electricity bills, and benefits;
- Increase enrollment in financial assistance programs such as CARE and FERA;
- Increase enrollment in CPA's Power Response program; and
- Enroll customers in CPA's Disadvantaged Communities Green Tariff (pending CPUC approval of CPA's funding request).

e. Cost and Rate Analysis

CPA's portfolio costs and expected impacts to electricity rates for the 46 MMT preferred compliance and the 38 MMT preferred compliance portfolios are depicted below. A full description of the cost components follows that define each discrete component.

For CPA, the portfolio cost trajectory, cost mix and expected impacts to rates for the 46 MMT and 38 MMT Conforming Portfolios are similar. The reason that the portfolios exhibit similar characteristics through the study period is a direct result of the process taken to develop the 2020 IRP portfolios. As discussed in Section II. Study Design, CPA's portfolio was optimized around internal RPS and GHG-free goals and then resources were added or removed to arrive within one percent of the CPUC GHG MMT target for the respective case. As a result, most of the cost difference between the two cases in the early years are driven by the underlying changes in the California market. In the final years of the study horizon, the expansion plan between the two portfolios begins to diverge, with the 38 MMT portfolios building additional wind and geothermal resources to achieve its proportional share of the GHG MMT target.

Figure 10: CPA 46 MMT Portfolio Costs (2018\$, \$,000)

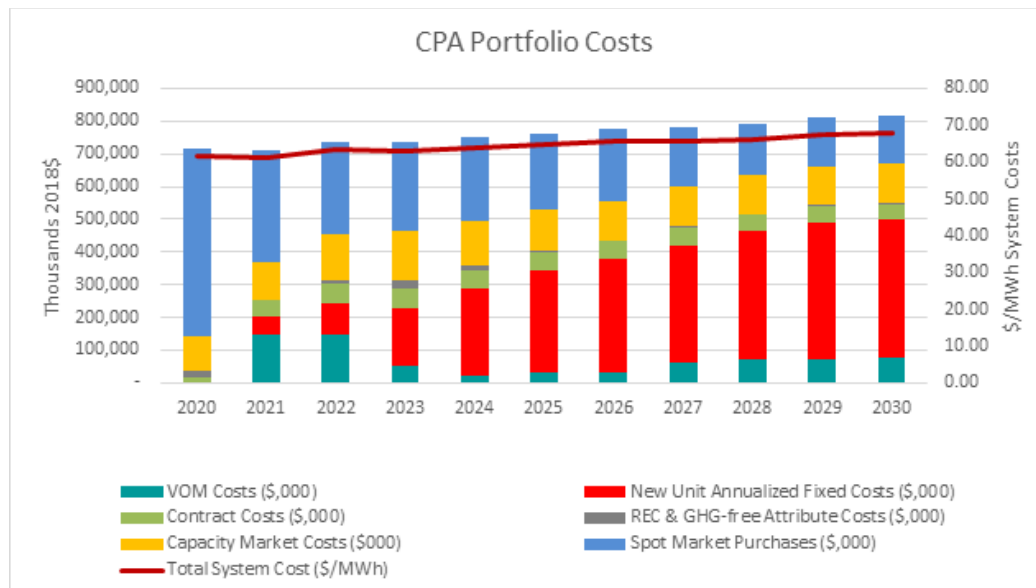
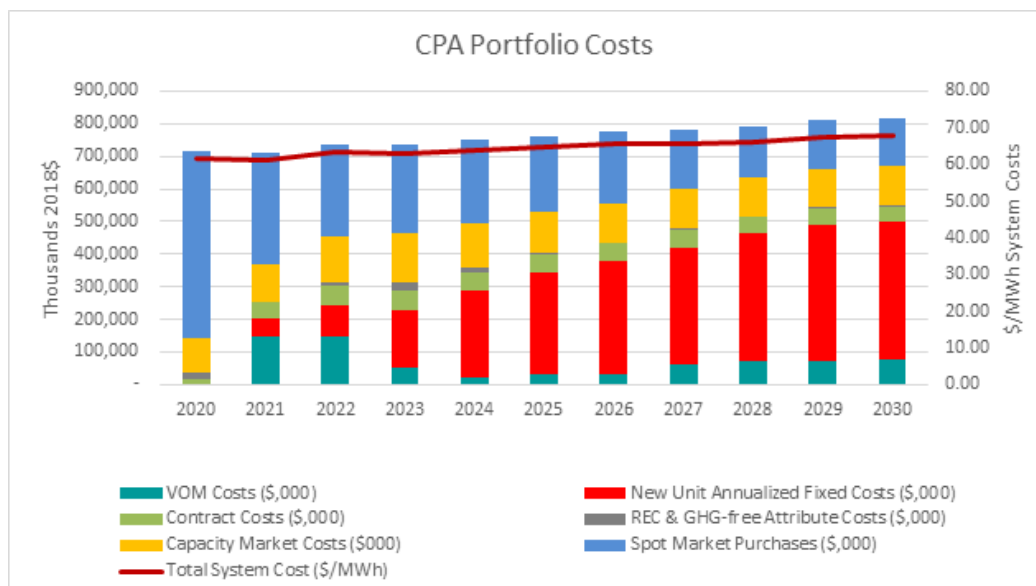


Figure 11: CPA 38 MMT Portfolio Costs (2018\$, \$,000)



Market Purchases: The 46 MMT and 38 MMT Conforming Portfolios start with significant amounts of market purchases in the early years of the study period. Market purchases continue to diminish over the study horizon as CPA enters into long-term contracts. Given the portfolio mix of CPA, there is reliance on short-term contract purchases (in the form of off-peak and non-peak solar hours in the early years), and then becomes less reliant on short term purchases as generation from geothermal provides significant amount of off-peak generation.

