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City of Palo Alto
2018 Electric Integrated Resource Plan



CITY OF
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UTILITIES

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List of Key Supplemental Reports and Documents

1. [NCPA-CAISO Metered Sub-System Agreement](#)
2. [Ten-Year Electric Energy Efficiency Goals \(2017\)](#)
3. [Energy Storage Assessment Report \(2017\)](#)
4. [Proposed Distributed Energy Resources Plan \(2017\)](#)
5. [Distribution System Assessment Report \(2018\)](#)
6. [Demand Side Management Annual Report \(2018\)](#)

I. Executive Summary

The City of Palo Alto's 2018 Electric Integrated Resource Plan (EIRP) is a comprehensive plan for developing a portfolio of power supply resources to meet the utility's objective of providing safe, reliable, environmentally sustainable, and cost-effective electricity services while addressing the substantial risks and uncertainties inherent in the electric utility business. The EIRP also supports the City's mission to promote and sustain a superior quality of life in Palo Alto. In partnership with our community, our goal is to deliver cost-effective services in a personal, responsive and innovative manner.

The IRP meets the requirements of California Senate Bill (SB) 350 (de León, Chapter 547, Statutes of 2015), which requires publicly owned utilities (POUs) with an average annual energy load greater than 700 gigawatt-hours (GWh) to submit an IRP at least every five years to the California Energy Commission (CEC).

The EIRP discusses current and anticipated California regulatory and policy changes facing Palo Alto and the electric utility industry. Additionally, the IRP presents the analyses conducted and underlying assumptions, and outlines a resource plan to reliably and affordably meet customers' energy needs through calendar year 2030.

The electric utility industry has undergone significant changes since Palo Alto prepared its last Long-term Electric Acquisition Plan (LEAP) update in 2012, with a major shift underway towards greater levels of variable, distributed, low-emissions generation, along with an expanding suite of regulatory mandates that the City must satisfy. Table 1 provides an overview of some of the key structural changes in California's electricity market that must be addressed in the 2018 EIRP, compared to their status at the time of the 2012 LEAP update.

Table 1: California Energy Market Changes Since 2012

EIRP Topic	2012 Status	2018 Status
GHG Emissions Targets	Statewide emissions reduced to 1990 levels by 2020	40% below 1990 levels by 2030
Cap and Trade	Authorized through 2020	Authorized through 2030
Renewable Procurement	33% by 2020 and beyond	50% by 2030 and beyond
Distributed Generation	Modest growth	High growth
Energy Efficiency	Utility-specific targets (all cost-effective energy efficiency)	Statewide goal of doubling energy efficiency savings by 2030
Energy Storage	No explicit requirement	Requirement to study adoption of targets
Transportation Electrification	No explicit requirement	Requirement to address procurement of EV infrastructure
Structured Markets	Hourly market	Intra-hour market
Resource Adequacy	Local and system capacity requirements	Local, system, and flexible capacity requirements

Similarly, Palo Alto itself has undergone a myriad of changes over the past six years—both in its long-term planning goals and in how it uses electricity currently. Table 2 describes some of the major changes and accomplishments in Palo Alto since 2012, from dramatic changes in the City’s power supply and emissions reduction targets, to considerable growth in local solar generation and electric vehicles (EVs).

Table 2: City of Palo Alto Energy-Related Changes Since 2012

Topic	2012 Status	2018 Status
Community-wide GHG Emissions (from electricity, natural gas and transportation)	Goal: Reduce GHG emissions to 15% below 2005 levels by 2020. Achieved: 22% below 2005 emission levels (28% below 1990 emissions levels).	Goal: Reduce GHG emissions to 80% below 1990 by 2030. Achieved: 43% below 1990 emission levels.
Electric Supply Portfolio	Goal: 33% RPS by 2015 Achieved: 21% RPS	Goal: 50% RPS by 2030; 100% Carbon Neutral by 2015 Achieved: 58% RPS; 100% Carbon Neutral
Local Solar PV Systems	Goal: 0.71% of load by 2017 Achieved: 0.57% of load (502 systems)	Goal: 4% of load by 2023 Achieved: 1.94% of load (1,081 systems)
Energy Efficiency	Goal: 0.63% avg. annual load savings; 4.8% cumulative savings (2014-2023) Achieved: 0.68% of avg. annual load; 4.2% cumulative 6-year savings (2007-2012)	Goal: 0.75% avg. annual load savings; 5.7% cumulative savings (2018-2027) Achieved: 0.73% of avg. annual load; 4.4% ¹ cumulative 6-year savings (2013-2018)
Energy Storage	Goal: No explicit goal.	Goal: No explicit goal or rebates as not yet cost-effective. Facilitate customer adoption in coordination with Building department.
Transportation Electrification	Goal: Support California State goal Achieved: approx. 200 EVs registered in Palo Alto.	Goal: Target 90% EVs by 2030 Achieved: approx. 3,000 EVs registered in Palo Alto; 60 public EV chargers; Incentives for EV charger installation.
Annual Energy Load	972 GWh	925 GWh
Summer Peak Capacity Load	170 MW	182 MW
Average Retail Rate²	11.6 cents/kWh	13.9 cents/kWh

¹ Includes savings related to Codes and Standards changes, as well as estimated savings for 2018.

The EIRP planning period is from 2018 to 2030. Through 2028, the City of Palo Alto Utilities (CPAU) has sufficient renewable contracts to supply over 50% of the City's needs. The City's first long-term renewable contract—for wind power—expires at the end of 2021 and the other wind contract and all five landfill-gas-to energy contracts expire in the late 2020's or early 2030's, while the solar contracts all extend beyond 2040. The City's contract with the Western Area Power Administration (WAPA) for hydroelectric resources, which supplies nearly 40% of the City's energy needs in a normal hydro year, expires at the end of 2024. A major consideration for the EIRP is whether to renew the contract with WAPA (and if so, at what participation level) and/or seek other renewable supplies.

CPAU expects to continue operating within the Northern California Power Agency's (NCPA) Metered Sub-System Aggregation (MSSA) Agreement with the California Independent System Operator (CAISO). Under this agreement, NCPA balances CPAU's loads and resources to comply with CAISO planning and operating protocols. With resources available under the NCPA MSSA Agreement, Palo Alto has access to sufficient system, local, and flexible capacity, as well as resources to provide ancillary services to reliably meet City loads.

Costs are projected to increase through 2030, primarily due to system upgrade costs, increasing environmental regulations, and renewable integration costs (which are part of the tradeoff between pursuing sustainable electricity supplies and reducing overall supply costs). Costs are increasing, but retail energy sales are decreasing due to increases in energy efficiency and local solar installations, and are further expected to decline in 2020 and beyond due to building codes mandating new homes be net zero annual energy. Part of this reduction in electrical energy use is expected to be offset by higher penetration of electric vehicles and electrification of natural gas appliances.

CPAU staff will provide public updates on the progress, successes, and new challenges over the implementation period of this IRP.

A. CEC IRP Guidelines & Required Elements

The schedule and structure of the EIRP process is being guided in large part by requirements imposed by SB 350,³ which states that Palo Alto's IRP must be adopted by Council by January 1, 2019, submitted to the CEC by April 30, 2019, and updated at least once every five years thereafter. At a minimum, Sections 9621 and 454.52 of the State Public Utilities Code require that the City's IRP will need to:

- Ensure procurement of at least 50% renewable resources by 2030 (see EIRP Sections II.B, II.C.iii, V.A, X.A)
- Meet Palo Alto's share of the greenhouse gas emission reduction targets established by the California Air Resources Board (CARB) for the electricity sector, to enable California to

² Retail rate and energy efficiency values are for Fiscal Years 2012 and 2018; the rest of the values in Table 2 are for Calendar Years 2012 and 2018.