New Unit Annualized Fixed Costs: As CPA begins to build new resources within the portfolio, the cost mix of the portfolio begins to shift and becomes largely driven by the capital and fixed O&M costs for long term capacity selected by the optimization routine.

Capacity Market Costs: Capacity market costs serve as a representation for the cost of reserve adequacy products to meet reliability requirements. Capacity market contracts were assumed to cost \$5/kw-month over the duration of the study period. The contribution to total system costs from the reliability products are steady over the study horizon.

REC and GHG-free Attribute Costs: REC and GHG-free purchases server as a representation for the cost of attribute only products CPA will need to meet internal RPS and GHG-free targets. The price of the products was derived from the S&P Platts North American Emissions Special Report and fluctuate depending on the renewable and GHG-free generation contributed from the two portfolios.

Total System Cost: Overall, the transition from relying on market purchases to serving energy needs through owned and contracted resources does not have a major impact on the cost to serve load on a \$/MWh basis. The range of cost to serve load on a \$/MWh basis is within \$60-\$70/MWh over the entire study horizon. These costs do not reflect CPA's non-energy procurement costs (e.g. data and customer management, overhead, etc. are not included in this analysis).

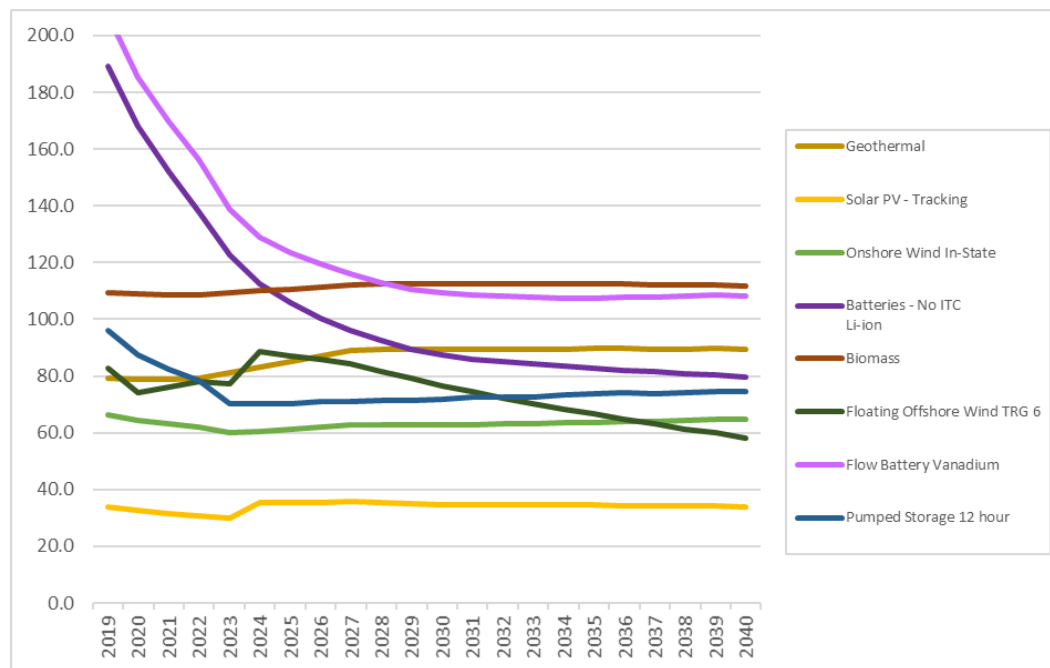
The portfolio cost components include:

- **VOM Costs:** Variable O&M costs for long-term capacity selected by the optimization, contract costs for short term contracts and long-term hydro contracts (in-state and out of state). It does not include existing PPA contract costs
- **Fuel Costs:** Provided for reporting. N/A for CPA's portfolio.
- **New Unit Annualized Fixed Costs:** Includes capital and fixed O&M costs for long term capacity selected by the optimization analysis
- **Contract Costs:** Reflects total cost for existing PPAs, as provided by CPA
- **Capacity Market Costs:** Existing and future RA capacity purchase needs to meet an overall 15% reserve margin requirement. Assumes \$5/kw-month capacity price
- **Market Purchases:** Reflects spot market Purchases
- **Market Sales:** Reflects spot market Sales
- **NPV: Discount** Rate of 8% is applied

In developing the 2019-20 IRP, CPA used CPUC assumptions wherever possible. The candidate resources' capital cost, operating cost, and levelized cost of energy used in the analysis were derived from the CPUC's 2019-2020 IRP assumptions. Cost values were taken from CPUC's released "RESOLVE_Resource Costs and Build_2020-02-07.xlsb" file, which are reported in 2016\$.

Figure 11 below displays the levelized costs assumptions in \$/MWh for the set of critical technologies. These costs include Overnight Capital Costs, Interconnection Cost, and Investment Tax Credits as applicable to each technology. In addition, periodic replacement and augmentation costs for battery storage technologies are included as well. All costs are consistent with CPUC assumptions as provided in the “RESOLVE_Resource Costs and Build_2020-02-07.xlsb” file.

Figure 12: Levelized Costs of Energy for Selected Technologies (2016 \$/MWh)



In addition to fixed and variable costs from new built resources and existing PPAs, fuel and power prices were a driver of portfolio costs through the cost of market purchases. The amount of open market position for the portfolios varies overtime.

Attribute prices were developed based on S&P Platts North American Emissions Special Report.

Table 21: Fuel and Emissions Cost Assumptions

Fuel/Emission Costs	CA NG	NW NG	SW NG	CA Coal	Carbon Cost Low	Uranium	PCC 1 RECs
	/MMBTU	/MMBTU	/MMBTU	/MMBTU	/tCO2	/MMBTU	/MWh
2019	4.28	3.34	2.54	2.00	14.57	0.70	15.12
2020	4.30	3.35	2.57	2.00	15.25	0.70	15.36
2021	4.31	3.35	2.58	2.00	16.00	0.70	15.60
2022	4.31	3.36	2.59	2.00	16.84	0.70	15.84
2023	4.31	3.36	2.59	2.00	17.71	0.70	16.08
2024	4.32	3.37	2.59	2.00	18.62	0.70	15.36

2025	4.33	3.37	2.60	2.00	19.59	0.70	15.12
2026	4.34	3.38	2.61	2.00	20.59	0.70	14.40
2027	4.34	3.38	2.62	2.00	21.66	0.70	13.44
2028	4.34	3.39	2.62	2.00	22.79	0.70	12.24
2029	4.35	3.39	2.63	2.00	23.99	0.70	9.60
2030	4.36	3.40	2.64	2.00	25.25	0.70	5.76

The 46 and 38 MMT Conforming Portfolios identify the lowest cost, bulk power supply portfolio. The cost analysis studies only power supply components of serving retail load; as a CCA, the incumbent IOU is still responsible for transmission and distribution of the energy to the retail level. The cost of procuring the resources selected in the 46 MMT Conforming Portfolio is forecasted to increase CPA's power supply costs respectively at a rate of 1.2% annually between 2020 and 2030, based on 2018 real dollars. The 38 MMT Conforming Portfolio, which requires more amounts of renewables to reduce GHG emissions, will increase the total cost by 0.3% at a rate of 1.5% annually between 2020 and 2030. Additionally, CPA's portfolios account for the RA benefits of IOU resources that its customers pay through the Cost Allocation Mechanism (CAM). The CPUC adopted the CAM to support the development of new generation resources to ensure electric reliability, and which allows the costs and benefits of new generation to be shared by all benefiting customers in an IOU's service territory.

f. System Reliability Analysis

CPA used three metrics to assess if CPA's portfolio maintains system reliability. The first method is by evaluating market pricing and CPA portfolio costs under a range of potential scenarios using stochastic analysis. The second is evaluating how CPA's portfolio meets Resource Adequacy capacity to comply with the state's system RA requirement. The third is evaluating curtailment of intermittent resources.

Stochastic Analysis

CPA conducted a stochastic analysis on the 46 and 38 Conforming Portfolios in order to address system reliability concerns. The purpose was to test the portfolio's performance under a range of market conditions. The stochastic approach includes the development of 200 Monte Carlo iterations of relevant fundamental variables testing each portfolio over this broad range of market conditions. Siemens provided distributions for all fundamental variables, including load forecasts, emission prices, gas prices, coal prices, technology cost, and hydro generation that can be used for selecting the 200 iterations of the model.

To assess system reliability, the analysis focused on a set of stochastic exposures including market prices, market purchases (spot) exposure, curtailment, and to a lesser extent emissions. The goal was to provide ranges of market exposures and determine the potential for price impacts experienced by CPA.

The result of the analysis was that on an annual basis, there were no systemic high price events identified that would demonstrate systemic supply and demand balance insufficiencies identified in the California

system. The main driver of price variability in the stochastic runs was gas prices, rather than supply/demand considerations.

Figure 13: California On and Off-Peak Prices - 2018\$/MWh - Stochastic Analysis of 46 MMT Portfolio