³ SB 350 also requires the doubling of energy efficiency savings targets by 2030 and establishes a new Renewable Portfolio Standard (RPS) to meet 50% of the City's load from applicable renewable supplies by 2030. The 10-Year Energy Efficiency Potential Plan approved by Council in March 2017 addresses the new energy efficiency savings requirements and the City expects to achieve an RPS of 58% in 2018.

achieve the economy wide greenhouse gas emissions reductions of 40% from 1990 levels by 2030 (Sections II.B, II.C.ii, X.B)

- Minimize impacts to customer bills (Section VI)
- Ensure system and local reliability, including in the hour of peak net demand (Sections III.B.vii, IV.E, IV.F, VII)
- Strengthen the diversity, sustainability, and resilience of the bulk transmission, distribution systems and local communities (Sections II.B, IV.A.ii, IV.E, IV.F, VII, VIII)
- Enhance distribution systems and demand-side energy management (Sections IV.A.i, VII.B)
- Minimize localized air pollutants and other greenhouse gas emissions with early priority to disadvantaged communities (Sections II.B, IV.A.ii, IX)
- Address the following procurement topics:
 - Energy efficiency and demand resources that are cost effective, reliable and feasible (Sections II.B, II.C.iv, III.B.i, IV.A.i)
 - Energy storage (Section III.B.iv)
 - Transportation electrification (Section II.B, III.B.iii)
 - A diversified procurement portfolio of short term electricity, long term electricity, and demand response products (Section III.B.v)
 - Resource adequacy (Sections IV.G, V.A)

The City currently has the resources and systems in place needed to achieve all of the objectives addressed by these IRP requirements. In addition, CPAU is submitting the following four Standardized Tables as part of the EIRP:

- Capacity Resource Accounting Table (CRAT): Annual peak capacity demand in each year and the contribution of each energy resource (capacity) in the POU's portfolio to meet that demand.
- Energy Balance Table (EBT): Annual total energy demand and annual estimates for energy supply from various resources.
- RPS Procurement Table (RPT): A detailed summary of a POU resource plan to meet the RPS requirements.
- GHG Emissions Accounting Table (GEAT): Annual GHG emissions associated with each resource in the POU's portfolio to demonstrate compliance with the GHG emissions reduction targets established by the California Air Resources Board (CARB).

This EIRP along with the four aforementioned Standardized Tables and the materials listed in the Supporting Information section satisfy the IRP filing guidelines listed in Chapter 2 of the CEC guidelines.

B. Public Process Summary

Palo Alto staff has provided numerous reports and presentation related to various facets of the EIRP to the Utilities Advisory Commission (UAC) over the past 15 months. The current EIRP report was reviewed by the UAC on September 5, 2018 and October 3, 2018, before being presented to the Finance Committee and City Council for approval in October and November 2018. Table 3 below lists all public presentations related to the EIRP, with links to the associated reports.

Table 3: Public Process Summary for Development of the 2018 EIRP

Forum	Date	Topic	Link
UAC	6/7/2017	Overview of CPAU's EIRP Development Process	Report
UAC	8/2/2017	Discussion of DER Plan Development	Report
UAC	8/2/2017	Discussion of California Wholesale Energy Market and Electric Portfolio Cost Drivers	Report
UAC	9/6/2017	Discussion of Hydroelectric Resources and Carbon Neutral Portfolio Alternatives	Report
UAC	11/1/2017	Discussion of Proposed DER Plan	Report
UAC	12/6/2017	Discussion of Renewable and Carbon Neutral Portfolio Strategy	Report
UAC	4/12/2018	Assessment of CPAU's Distribution System to Integrate DERs	Report
UAC & Council	5/2/18 & 5/21/2018	CPAU Demand Side Management Annual Report – FY 17	UAC, Council
UAC	6/6/2018	Long-term Electric Portfolio Analysis Results and Options for Rebalancing Portfolio in the Next Five to Ten Years	Report
UAC	9/5/2018	Discussion of 2018 EIRP Executive Summary, Objective & Strategies, and Work Plan	Report
UAC	10/3/2018	Recommendation to Approve CPAU's 2018 EIRP	TBD
Finance	10/16/2018	Recommendation to Approve CPAU's 2018 EIRP	TBD
Council	Nov 2018	Approval of CPAU's 2018 EIRP	TBD

An IRP represents a snapshot of a continuous process that evolves and transforms over time. The conditions and circumstances in which utilities must make decisions about how to meet customers' future electric energy needs are ever-changing. The IRP process utilizes a methodology and framework for assessing a utility's ever-changing business and operating requirements and adapting to factors such as changing technology, regulations, and customer behavior. Assumptions, scenarios, and results are all reviewed and updated as information and events unfold, and the process is continually revisited under formal or informal resource planning efforts.

II. Background & Achievements to Date

A. CPAU History and Mission Statement

The City of Palo Alto Utilities' (CPAU) history began over one hundred years ago, in 1896, when the water supply system was first installed. Two years later, the wastewater or sewer collection system came online. In 1900, the municipal electric power system began operation, followed in 1917 by a natural gas distribution system. While CPAU and the utilities industry have evolved dramatically over 118 years, the City has nonetheless maintained a consistent set of core values: Quality, Courtesy, Efficiency, Integrity, and Innovation.

Palo Alto's 2018 EIRP is a comprehensive planning document to guide long-term power planning aligned with CPAU's Mission Statement, which is "to provide safe, reliable, environmentally sustainable and cost effective services."⁴

B. Previous IRPs & Recent Accomplishments

Palo Alto regularly engages in long-term planning efforts related to its electric supply portfolio – previously under the auspices of the Long-term Electric Acquisition Plan (LEAP) and in the future under the EIRP.⁵ The last time the City completed a LEAP update was on April 16, 2012 ([Staff Report 2710, Resolution 9241](#)). A few years later, in 2015, Senate Bill 350 (SB 350) was signed into law, and it includes a requirement that publicly-owned utilities (POUs) serving loads greater than 700,000 megawatt-hours per year, such as Palo Alto, develop and adopt an IRP by January 1, 2019 and submit it to the CEC by April 30, 2019 and every five years thereafter.⁶

As part of the 2012 LEAP update, the City Council approved a set of electric portfolio decision-making Objectives and Strategies. At the outset of the current EIRP development process, staff developed an updated Objective and Strategies. The current version, which aligns with the Utilities [2018 Strategic Plan](#), is very similar to the ones adopted in 2012, with the new Objective and Strategies placing greater emphasis on managing uncertainty related to resource availability and costs, regulatory uncertainty, and the increased penetration of DERs.

The 2012 LEAP update included an Implementation Plan describing a set of ongoing tasks and new initiatives for the City to undertake in order to satisfy the LEAP Objectives and Strategies. In carrying out this Implementation Plan and other initiatives, Palo Alto has accomplished the following over the past six years:

⁴ See the City of Palo Alto Utilities 2018 Strategic Plan, which includes the Mission Statement and Strategic Direction, here: <https://www.cityofpaloalto.org/civicax/filebank/documents/64505>.

⁵ Staff will hereafter discontinue using the term LEAP and in the future use the term EIRP when seeking long-term electric portfolio plan approvals from the Council.

⁶ The Clean Energy and Pollution Reduction Act of 2015 also raised the state's renewable portfolio standard (RPS) to 50% by 2030 and required a doubling of energy efficiency savings by 2030. The primary objective of the IRP requirement in SB 350 is to ensure that the state's large POUs are on track to reduce their greenhouse gas emissions, helping the state meet its overall target of reducing GHG emissions to 40% below 1990 levels by 2030.

- Developed a **Carbon Neutral Electric Supply Plan** and implemented it every year, beginning in 2013;
- Increased the **renewable energy supply** from 21% of total load to 57% of total load;
- **Reduced GHG emissions** related to electricity by 109,000 MT CO₂e, helping reduce community-wide emissions by 43% compared to 1990 levels;
- Developed and launched a **Feed-in Tariff program** (Palo Alto CLEAN) for local renewable energy projects, which currently has 1.6 MW of operating solar PV projects and an additional 1.3 MW of solar projects in development;
- Executed **six new utility-scale solar contracts** (totaling 153 MW of capacity), of which five projects (127 MW capacity) are currently operational;
- Achieved cumulative **energy efficiency savings** of 4.4%⁷ since 2012;
- Coordinated with other departments on the installation of 60 **public EV charger ports** owned and maintained by the City;
- Approved a **Local Solar Plan** setting a goal of producing 4% of the community's power supply with local solar resources by 2023;
- Approved an **Electrification Work Plan** to facilitate the electrification of natural gas loads in buildings and facilitate adoption of electric vehicles;
- Adopted **aggressive energy efficiency goals** which are 20% greater than a business as usual approach and require new and innovative programs;
- Adopted a **Sustainability and Climate Action Plan** with a goal of reducing community emissions to 80% below 1990 levels by 2030;
- Approved a new CPAU **Strategic Plan**; and
- Continued to **balance our own loads and resources** under the CAISO-NCPA Metered Subsystem Agreement.