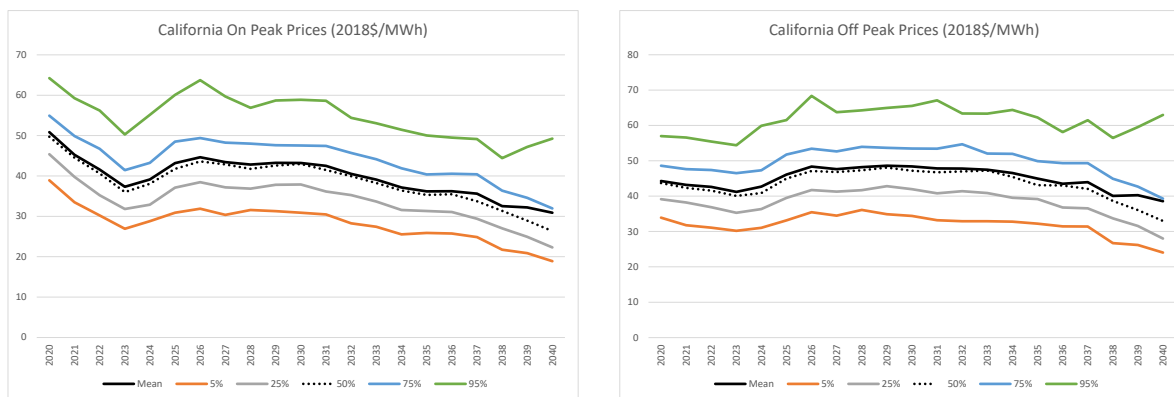
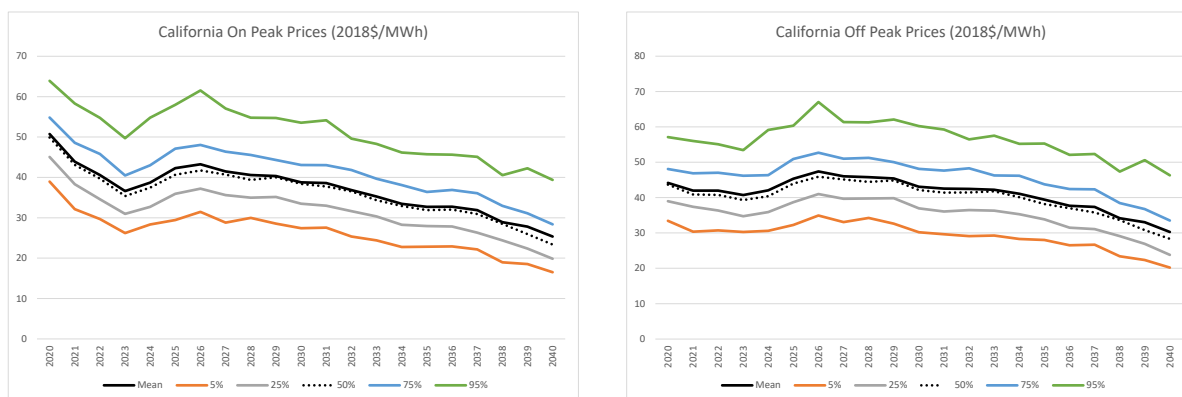


Figure 14: California On and Off-Peak Prices - 2018\$/MWh - Stochastic Analysis of 38MMT Portfolio



Resource Adequacy

In addition to evaluating the portfolios under a range of potential market scenarios, CPA evaluated system reliability by assessing its open System RA position compared to its share of its load share of total system resources in the respective RSP, net of its contracted resources and coal and nuclear resources, for which CPA does not contract. Including a 15% reserve margin over CPA's forecast peak load and the projected declines in ELCC for clean energy resources, the largest anticipated open System RA position is still within the CPA's load share of existing system resources in the RSP, as shown in the Figures below. As long as the System RA attributes in excess of other LSE load shares are not withheld from the market, the system as a whole should have adequate resources to accommodate CPA's portfolio.

Table 22: CPA RA Assessment (46 MMT Conforming Portfolio)

Year	Peak Demand with 15% PRM	System RA Need Met with Short-Term Purchases	CPA Load Share of System Resources (ELCC Adjusted)	Short-term Purchases Exceeding System Share
2022	3,349	2,364	2,380	No
2026	3,375	2,028	2,603	No
2030	3,421	1,940	2,757	No

Table 23: CPA RA Assessment (38 MMT Conforming Portfolio)

Year	Peak Demand with 15% PRM	System RA Need Met with Short-Term Purchases	CPA Load Share of System Resources (ELCC Adjusted)	Short-term Purchases Exceeding System Share
2022	3,349	2,350	2,387	No
2026	3,375	1,984	2,604	No
2030	3,421	1,820	2,673	No

Curtailement

CPA evaluated curtailment as a metric for reliability. CPA's 46 and 38 MMT cases demonstrate less than 2% of supply curtailed in any year. The simulation results show curtailments mostly for wind during the solar hours. There are minimal or no curtailments of renewables during non-solar hours. The AURORA model selects to curtail wind over solar due to a small difference in variable operating costs with wind having higher costs, based on CPUC assumptions. Most of the curtailments happen in 2024-2025 and after the study horizon (post 2030), when there is greater penetration of renewable generation in the portfolio and in the California market. Furthermore, after the mid-2020s, wind developers do not have the Investment Tax Credit, which currently allows them to bid at negative prices into the market and dispatch ahead of solar. A summary of curtailment as a percentage of load is provided in the table below.

Table 24: Curtailment as a Percentage of Load by Case

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
46 MMT	0.0%	0.0%	0.0%	0.5%	1.3%	1.3%	0.5%	0.4%	0.5%	0.5%	0.6%
38 MMT	0.0%	0.0%	0.0%	0.5%	1.4%	1.4%	0.7%	0.6%	0.6%	0.6%	0.8%

g. Hydro Generation Risk Management

CPA assessed risks of in-state drought and hydroelectric generation uncertainty in its the stochastic analysis and the impact of hydro availability on the Portfolio costs. The approach to modeling hydro uncertainty was applied in the stochastic analysis for the 46 MMT and 38 MMT Conforming Portfolios. Using historic hydro generation years in California the model randomly assigned identified levels of generation to the 200 stochastic iterations. The approach results in a range of hydro generation that varied across both iterations and years within each iteration. The impact of this variation on CPA's portfolio costs and California wholesale power prices were less impactful than load, gas prices, and CO2

prices; each having a larger impact on California price formation and, by extension, CPA's market purchase/sales costs and revenues.

However, CPA acknowledges that availability of hydro generation, which is used as a clean generation resource as well as a flexible integration resource, is at risk due to climate change. CPA closely monitors hydro availability and hydro facility generation profiles for changes due to changing rainfall/snowpack. If CPA identifies reduced availability of hydro generation, it can pivot procurement to other clean energy and flexible resource technologies.

h. Long Duration Storage Development

With respect to long-duration storage, the CPUC's 2020 Integrated Resource Planning identified a need for between 973 MW and 1,605 MW of long-duration storage by 2026. In response to the CPUC's analysis, CPA and twelve other CCAs issued a request for information (RFI) on long-duration storage in June 2020. This RFI defined long-duration storage resources as those with the capability to discharge at full capacity for at least 8 hours. The RFI requested the following types of information: (1) storage technology and commercial history; (2) project specifics, including location, permitting, financing and development risks; (3) contracting terms and preferences, including indicative pricing.

The RFI received responses from 31 entities representing numerous types of chemical, mechanical and thermal long-duration storage technologies, such as: lithium-ion batteries; vanadium redox and other flow batteries; used electric vehicle batteries; waste to fuels via ultrasound; hydrogen storage; pumped storage hydro; geomechanical pumped storage; crane and stacked blocks; compressed air; flywheels; and molten salt and other thermal storage technologies. Moreover, the respondents identified 25 specific projects that represent more than 9,000 MW of capacity, two thirds of which is advertised as able to achieve commercial operation by 2026.

CPA and other CCAs are now engaging in the critical next step of assessing the economics and technical viability of such projects. Long-duration storage technologies were not specifically selected by AURORA for CPA's Conforming Portfolios within the 2020-2030 timeframe, which selected meeting CPA's reliability needs with traditional 4-hour batteries instead. AURORA did not select long-duration storage technologies for CPA's portfolio until 2037.

However, CPA seeks to encourage the development of these long-duration storage resources as long as they are cost-effective and technologically viable. CPA will consider offers for long-duration storage resources that can come online by 2026 in its planned 2020 Clean Energy RFO. Due to the scale and complexity of these projects, however, successful development will depend on efficient collaboration among numerous entities including load-serving entities, developers, manufacturers, market operators, regulators and environmental stakeholders.

i. Out of State Wind Development

To date, CPA has procured 300 MW of out-of-state wind. For its conforming portfolios, the AUORA model did not select any additional out-of-state wind for the study period, selecting instead a combination of in-state wind, solar, and geothermal renewable projects in its conforming portfolio. CPA is actively exploring new wind projects for procurement, including both in-state and out-of-state wind resources.

j. Transmission Development

For resources that are already contracted, CPA provided location-specific information in the Resource Data Template. For generic projects, CPA provided locations based on the RSP (as described in Section II), however these are used for reporting purposes. For generic projects, CPA is not tied to the locational regions identified in the Resource Data Template or the CSP Calculator.

In addition, CPA is seeking opportunities with developers of its contracted projects to add additional renewable energy or storage resources to these projects where unused transmission capacity is available. This strategy would allow additional clean energy resources to be built with no transmission upgrades, which reduces resource costs and construction timelines compared to other new build projects that require transmission upgrades.

IV. Action Plan

a. Proposed Activities

CPA's procurement activities are structured to achieve internal energy and financial goals, as directed by its Board, including meeting all compliance obligations to achieve a safe, affordable, reliable, and clean power supply.

CPA will continue to solicit more long-term renewable contracts in Fall 2020. CPA will incorporate key trends from this IRP in its forecasting and procurement processes, including:

- Demand trends including population of customers served, climate, energy efficiency, distributed generation, electrification of vehicles and buildings, and emerging industries impact both the volume and shaping of CPA's resource requirement.
- A diverse resource mix, including conventional and long-duration storage technologies, must address impacts of curtailment, improve grid reliability, reduce reliance on system power, and provide resource value for customers.
- CPA will continue to include carbon-free non RPS-eligible hydro resources that will facilitate meeting emissions-reductions targets in a cost-effective manner.
- With respect to Disadvantaged Communities, CPA will continue to incorporate positive impacts of new resources on Disadvantaged Communities in its selection metrics for future solicitations and intends to deploy air pollution reduction strategies, such as transportation and building electrification.

CPA's long-term procurement planning processes are evolving, and CPA intends to incorporate the following analysis in the next IRP cycle:

- Load forecast incorporating CPA-specific customer programs and goals
- Resource mix that incorporates up-to-date, observed market-based resource costs assumptions based on pricing information received in RFIs and RFOs conducted by CPA
- Local resource development programs consistent with CPA's Board-approved Local Programs Strategic Plan with feedback from CPA's community outreach efforts, including its Community Advisory Committee, and any other energy policies established by the CPA Board
- Programs addressing air pollution minimization for Disadvantaged Communities

CPA continuously monitors and updates its procurement portfolio planning based on market information and risks, legislative and regulatory changes, technological improvements, and customer trends. CPA evaluates its resource mix to balance cost minimization to ratepayers, compliance with regulatory requirements and emissions goals, and implementing CPA-specific energy goals.

b. Procurement Activities

In the near term, CPA is planning to launch a Clean Energy RFO in Fall 2020 to seek RPS-eligible and storage resources. CPA is also planning to launch another RFO for California's Disadvantaged Communities and Community Solar Green Tariff Programs (DAC-GT & CSGT) once CPA's Tier 3 Advice Letter is approved by the CPUC. Both programs aim to promote the installation of renewable generation among residential customers in disadvantaged communities. CPA has been allocated 12.19 MW for its DAC-GT program and 3.13 MW for its CSGT program based on the proportional share of residential customers in DACs that each CCA serves.