C. Changing Planning Environment

Across the industry, integrated resource planning has undergone significant changes in recent years. Traditionally, an IRP was an opportunity for a utility to evaluate the steady growth of its customer loads over a 10+ year planning horizon, and develop a plan for meeting that load growth through staged additions of new centralized thermal generation resources. Today's IRPs, however, have to consider how to integrate increasing volumes of variable and/or distributed generation in an environment of declining loads and increasing regulatory mandates, all while maintaining reliability and controlling costs. Accordingly, the objective of this IRP is to evaluate Palo Alto's portfolio of resources against the changing utility landscape and California's environmental requirements, while recommending strategies to ensure Palo Alto continues to meet the Council's goals for affordability and sustainability. The following is a description of some of the primary changes to the utilities planning environment over the past several years.

i. Increasing DER Penetration & Load Profile Uncertainty

California's resource mix has changed considerably as a result of its ambitious renewable mandates and the rapidly declining costs of solar and wind resources. The shift to renewables has led to lower (sometimes negative) market prices for power at certain times of the day, but has changed the daily

⁷ Includes savings related to Codes and Standards changes, as well as estimated savings for 2018.

load shape, which traditionally had a single peak lasting a few hours each day. The changing load shape means new resources will be needed, and existing resources will need to be used differently, while maintaining affordability for customers.

Solar and wind resources, unless paired with multi-hour energy storage systems, are intermittent sources of generation, where energy output is a function of fuel availability (i.e., sunlight and wind). In order to accommodate large volumes of intermittent resources, the system must include a sufficient supply of highly responsive resources (or load) to follow this new demand profile, which is referred to as net load (i.e., gross electricity consumption less intermittent generation). Recent capacity additions for RPS compliance have largely been solar resources, which are introducing a surplus of energy supply in the daytime hours, particularly in the spring and fall when renewable resources maintain higher levels of output and customer loads are at seasonal lows.

Figure 1: The Duck Curve – Net Load in California with Penetration of Intermittent Generation (Source: CAISO)

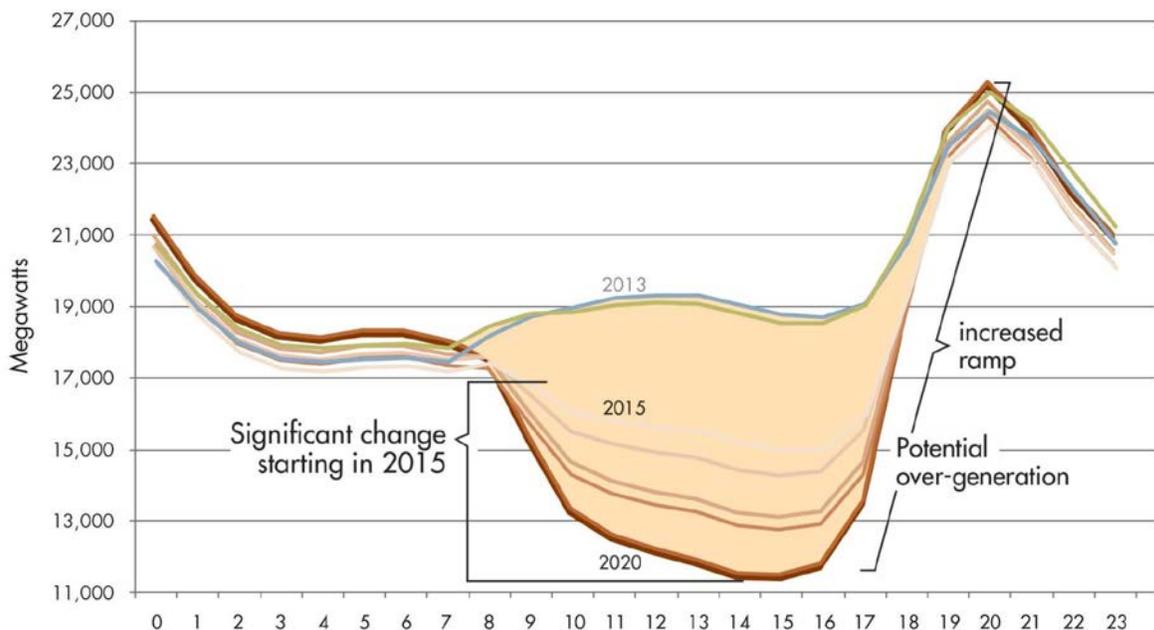


Figure 1 is a visual representation of the difference in load vs net load, highlighted by the beige area. This is commonly referred to in the industry as the “duck curve.” As seen in Figure 1, solar contributes to meeting load in the middle of the day, but rapidly trails off in the evening when load is still at or near its daily peak. For reliability, this creates the added capacity challenge of being able to meet the ramp, in addition to meeting peak demand. The resource fleet must be able to ramp down in the morning to accommodate increases in solar output, then ramp back up very rapidly to meet peak demand as solar generation diminishes with the setting sun. And while utility-scale solar is a challenge for grid operators to integrate, the growing amounts of distributed solar are an even more vexing, as these resources are essentially invisible to grid operators – thus they add a significant amount of uncertainty to net load projections.

ii. GHG Emission Reductions

In 2006, California passed Assembly Bill (AB) 32, the California Global Warming Solutions Act. AB 32 is a mandate for several sectors, including the electricity sector, to reduce GHG emissions to 1990 levels by 2020. In 2016, AB 32 was augmented by Senate Bill (SB) 32, which mandated a GHG emissions reduction target of 40% below 1990 levels by 2030. California's goal of reducing GHG emissions will be achieved through a combination of market mechanisms (Cap and Trade) and prescriptive mandates (RPS) to retire and replace high emitting resources with cleaner resources.

In order to achieve the SB 32 targets, many sectors of the economy – including industry, transportation, and electricity – will need to reduce their GHG emissions. The state's electric sector GHG emissions in 1990 were 108 MMT CO₂e. Reducing this amount by 40% creates a target of 64 MMT CO₂e; however, CARB's proposed range of 30-53 MMT CO₂e for the electricity sector is a 51% to 72% reduction, well in excess of the sector's pro-rata share of the overall reduction target.⁸

The electricity sector is expected to surpass its pro-rata emission reduction share due primarily to the 50% RPS goal and aggressive energy efficiency requirements. SB 350 requires that POU IRPs not only describe how they will meet their 2030 50% RPS target, but also how they will contribute to the electricity sector's share of GHG emissions reductions by 2030. For benchmarking in this IRP and for portfolio planning purposes, Palo Alto used the mid-range value of 42 MMT CO₂e as the 2030 target for the electricity sector (of which Palo Alto's load-based pro rata share is 73,013 MT CO₂e). These goals are for planning purposes and not compulsory; however, if changes to the regulations occur, Palo Alto will reflect those updates in its future resource planning efforts.

iii. Renewable Portfolio Standards (RPS)

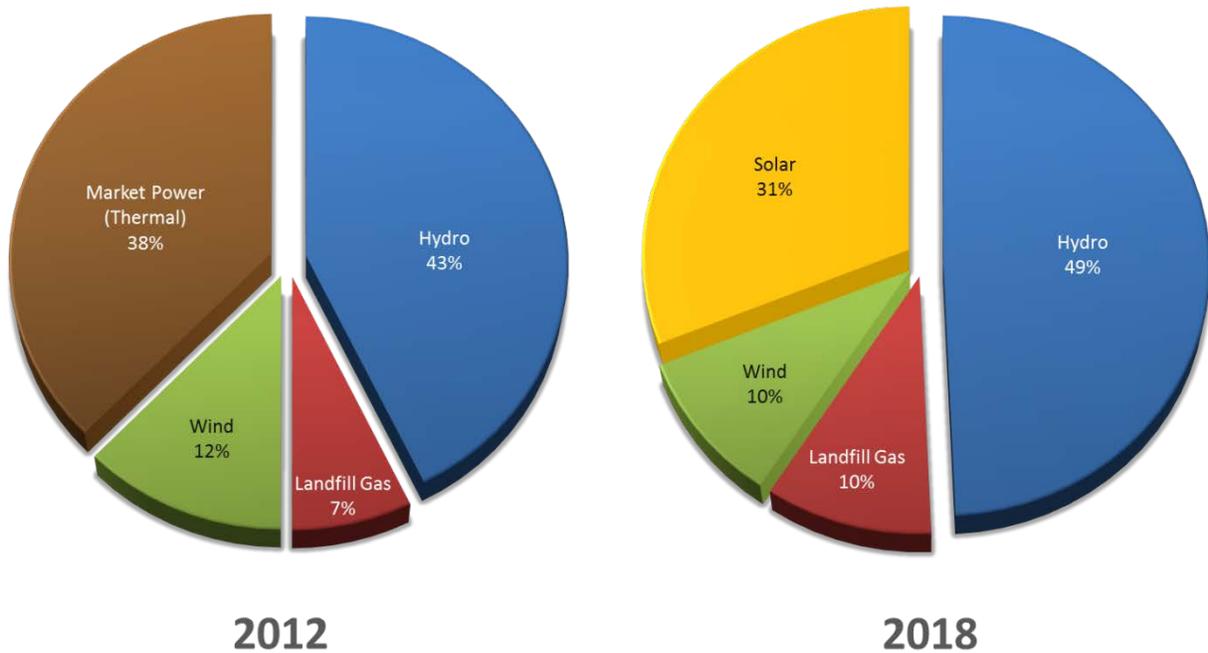
One of the primary mechanisms for reducing GHG emissions in the electricity sector is the state's RPS. The state's RPS program mandates that an increasing percentage of retail sales be served by qualifying renewable generation. An RPS mandate was first imposed on Palo Alto by SB X1-2 in 2011, and subsequently expanded by SB 350 in 2015. Currently, the major targets are 33% renewables by 2020, and 50% by 2030. In addition to the minimum renewable generation procurement requirements, the RPS program also includes portfolio balancing requirements and long-term contract requirements, as described in Palo Alto's RPS Procurement Plan (included as Supplementary Information).

Palo Alto satisfies its RPS requirements through a diverse portfolio of qualifying renewable resources – wind, solar, bioenergy (landfill gas), and small hydro. In addition, approximately half of Palo Alto's load is served by large hydro, a carbon-free resource that helps reduce GHG emissions, yet cannot be counted for RPS compliance. Figure 2 illustrates Palo Alto's actual and projected power supply mix for 2012 and 2018. (Note that 2012 was a slightly dry year, so the hydroelectric supply was a bit lower than average. Also, about 1% of the overall hydro supply is RPS-eligible "small hydro.") If the City

⁸ The two other major sectors in the economy are the industrial and transportation sectors. In the Scoping Plan, CARB estimates the industrial sector can reduce GHG emissions between 8% and 15%, while the transportation sector can reduce GHG emissions between 27% and 32%. Much of the transportation sector's emissions reduction burden is expected to be shifted to the electricity sector via transportation electrification, which was not accounted for in CARB's Scoping Plan. This means the electricity sector's GHG emissions reduction burden will be even greater than it appears.

renews its contract with the Western Area Power Administration after 2024, the 2030 power supply mix is projected to be similar to the 2018 mix, but with less wind and landfill gas and more solar.

Figure 2: Palo Alto Power Supply in 2012 and 2018



iv. Energy Efficiency

California has continually increased the energy efficiency of its new buildings and appliances since the Warren Alquist Act of 1974. These efficiency standards (Title 24) were updated to mandate Zero Net Energy (ZNE) residential new construction starting in 2020. ZNE homes require energy efficiency that will be achieved through implementing a high-efficiency envelope (insulation, windows, etc.), and efficient heating, ventilation, and air conditioning units. The remaining energy consumption must be offset by on-site generation, sized so that the annual building electricity consumption is equal to the building’s electricity generation. By 2030, staff anticipates that the CEC will incorporate a carbon metric as part of the Title 24 building standards.

D. Overview of EIRP methodology

Integrated resource planning is the process that utilities undertake to determine a long-term plan to ensure generation resources are adequate to meet projected future peak capacity and energy needs, while achieving other utility goals such as maintaining an adequate capacity reserve margin for system reliability. Resource plans must ensure generation reliability is maintained at or above industry-standard levels. IRPs should also forecast long-term costs and potential rate impacts to customers to ensure that the utility can monitor and track trends with sufficient time to implement solutions to ensure reliability, compliance, and affordable electric service. An effective resource plan should also

provide a reasonable degree of flexibility for the utility to deal with uncertainty in technological change and future regulations.

IRPs require the use of sophisticated analytical tools capable of evaluating and comparing the costs and benefits of a comprehensive set of alternative supply and demand resources. Supply options typically include the evaluation of new conventional generation resources, renewable energy technologies, and distributed energy resources. Demand options typically include consideration of demand response programs, energy efficiency programs, and other “behind the meter” options which may reduce the overall load that the utility must be prepared to supply.

IRPs utilize various economic analyses and methodologies to assess alternative scenarios (e.g., different combinations of supply and demand resources) and sensitivities to key assumptions to arrive at an economically optimal resource plan (subject to various constraints, such as regulatory mandates and local policies). The key steps in the resource planning process are outlined below.

Step 1: EXAMINE PLANNING FRAMEWORK AND RISKS: Identify and assess challenges the utility faces in the current business and regulatory environment.

Step 2: ASSESS NEEDS: Develop forecasts of load changes (incorporating impacts of cost-effective demand-side resources), existing plant conditions, contract terms, and operational constraints to determine resource needs over the planning period.

Step 3: CONSIDER RESOURCE OPTIONS: Evaluate available generation resources, including centralized and distributed renewables and long-term market power purchases to identify the role each will play in meeting customer needs and regulatory and policy goals.

Step 4: DEVELOP RESOURCE PORTFOLIOS: Develop resource portfolios, and evaluate them quantitatively and qualitatively to determine a preferred portfolio. Evaluation relies upon GHG emission requirements, needs assessment, and planning data specified in previous steps.

Step 5: PERFORM SCENARIO AND RISK ANALYSIS: Perform detailed evaluations of preferred resource portfolios through scenario and risk analysis, to assess performance under a range of potential market and regulatory conditions.

Step 6: IDENTIFY PLAN: Identify a “Preferred Plan” based on the resource portfolio expected to reliably serve demand at a reasonable long-term cost, while achieving regulatory compliance, accounting for inherent risks, and allowing for flexibility to respond to future policy changes.

III. Forecast Methodology for Energy and Peak Demand

Palo Alto’s forecasted energy and demand were generated by creating an econometric model for monthly energy and peak demand and then combining them with separate forecasts for new distributed energy resources (DERs) expected to be deployed. This approach was used since the econometric models do not accurately capture new expected growth in these DERs. Separate models were used to forecast DERs of highest impact. After energy and peak demand profiles for these DERs were generated, these exogenous forecasts were then applied to the energy forecast as out-of-model adjustments.

Equation 1: Methodology Energy and Peak Demand Forecast

$$\text{Total Forecast}_{\text{Energy OR Peak Demand}} = \text{Econometric Forecast}_{\text{Energy OR Peak Demand}} + \text{New DER Forecasts}_{\text{Energy OR Peak Demand}}$$

More details on the DER forecasts and load shape profiles that were generated are available in the [Proposed Distributed Energy Resources Plan, which was presented to the UAC in November 2017](#).

The DERs modeled for the purpose of this analysis were:

- Energy Efficiency (EE)
- Solar Photovoltaics (PV)
- Electric Vehicles (EV)
- Demand Response (DR)
- Energy Storage (ES)
- Heat-pump Water Heaters (HPWH)
- Heat-pump Space Heaters (HPSH)

The base case annual energy forecast is shown in Figure 3. The projected change in hourly load shape on a peak day in 2030 is shown in Figure 4.