In compliance with CPUC Decision 19-10-016, CPA is required to procure 196.9 MW of resources qualifying as system RA and for purposes of renewable integration as defined by Public Utilities Code Section 454.51. Of the 196.9 MW of resources, 98.45 MW needs to be online by August 1, 2021, 147.675 MW by August 1, 2022, and the remainder by August 1, 2023. CPA's list of resources and compliance progress are shown in the charts below, and as demonstrated, CPA anticipates meeting more than its apportioned share of System RA resources by August 1, 2023. CPA notes that because the Mohave County Wind Farm project is located out of state and the qualifying capacity (QC) depends on CPA's ability to obtain Import Allocation Rights (IARs) for that project, CPA counts that resource's QC separately in the compliance progress table.

Table 25: Project List

Project	Resource Type	Capacity (MW)	Storage Capacity (MW/MWh)	September Qualifying Capacity (MW)	Status	Delivery Start Date	Incremental
Voyager Wind II Phase 4	Wind	21.6		3.24	Online	1/1/2019	Yes
Mohave County Wind Farm (Arizona)	Wind	300		39.38	Contracted	12/31/2020	Yes
Golden Fields Solar III	Solar	40		5.6	Contracted	3/31/2021	Yes
Luna	Storage		100/400	100	Contracted	8/1/2021	Yes
Edwards Sanborn	Storage		100/400	100	Contracted	8/1/2021	Yes
High Desert	Solar + Storage	100	50/200	57	Contracted	8/1/2021	Yes
Arlington Energy Center II	Solar	233		32.62	Contracted	12/31/2021	Yes
Azalea	Solar + Storage	60	38/152	41.08	Contracted	12/31/2022	Yes

Table 26: Compliance Obligations Progress

	2021	2022	2023
IRP Compliance Obligation (MW)	98.45	147.675	196.9
Expected QC (MW)	265.84	279.84	339.54
Capacity Toward IRP Targets (Mohave Inc.)	305.22	319.22	378.92

*Mohave County - if CPA secures IARs will add 39.3 MW to the total obligation for each year.

*Arlington Energy Center has a 100 MW interim capacity for the first contract year.

c. Potential Barriers

For procurement decisions, CPA considers risk factors, including the following:

Market Challenges

- Market and commodity price (CAISO LMPs, RA prices, RPS prices, etc.): Price volatilities could increase the risk of CPA's operational costs and eventually translate into higher customer electric rates.
- Counterparty credit risk: There is a potential risk that counterparties can become financially impaired and fail to deliver power to CPA.
- Variance from estimated load forecasts: Load forecast is a significant driver of risk in CPA's ability to meet Load Resource Balance. Should the long-term load forecast be too low, this may result in over-procurement and a surplus of market purchases. Should CPA's load grow significantly, either through increased usage or the addition of new communities, CPA may require additional procurement beyond what is described in these Conforming Portfolios.
- Renewable curtailments: The costs associated with renewable curtailments could become higher as CPA continues to procure more renewable resources to meet its clean energy goals and RPS mandates.
- Adoption of customer and community programs (e.g. customer solar PV installation, electric vehicles): The utility industry is currently undergoing a significant "paradigm shift" in the United States because of new and evolving technologies, such as distributed rooftop solar and battery storage. We are moving away from the concept of solely relying on large, centralized generation assets to supply our customers with power on a 24x7 basis and towards a more inter-dependent grid where both customer and smaller utility-scale distributed generation will pay an increasingly important power serving role. These programs may result in demand fluctuations and increased costs for non-participant customers.
- Resource costs: Changes to assumed resource costs, particularly for emerging technologies like storage, may increase costs for CPA's portfolio.
- CPA's customer participation or rate tier changes could affect CPA's projected cost trajectory, CPA rates for its enrolled customers, and could increase the risk for CPA to meet the electric demand of its customers.

Legislative and Regulatory Uncertainties

As a market participant in a highly regulated electricity market, CPA's procurement and planning activities are subject to changes in legislative and regulatory mandates and rules. CPA highlights some recent examples that would impact its procurement decisions and ability to meet the mandated goals of SB 350, SB 100, and RA compliance obligations set by the CPUC:

- Local RA CPE: While CPA is committed to procure resources to relieve local transmission constraints and promote local reliability, the recently adopted CPE framework imposes

uncertainty for CPA and its counterparties to appropriately value the local resource premiums. The mechanism also introduces some uncertainty for System and Flex RA compliance product procurement, as LSEs need to consider the allocation of those attributes from the CPE so that their activities do not lead to over-procurement of System and Flex resources. As compliance year 2023 approaches, CPA will need to carefully evaluate its portfolio to develop its strategies of whether and how to participate in the CPE's auction and manage its RA positions.

- Long-duration energy storage mandate: As stated in this plan, CPA is part of a CCA group that conducted a long-duration storage RFI. CPA will be considering procurement of long-duration storage in 2026 and beyond due to grid needs, technology maturity, and more competitive pricing. However, CPA is concerned that legislative mandates of long-duration storage may disrupt the IRP planning process and could lead to stranded assets if the timing of the mandate does not align with IRP modeling results.

d. Proposed Commission Direction or Actions

CPA presents Conforming Portfolio cases for the Commission's consideration; however, based on the preference of CPA's Board and local stakeholders, CPA requests that the Commission adopt CPA's 38 MMT portfolio. While the 38 MMT portfolio results in 0.3% increased power costs to customers compared to the 46 MMT case, the 38 MMT portfolio presents an opportunity to significantly reduce GHG emissions while maintaining grid reliability.