Figure 3: Annual Energy Forecast including DERs (2018-2030)

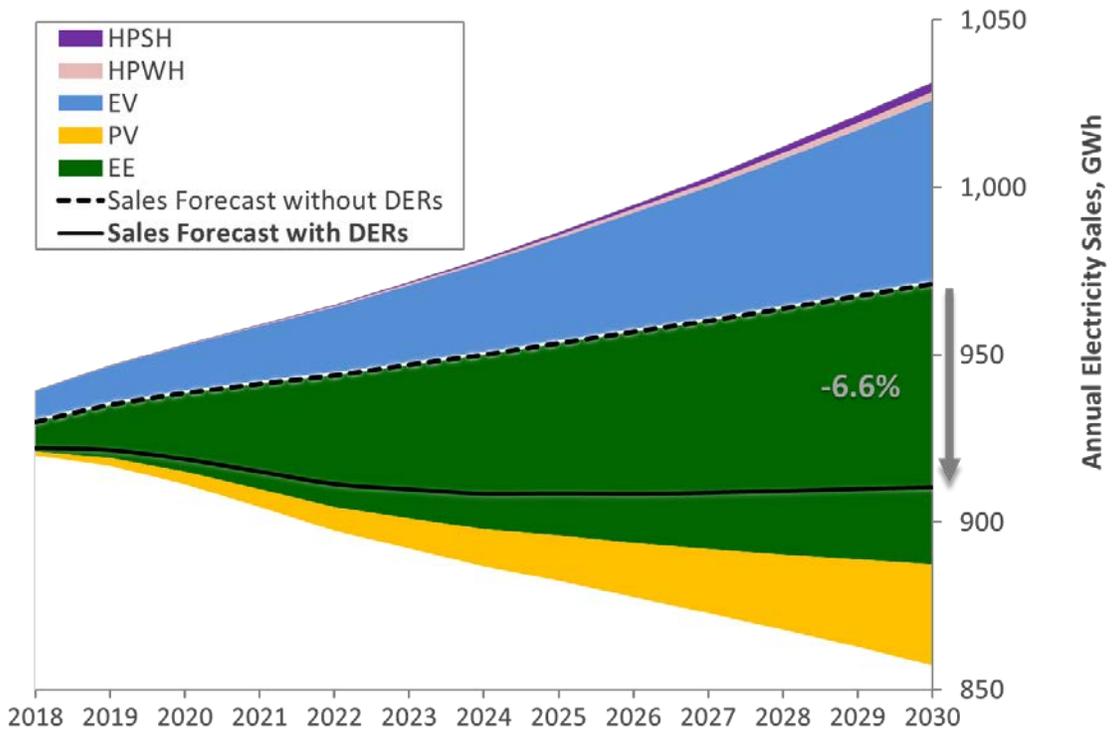
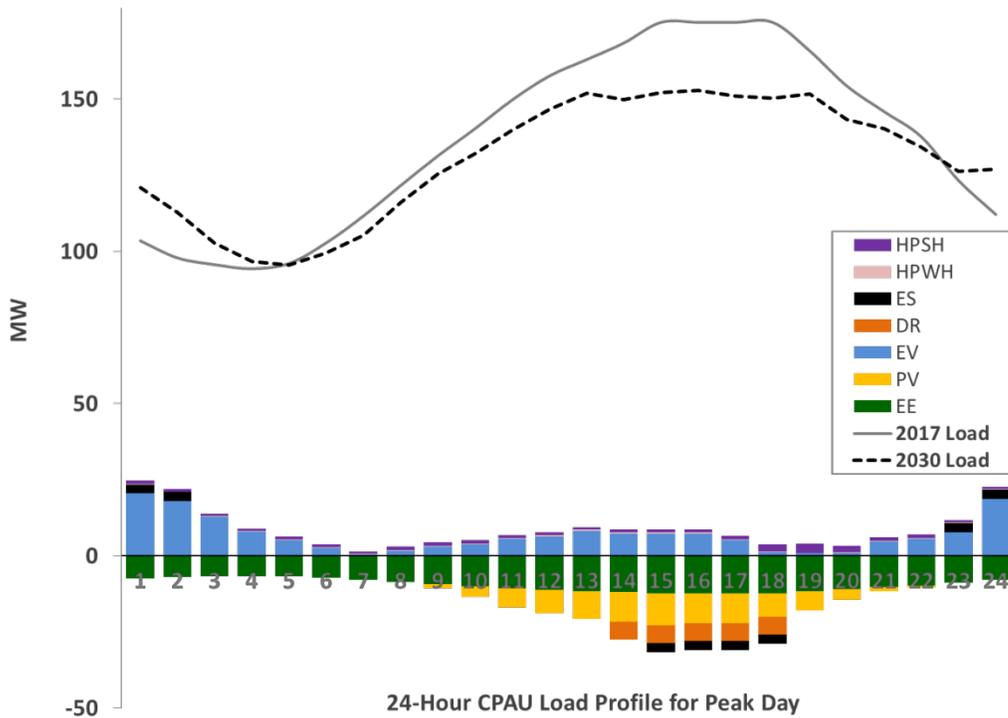


Figure 4: Impact of DERs on Hourly Summer Load Shape in 2030



A. Description of Econometric Forecast Models

The econometric model inputs (i.e. independent variables) have been selected based on the availability of data, economic theory, and tests to validate the forecasts with actual energy (or demand) data. The coefficients of the models were obtained via statistical estimation on historical (in-sample) data where the Yule-Walker Generalized Least Squares method was employed to take into account the autocorrelation structure of the residuals so as to obtain valid standard error estimates. The coefficients were then combined with forecasts of each driver (independent variable) to produce the forecasted energy (or peak demand). Forecasts of the economic driver variable were provided by the Bureau of Economic Analysis and the forecasted values provided by the UCLA Anderson Forecast group. Weather variables were obtained from NOAA, and the forecasted weather conditions were set to reflect normal weather based on average temperatures across the training data set.

i. Energy Econometric Model

The Energy forecast is an econometric model that maps a set of calendar variables, weather variables, and an economic driver variable onto Palo Alto's monthly energy consumption measured at its California Independent System Operator (CAISO) meter at the Palo Alto City Gate. The monthly calendar variables are used in the model to capture underlying changes in Palo Alto customers' electric consumption caused by changing daylight hours and seasonal electricity usage. Monthly Heating Degree Days and Cooling Degree Days are used to explain the variation in energy due to the weather. Investment in non-residential equipment and software as reported by the Bureau of Economic Analysis was used as the economic driver. This variable represents business activity in the computer software and equipment sector of the economy, which directly affects Palo Alto's utility customers' energy consumption.

ii. Peak Demand Econometric Model

The Peak Demand forecast is also an econometric model that maps a set of calendar variables, weather variables, and the energy forecast onto Palo Alto's monthly peak demand measured at its CAISO meter. Similar to the Energy Forecast, monthly dummy variables are used in the model to capture underlying changes in Palo Alto customers' electric consumption throughout the year. Daily heating and cooling degree days corresponding to the peak day of the month is used as the weather driver. Monthly historical energy usage is added as the final variable explaining peak demand.

B. Description of Distributed Energy Resources Forecasts

Distributed Energy Resource forecasts for a number of technologies were developed and presented to the Palo Alto UAC in the proposed [Distributed Energy Resources Plan](#) in November 2017.

The distributed energy resources considered for the purposes of these analyses were:

- Energy Efficiency (EE)
- Solar Photovoltaics (PV)
- Electric Vehicles (EV)
- Demand Response (DR)
- Energy Storage (ES)
- Heat-pump Water Heaters (HPWH)
- Heat-pump Space Heaters (HPSH)

DER penetration forecasts and load shape models were developed to address three main areas:

1. **DER Adoption Projections:** Adoption forecasts for each DER technology.
2. **DER Load Impact Projections:** Energy used or delivered to the system on an hourly and seasonal basis to determine the impact of DERs on electric sales and load shape.
3. **DER Financial Impact Projections:** Financial impact to the utility of DER adoption based on the adoption and load impact projections. This analysis considered only the impact to wholesale electric supply costs, and did not include the impact of changes to current rate structures.

The detailed assumptions and limitations of each of these projections are discussed in their following respective sections. The forecasts of the number of distributed energy resources in Palo Alto are shown in Table 4. The impact that these DER systems will have on CPAU’s net electricity sales is shown in Table 5, and previously in Figure 4.

Table 4: Projected Number of DER Systems (2017-2030)

<i>Projected Number of Systems</i>			
DER Technology	2017 (current)	2020	2030
PV	1,000	1,300	2,500
EV ⁹	2,500	5,900	18,700
EE	40,880	45,000	60,000
DR	8	25	75
ES	11	85	580
HPWH	10	200	2,700

Table 5: Projected Contribution to Energy Sales of DER Systems (2017-2030)

<i>Contribution to Energy Sales</i>	<i>2017 (current)</i>		<i>2020</i>		<i>2030</i>		
	DER Technology	MWh	%	MWh	%	MWh	%
PV		-15,000	-1.6%	-18,800	-2.0%	-45,200	-4.9%
EV		7,100	0.8%	14,300	1.6%	54,800	6.0%
EE		-55,300	-6.0%	-78,800	-8.6%	-139,200	-15.2%
DR		7	-	23	-	200	0.02%
ES ¹⁰		-	-	-	-	-	-
HPWH		9	-	190	0.02%	2,500	0.3%
HPSH		-	-	90	0.01%	2,800	0.3%

⁹ This is the total number of residential EVs currently registered in Palo Alto. There are also EVs which commute into Palo Alto, some of which charge while in Palo Alto and add to CPAU electricity sales. In addition to the residential EVs shown here, there are estimated to be approximately 3,100, 5,900 and 20,000 commuter EVs in 2017, 2020 and 2030 respectively.

¹⁰ Batteries and other ES devices may result in either net increased energy retail sales (due to battery losses where commercial customers use batteries to avoid CPAU demand charges) or net decreased energy retail sales (due to increased onsite consumption of behind the meter solar). For the purpose of these analyses these two effects are assumed to be roughly the same magnitude and therefore ES systems are not currently considered to have any net effect on energy sales.

Contribution to Energy Sales	2017 (current)		2020		2030	
	MWh	%	MWh	%	MWh	%
DER Technology						
Combined DER Impact: from 2007	-63,200	-6.9%	-83,000	-9.1%	-124,000	-13.6%
Combined DER Impact: from 2017	-	-	-19,700	-2.2%	-60,900	-6.6%
CPAU Overall System Load Growth from 2017¹¹	-	-	-3,200	-0.3%	-6,900	-0.8%

i. Energy Efficiency Forecast

a. Committed Energy Efficiency

AB 2021 (2006) required POUs to identify all potentially achievable cost-effective electric efficiency savings and to establish annual targets for energy efficiency savings over ten years, with the first set of EE targets to be reported to the CEC by June 1, 2007, and updated every three years thereafter. AB 2227 (2012) amended this target-setting schedule to every four years. Palo Alto adopted its first Ten-Year Energy Efficiency Portfolio Plan in April 2007, which included annual electric and gas efficiency targets between 2008 and 2017, with a ten-year cumulative savings goal of 3.5% of forecasted energy use. In accordance with California law, the electric efficiency targets were updated in 2010, with the ten-year cumulative savings goal doubling to 7.2% between 2011 and 2020. Since then, increasingly stringent statewide building code and appliance standards have resulted in substantial energy savings. However, these “codes and standards” energy savings cannot be counted toward meeting the utility’s EE goals. The ten-year electric efficiency targets were updated again in 2012, with the ten-year cumulative electric efficiency savings being revised downwards to 4.8% between 2014 and 2023. For fiscal year (FY) 2017, CPAU achieved electric savings of 0.7% of load through its customer efficiency programs as shown in the most recent [Demand Side Management Report](#). Cumulative electric efficiency savings since 2006 are about 6% of the FY 2017 electric usage. Adoption rates for EE are based on the 10-year Energy Efficiency Goals for 2018-2027 which were updated in 2017. The ten-year cumulative electric efficiency savings target was updated to 5.7% between 2018 and 2027. These adopted goals are ambitious goals which include new programs in order to achieve a 20% increase over the last goals adopted. For the years 2028 through 2030 the assumed savings are the average of the savings in 2026 and 2027, which is the methodology suggested by the CEC for estimating savings beyond the ten-year energy efficiency goals.¹² More details on the EE methodology for market potential can be found in [Staff Report 7718](#) from March 6, 2017.

¹¹ Going forward from 2017 the total CPAU load is forecasted to grow at roughly 0.4% per year if no more DERs were added to the system. With the addition of new DERs, the total CPAU load is projected to decrease by roughly 0.8% from 2017 electricity sales by the year 2030.

¹² The extension of savings through 2030 is based on the methodology put forth in the CEC presentation by Mike Jaske from September 7, 2017, which can be found here: [CEC presentation on Energy Efficiency Savings from Utility Programs](#).

Although CPAU established its EE goals based on net savings, the energy efficiency savings shown in the tables and graphs here include EE savings due to free-ridership as well as savings from statewide codes and standards.

b. Additional Achievable Energy Efficiency

There is no additional achievable energy efficiency assumed in this EIRP forecast because the additional achievable energy efficiency is already included in the ambitious adopted energy efficiency goals for 2018 to 2027. These ambitious energy efficiency goals are 20% higher than a business-as-usual case and will require new innovative programs.

ii. Solar Photovoltaic Forecast

Solar PV projections are based on technical and economic potential; they indicate that adoption will grow steadily, with the growth rate itself plateauing as is typically seen in a maturing market. These projections include behind-the-meter installations in residential and commercial sectors, but do not include a potential Community Solar installation that has recently been discussed by the Palo Alto UAC.

In April 2014, the Palo Alto City Council approved the Local Solar Plan, which sets a community-wide goal of meeting 4% of the City's energy needs through local solar by 2023 and identifies a number of strategies to help achieve that goal. These strategies include the development of several solar programs to encourage installation of roof-top solar such as existing incentives like the feed-in tariff program and the PV Partners solar rebate program. As of the end of 2017 all solar installations within the City generate 1.94% of the City's electricity from about 10 MW of installed local solar capacity.

iii. Transportation Electrification Forecast

To date, Palo Alto has observed residential EV adoption rates approximately three times greater than the California statewide average, and this residential adoption rate relative to statewide average projections is assumed to continue to 2030. To estimate the EV adoption rates of commuters *into* Palo Alto, the observed adoption rate from 2017 census data for the entire Bay Area was extended to 2030. In addition to the number of residential EVs shown in Table 4 above, there are projected to be approximately 3,100, 5,900, and 20,000 commuter EVs in 2017, 2020 and 2030, respectively.

iv. Energy Storage Forecast

This forecast is based on statewide projections for batteries and CPAU electricity rate structures. CPAU, in coordination with the Palo Alto Development Services Department, is facilitating the adoption of energy storage systems by customers by streamlining the process for permitting and interconnecting such systems. Detailed analysis in 2017 showed that batteries are currently not cost effective within CPAU's service territory or at our remote renewable generation sites and therefore Palo Alto currently does not provide any rebates for energy storage systems and is not currently planning to install storage at any of our renewable resources. In August 2017, the [Palo Alto City Council adopted a resolution](#) determining not to set a target for CPAU to procure energy storage systems at the wholesale level (or

to establish a rebate program for behind-the-meter installations) due to a current lack of cost-effective applications for Palo Alto. The City plans to revisit the analysis by 2020.¹³

v. Demand Response Forecast

CPAU has been running a voluntary summer demand response program for large commercial and industrial customers since 2013, with an average of 4-5 DR events per year resulting in 0.5-1 MW of peak load reduction. For the 2018 demand response program there are a total of 7 commercial customers enrolled, with 525 kW of projected peak load reduction. The EIRP Energy and Peak Demand forecasts are based on modest growth projections for the current voluntary large commercial demand response program. Somewhat more robust growth is expected after the implementation of Palo Alto's Advanced Metering Infrastructure (AMI) program in 2023.

vi. Electrification of Space and Water Heating Forecast

The Energy and Peak Demand forecasts use historical solar PV penetration rates as a proxy for adoption rates of heat-pump water heaters and space heaters. Based on this analysis, staff projects a natural gas load reduction of up to 1% from HPWH adoption, and an additional 1% load reduction from HPSH adoption, by 2030.

vii. SB 338 Requirements

On September 30, 2017, SB 338 was signed into law by Governor Brown, including additional provisions for the POU IRPs, which were effective January 1, 2018. This included revisions to Public Utilities Code section 9621(c), requiring the POU's governing board to *"consider the role of existing renewable generation, grid operational efficiencies, energy storage, and distributed energy resources, including energy efficiency, in helping to ensure each utility meets energy needs and reliability needs in hours to encompass the hour of peak demand of electricity, excluding demand met by variable renewable generation directly connected to a California balancing authority, as defined in Section 399.12, while reducing the need for new electricity generation resources and new transmission resources in achieving the state's energy goals at the least cost to ratepayers."*

The development of this IRP began well in advance of the effective date of these provisions. However, as part of the comprehensive process undertaken to develop this EIRP, the City reviewed and considered resource options that included all of the technologically feasible and cost-effective options available to it, including what options would be best utilized to meet energy needs and reliability requirements during hours of peak demand for the utility. This includes a review of the best available options considering both new and existing preferred resources, as would necessarily be assessed in order to ensure that Palo Alto provides its customers with the cleanest and most cost-effective generation resources, while also ensuring that the City meets all of the statutory requirements of not only Section 9621, but other procurement and resources mandates, as well.