CPA greatly appreciates the Commission's decision in the 2019-2020 IRP cycle to allow LSEs to submit a 38 MMT portfolio for consideration. However, CPA recommends that for the 2021-2022 IRP cycle, the Commission should consider a less prescriptive process that will allow LSEs to reflect assumptions and resource portfolios that may deviate from the Reference System Plan, to allow LSEs to present portfolios that are the most reflective of their procurement policies and market trends. This change could lead to a more realistic reflection of planned procurement, and the modeling results can better inform LSEs as to whether they need to adjust their planned activities based on overall system needs.

e. Diablo Canyon Power Plant Replacement

As discussed in the decision adopting the preferred system portfolio and plan for the CPUC IRP cycle (D.19-04-040), CPUC's IRP allows "LSEs collectively to plan for the purchase of power in an orderly fashion to serve the load that was previously served by Diablo Canyon Power Plant (DCPP) output." In its conforming portfolios, CPA intends to procure long-term contracts of clean energy resources that are consistent with the CPUC's Reference System Plan (RSP), and therefore CPA's contribution to replacing DCPP is embedded within its plans. CPA will satisfy its system reliability by procuring clean energy and GHG-free resources.

As demonstrated in CPUC's RSP, DCCP replacement can be accomplished by a mix of wind, solar, DR, and storage resources. CPA therefore plans to rely on the same set of resources to substitute for DCCP. However, CPA acknowledges that defining new reliability standards for carbon-free portfolios is not an easy task. Traditional resource planning standards, namely procuring capacity equal to peak load plus a reserve margin, need to be modified for portfolios that include large amounts of renewable generation resources. The energy available from renewable resources varies significantly in different time periods, including annual, seasonal, and daily variation. To address this difficulty in developing reliability metrics that are appropriate for time-limited resources, CPA confirmed that the qualifying capacity of new resources added in CPA's portfolios exceeded its load-share of DCCP's system RA value over the modeling horizon in both 46 MMT and 38 MMT conforming portfolios. In 2026, CPA's 46 MMT portfolio will add 1,873 MW of solar, 722 MW of wind, 35 MW of geothermal, and 850 MW of battery storage. CPA's 38 MMT will procure an additional 35 MW of geothermal resources demonstrating that CPA's portfolios far exceed its capacity contribution. Because CPA's Conforming Portfolios demonstrate new capacity contributions by 2026 exceeding its load-share of the RSP, CPA is prudently planning for DCCP replacement.

V. Lessons Learned

CPA shares key lessons learned from this IRP cycle and looks forward to collaborating with the CPUC further to refine and improve future IRP cycles.

Modeling Assumptions

CPA's Conforming Portfolios submission utilizes assumptions and methodology consistent with the Reference System Plan. However, some Reference System Plan assumptions, particularly resource availability and cost projections, may not be aligned with LSEs' observations in the market, which can lead to skewed results in the Conforming Portfolios submitted by all LSEs. CPA is committed to working closely with the CPUC and other stakeholders in future resource planning efforts to ensure modeling assumptions are reflective of actual LSE planning assumptions and that planning efforts result in statewide energy goals being met in a reliable and cost-effective manner for CPA's customers.

IRP Process and Filing Requirements

The late and changing instructions from the CPUC made the 2020 IRP challenging, particularly given CPA's required approval timeframes of the IRP submission. For example, the revised Clean System Power tool from CPUC staff that accounts for Behind-the-Meter Combined Heat and Power emissions was not available to LSEs until late-June 2020. However, CPA appreciates CPUC staff efforts to clarify and revise templates and instructions to address CCA concerns. For future cycles, CPA looks forward to engaging the CPUC early in the IRP planning process to ensure submission documents are relevant and applicable to CCAs and take into account local decision-making structures.

Regulatory Coordination and Consideration

As the IRP process improves and matures, CPA hopes that the IRP process will be more closely aligned with other regulatory proceedings where policy changes could potentially impact planning inputs and assumptions. While adjusting the inputs and assumptions in real time may provide a new set of challenges that would impact the timing of IRP submissions, some regulatory rule changes can have material impacts on LSEs' long-term procurement planning. Without incorporating these changes in LSEs' planning, CPA is concerned that any subsequent procurement mandates based on the submitted plans may not necessarily be reflective of grid needs.

For instance, the allocation of PCIA-eligible resources will likely have a material impact on LSEs' procurement of carbon-free, RPS-eligible, and RA resources. While CPA understands that the staff is unable to provide directions on incorporating the allocations since a Commission decision is still pending, the outcome of the proceeding will likely affect the amount and technology types of resources that each LSE needs to procure. When aggregated, these differences may reveal a different portfolio of resources that need to be planned and procured. Similarly, while the Local RA CPE will not be implemented until compliance year 2023, the implementation of this regulatory change will likely impact the modeling results in subsequent planning years.

CPA understands that incorporating regulatory changes in real time provides significant challenges. However, CPA is concerned that any procurement order made based on assumptions that are not consistent with the regulatory reality would lead to inaccurate allocation of resource procurement, and potentially stranded costs. CPA would appreciate an IRP process that closely coordinates and aligns with all relevant proceedings, and look forward to working with staff and other stakeholders on refining such process to help the IRP achieve the goals set in SB 350 and SB 100.

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.

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 Plan: *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 Plan.*

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

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

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

VERIFICATION

Certification and Declaration

I am the Executive Director of Clean Power Alliance of Southern California (“CPA”) and authorized to make this verification on behalf of CPA. I have reviewed this compliance submittal. Based on my knowledge, information, or belief, this compliance submittal does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements true. Based on my knowledge, information, or belief, this compliance submittal contains all of the information required to be provided by Commission orders, rules, and regulations.