As previously mentioned, in November 2017 staff presented to the Palo Alto UAC an assessment of the future impact of distributed energy resources ([Distributed Energy Resources Plan](#)). This assessment

¹³ The analysis that led to the City Council's determination not to adopt a wholesale energy storage target can be found in this report to the Palo Alto UAC: <https://www.cityofpaloalto.org/civicax/filebank/documents/57435>.

included guidelines for facilitating customer adoption as well forecasts of their potential to mitigate peak demand for CPAU. The aggressive forecasts and programs for solar PV, energy efficiency, and demand response have great potential to mitigate CPAU's peak demand.

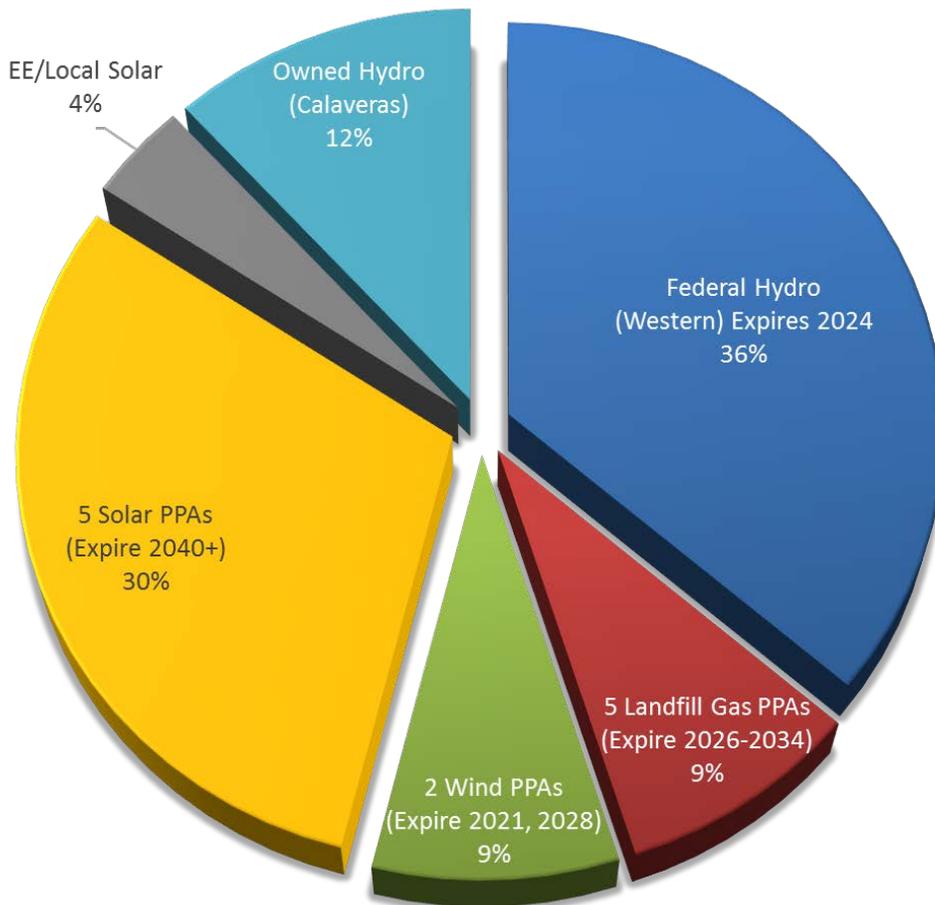
IV. Existing Resource Portfolio

The City’s current electric supply portfolio comprises the following major types of resources:

- Energy efficiency and distributed generation;
- Federal hydro (Western contract);
- Owned hydro (Calaveras);
- Long-term, in-state, RPS-eligible power purchase agreements (PPAs), which include solar, wind, and landfill-gas resources; and
- Market power purchases, matched with RECs, for monthly/hourly portfolio balancing.

For calendar year 2020, the projected contribution of each of these five resource types to the City’s overall electric supply portfolio is represented in Figure 5 below.

Figure 5: Projected Palo Alto Electric Supply Mix in CY 2020 by Resource Type
 * Estimated Average Annual Unit Cost of 6 ¢/kWh *



A. Energy Efficiency & Local Renewable Generation

i. Energy Efficiency

Palo Alto has long recognized cost-effective energy efficiency (EE) as the highest priority energy resource, given that EE typically displaces relatively expensive electricity generation and lowers energy bills for customers.

Palo Alto places such emphasis on energy efficiency and demand side management programs that each year we prepare a detailed [Demand Side Management Annual Report](#) describing and reporting on efficiency savings from electricity, gas, and water.

Highlights of Energy Efficiency Programs from 2017

- **Multifamily Residence Plus+ Program** - This program, which focuses on a hard-to-reach customer segment, was expanded in FY 2016 to include LED lighting measures, as the cost and quality of LED lighting had improved. In September 2016, the contract with the vendor was amended to add \$500,000 to accommodate demand for the upgrades. As a result, the program saw an increase in savings of over 950%.
- **The Home Efficiency Genie Program** - The Genie was launched in the summer of 2015 as a home efficiency assessment program. The licensed energy auditors still do house calls, but the program has expanded its focus to include more phone-based customer service on energy and water-related topics. The Genie now provides information not only about efficiency but also about the City's sustainability programs, such as heat pump water heaters (HPWHs) and the solar group-buy program (SunShares). Staff also changed the program guidelines to allow the Genie to discuss and advise residents on available rebates.
- **Heat-Pump Water Heater Pilot Program** - The goal of this program is reduction of greenhouse gas (GHG) emissions through switching from natural gas appliances to high-efficiency electric appliances. Installation of heat pump water heaters (HPWHs) has been identified as a good starting candidate for a pilot program. The pilot program—launched in the spring of 2016—was designed to facilitate the installation of HPWHs in single-family homes. In April 2017, the City hosted its first HPWH workshop to educate the community, including contractors, on the technology and installation of HPWHs.
- **Green Building Ordinance** – The Green Building Ordinance (GBO) is Palo Alto's local building reach code that is more stringent than the state Title 24 standard. This ordinance applies to both residential and commercial buildings. CPAU previously assisted in the development of this code, but FY 2017 is the first year for which savings associated with the GBO have been reported in this report.
- **Building Operators Certification (BOC) Course** - CPAU hosted a Building Operators Certification Course taught by Northwest Energy Efficiency Commission (NEEC) from Seattle. BOC is an eight-class certification course covering all aspects of building management and efficiency. Some

topics covered were: HVAC, electrical systems, comfort control and lighting. Upon passing an end-of-class exam, graduates could become Certified Building Operators (CBOs).

- **Residential Energy Assistance Program (REAP)** - This program provides qualifying low-income residents with free energy efficiency measures and access to the Rate Assistance Program (RAP) rate discount. For qualifying customers, a Home Assessment, an application to the RAP, and an on-site customer evaluation for weatherization and energy efficiency measure installation, including insulation and lighting, is provided. Customers may have refrigerators and/or furnaces replaced if the need is found.

ii. Local Renewable Generation

Local renewable energy programs are critical to lowering emissions of local air pollutants and CPAU has enacted a number of initiatives and programs to facilitate customer adoption. In addition, in 2014 the Palo Alto City Council adopted the [Local Solar Plan](#) with the goal of having local solar photovoltaic facilities provide 4% of the City's total energy needs by 2023.