I declare under penalty of perjury that the foregoing is true and correct.

Executed September 1, 2020 at Los Angeles, California.

/s/ Ted Bardacke
Ted Bardacke
Executive Director

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Senior Executive Attestation

Compliance Filing for LSEs Electing to **Self-Provide** the Integrated Resource Planning Procurement Required by D. 19-11-016

September 1, 2020

CA Public Utilities Commission (CPUC)
505 Van Ness Avenue, 4th Floor
San Francisco, CA 94102-3298

Re: September 1, 2020, Individual Integrated Resource Plan Senior Executive Attestation Pursuant to Decision (D). 19-11-016 adopted in R. 16-02-007

Pursuant to Ordering Paragraph (O.P.) 12 of Decision (D.) 19-11-016, adopted in R.16-02-007 on November 5, 2019, Clean Power Alliance of Southern California (CPA) submits this attestation.

Background

D.19-11-016 requires that all Load Serving Entities (LSEs) file their individual integrated resource (IRP) plans by May 1, 2020 [*revised to September 1, 2020*]¹. The decision also requires that all LSEs directed in the Decision shall present in their IRP plans an attestation from a senior executive in the company that the necessary capacity required in this Decision shall be provided if the LSE is electing to self-provide the capacity required.² This Decision states that the attestation shall be accompanied by a detailed list of projects, capacities, and dates by which the LSE expects the projects to be providing service to the LSE, as well as a demonstration that the projects are incremental, to meet the 2021, 2022, and 2023 requirements of the decision.

Resource Data Template and Narrative Template

The Resource Data Template to be used for the September 1, 2020, IRP filing has been developed to identify the required information in O.P. 12 D.19-11-016; consequently, this attestation refers to the template contents to obviate the need for a separate compliance document. The “Certification of Information” section at the bottom of this attestation refers to the specific data fields in the Resource Data Template referenced in Table 1 below, which map to the requirements in O.P. 12 of D.19-11-016. In addition, CPA also provided this information in its Narrative Template, as shown in Table 2.

Table 1

Resource Data Template Reliability Procurement Fields Related to O.P. 12, D.19-11-016

O.P. 12 Requirement	Corresponding Field in Resource Data Template
Detailed List of Projects	“Monthly_GWH_MW” tab; Columns B, C, & K
Capacities	“Monthly_GWH_MW” tab; Columns F, G, & H
Dates by which LSE expects projects to be providing service to LSE	“Unique Contracts” tab; Columns G, H, & I
Demonstration projects are incremental	“Unique Contracts” tab; Columns M & N

Table 2

Project	Resource Type	Capacity (MW)	Storage Capacity (MW/MWh)	September Qualifying Capacity (MW)	Status	Delivery Start Date	Incremental
Voyager Wind II Phase 4	Wind	21.6		3.24	Online	1/1/2019	Yes
Mohave County Wind Farm (Arizona)	Wind	300		39.38	Contracted	12/31/2020	Yes
Golden Fields Solar III	Solar	40		5.6	Contracted	3/31/2021	Yes
Luna	Storage		100/400	100	Contracted	8/1/2021	Yes
Edwards Sanborn	Storage		100/400	100	Contracted	8/1/2021	Yes
High Desert	Solar + Storage	100	50/200	57	Contracted	8/1/2021	Yes
Arlington Energy Center II	Solar	233		32.62	Contracted	12/31/2021	Yes
Azalea	Solar + Storage	60	38/152	41.08	Contracted	12/31/2022	Yes

¹ Decision (D.)20-03-028 modified the filing date from May 1, 2020 to September 1, 2020 at page 67.

² The LSEs directed in the Decision are named in OP 3 and by CPUC staff as discussed in OP 4

Attestation Requirements

To satisfy the requirements in O.P. 12 of D. 19-11-016, a senior executive shall sign the “Certification of Information” section below and submit this attestation as part of their compliance filing in the IRP Proceeding by September 1, 2020. No additional documentation is required at this time.

Certification of Information

Consistent with Rules 1 and 2.4 of the CPUC’s Rules of Practice and Procedure, the individual IRP compliance filing has been verified by a senior executive who shall expressly certify, under penalty of perjury, the following:

- (1) The necessary incremental Resource Adequacy capacity required of CPA in Decision (D.) 19-11-016 shall be provided in compliance with the terms established in D.19-11-016 and January 3, 2020, ruling finalizing baseline resources.
- (2) I have reviewed the Resource Data Template data fields referenced in Table 1 above (and any information provided to meet Milestone 1 of the backstop mechanism proposed in the June 5, 2020, Backstop Procurement and Cost Allocation Mechanisms Ruling) submitted in my company’s individual IRP compliance filing in the IRP Proceeding.
- (3) Based on my knowledge, information or belief, the compliance filing information referenced in (2) above is an accurate reflection of the CPA’s plans to self-provide its obligation of the incremental Resource Adequacy capacity and the terms identified in D.19-11-016, and does not contain any untrue statement of a material fact or data or omit to state a material fact or data necessary to make the statements true.
- (4) Based on my knowledge, information, or belief, the compliance filing information referenced in (2) above contains all of the information required to be provided by CPUC orders, rules, and regulations.

Senior Executive Signature:

Ted Bardacke

Executive Director

September 1, 2020



[Signature]

[Date]