The following is a description of Palo Alto's current customer-side renewable generation programs:

- **Solar PV Group-buy** - Every year since 2015 Palo Alto has been an active partner in promoting the Bay Area SunShares PV Group-buy program which pre-screens solar installers and negotiates lower rates for customers. In both 2015 and 2017 Palo Alto was the top "Outreach Partner," both in terms of the number of solar contracts signed and the kilowatts of rooftop solar capacity that will be installed through the program. From 2015 to 2017 Palo Alto residents have signed 88 solar contracts through the SunShares PV Group-buy program for a total of 421 kW of installed rooftop solar capacity.
- **PV Partners** - The PV Partners Program encourages photovoltaic or solar electric (PV) installations on Palo Alto homes and businesses by providing a rebate based on the capacity, measured in watts, of newly installed PV systems. The PV Partners Program continues to be one of the most successful in the State. Rebate funds were fully reserved in April 2016. The effect of the PV Partners program can be seen in the cumulative total of PV installations. As of June 30, 2017, there were 1,003 PV installations with the total capacity of 8.617 MW (5.04% of Palo Alto's system peak load).
- **Net-Energy Metering Successor Program** - Prior to January 1, 2018 residential and commercial customers in Palo Alto who installed approved PV systems were able to sign up for the CPAU Net Energy Metering (NEM) program. CPAU reached the NEM cap of 10.8 MW in January 2018 and CPAU is now offering a NEM Successor Program instead. The NEM Successor process is integrated with the permitting process, and customers receive a credit for electricity exported to the grid based on CPAU's avoided costs.
- **Palo Alto CLEAN (Clean Local Energy Accessible Now)** - This feed-in tariff program purchases electricity generated by renewable energy resources located in Palo Alto's service territory and interconnected on the utility-side of the electric meter. The electricity is purchased by Palo Alto for the electric renewable portfolio standard. The program was launched in 2012 and has been modified over the past few years. On February 3, 2014 the Palo Alto City Council approved a total program capacity of 3 MW at a price of 16.5 cents per kilowatt hour (kWh) fixed for 20

years. On May 8, 2017 the Palo Alto City Council approved minor changes to Palo Alto CLEAN. The program no longer has a total participation cap for either solar or non-solar eligible renewable energy resources. CPAU is currently offering to purchase the output of eligible renewable electric generation systems located in Palo Alto at the following prices:

- For solar energy resources: 16.5 cents per kilowatt hour (¢/kWh) for a 15-, 20- or 25-year contract term until the subscribed capacity reaches 3 MW – after that the price will drop to 8.8 ¢/kWh for a 15-year contract term, 8.9 ¢/kWh for a 20-year contract term, or 9.1 ¢/kWh for a 25-year contract term; and
- For non-solar eligible renewable energy resources: 8.3 ¢/kWh for a 15-year contract term, 8.4 ¢/kWh for a 20-year contract term, or 8.5 ¢/kWh for a 25-year contract term.

There is no minimum or maximum project size, but the program is best suited for commercial property owners with available roof-tops or parking lots. Palo Alto’s Public Works Department recently solicited proposals to install solar PV systems and electric vehicle chargers at four City-owned parking structures. All four of these parking garage solar PV systems are operational as of March 2018. As of August 2018, there are a total of six solar PV systems participating in the Palo Alto CLEAN program, including the four aforementioned systems on City-owned parking garages. These six projects account for 2.915 MW of the capacity available at the 16.5 ¢/kWh contract rate, with contract terms ranging from 15 to 25-years; five of them projects are now operational, and the sixth is expected to be online by the end of 2018.

B. Hydroelectric Resources

i. Western Base Resource

Since the 1960s, CPAU’s participation as a power customer of the Central Valley Project (CVP) has been an instrumental factor in its ability to deliver low-carbon electricity to Palo Altans at low rates. The U.S. Bureau of Reclamation (BOR) built the CVP in the 1930s and is charged with the operation, maintenance, and stewardship of the project. The CVP was constructed primarily for flood control of the Sacramento Valley area; however, it is also used to provide water for irrigation and municipal use and for navigation and recreational purposes. Hydroelectric generation is a lower priority function of the CVP, relative to the aforementioned purposes.

The BOR is legally required to first provide power to “Project Use” for operations and pumping water through the CVP project, and then to “First Preference Customers,” those customers whose livelihood and/or property/land was impacted by the construction of the CVP. The remaining hydroelectricity (“Base Resource”) is then made available for marketing under long-term contracts with not-for-profit entities such as municipal utilities and special districts. The Western Area Power Administration (WAPA) is the federal Power Marketing Agency charged with marketing and contracting with customers for the electric output associated with the CVP, and collecting funds to meet allocated revenue requirements on behalf of the BOR.

In 2000, the City executed a new 20-year contract with WAPA for CVP power deliveries starting in 2005. Under this contract the City receives 12.3% of all the Base Resource product output and is

obligated to pay 12.3% of all the CVP's revenue requirements as allocated to power customers, regardless of the amount of energy received. Under normal precipitation and hydrological conditions, this resource provides nearly 40% of CPAU's electricity needs. However, since 2005 the amount has varied from a low of 22% to a high of 64%. The corresponding cost per MWh has ranged from \$22 to \$61/MWh.

The current Base Resource contract is set to expire at the end of 2024. Western's proposed 2025 Power Marketing Plan, submitted to the United States Federal Register Notification ([U.S. FRN No 27433](#)), if approved by the Department of Energy, would allow existing Base Resource power customers to renew up to 98% of their existing allocation for a thirty-year term (2025-2054) under similar contract terms and conditions to their existing contracts.

The process for extending this contract is well underway and is expected to take five to seven years to complete ([Western's 2025 Power Marketing Plan Tentative Schedule](#)). CPAU staff has been actively involved in the process by providing informal and formal comments in response to the 2025 Western Power Marketing Plan and by working with WAPA staff and other Base Resource contract customers to develop a better model of long-term generation and cost projections. Pending approval of the 2025 Power Marketing Plan, Western will seek commitments through execution of the new Base Resource contract in 2020 – although participants are expected to have an option to reduce participation and/or terminate their contract in 2024.

A key topic for consideration in the EIRP is whether or not the City should renew its Base Resource contract – and if so, at what level. The analysis necessary to aid Council in its decision will need to consider the cost and the value of the resource going forward, which are both highly uncertain. This is due in large part to the nature of the CVP and supply availability, which is dependent on unpredictable precipitation conditions, the long-term effects of climate change, and the potential for new environmental policies and/or projects which threaten to erode generation value.

The costs associated with participating in the Base Resource are also highly uncertain. First, the BOR has yet to update the cost allocation study necessary to establish rates for CVP power under the existing contract, and it is unclear when such rates will be published for the post-2024 period. Additionally, funding requirements under the Central Valley Project Improvement Act (CVPIA)¹⁴ and the appropriateness of the allocation of Restoration Fund collections between water and power customers is of serious concern to CPAU and other power customers, who have been actively encouraging BOR and Congress to adjust this allocation.

Lastly, the potential for changes to local and state RPS requirements – such as portfolio mandates or carve-outs for baseload renewables and/or not providing consideration for supply variability associated with large hydroelectric resources – as well as the potential for loss of load due to distributed energy resources or load defection, increase the risk of a renewed Base Resource contract becoming a

¹⁴ The Central Valley Project Improvement Act was passed by the U.S. Congress in 1992 to establish the Restoration Fund, funding requirements and goals to restore the habitat of the area impacted by the CVP. Water and power customers are obligated to pay into the Restoration Fund. <https://www.usbr.gov/mp/cvpia/docs/public-law-102-575.pdf>

stranded resource, unless clear and reasonable termination provisions are included in the new contract.

NCPA staff and CPAU staff are in the process of assessing the impact magnitude and likelihood of several issues which threaten to dilute the future value of Base Resource, as well as NCPA's and CPAU's ability to influence these issues. These issues are in addition to highly variable hydrological and precipitation conditions which create year-to-year variations in value. Staff and NCPA will work towards refining the analysis of these risk factors, to aid in the decision of how much Base Resource to renew for the post-2024 period.

ii. Calaveras

Calaveras was bond-funded and built as a joint project between members¹⁵ of the Northern California Power Agency (NCPA) and the Calaveras County Water District (CCWD) in 1983. CCWD holds the Federal Energy Regulatory Commission (FERC) license and NCPA is the project operator. The project resides on the North Fork of the Stanislaus River in Calaveras, Alpine and Tuolumne Counties. Calaveras was built primarily for hydroelectric generation purposes and as such water is stored and managed to optimize generation value and to meet member owners' energy needs. Palo Alto's share in the project is 22.92%, which serves approximately 14% of the City's annual load in an average hydro year.

Calaveras' project capacity is about 253 MW and can generate 575 gigawatt-hours (GWh) of energy annually under average hydroelectric conditions. Palo Alto's corresponding share of the output is 58 MW of capacity and 132 GWh of annual energy.

As of January 2019, the City's outstanding debt on the project is approximately \$89 million, of which a large portion will be maturing in 2024 and the remainder will mature in 2032. Annually through fiscal year 2024, the City's debt related to this project is on average about \$9 million. For the remaining years until 2032, the debt is about \$5 million. Historically, debt and other costs associated with Calaveras have resulted in the overall value of the project being below market.¹⁶ For FY 2018, Palo Alto's share of the project cost, including debt, is \$12.5 million and the value is expected to be \$5.7 million, resulting in a net cost of \$6.8 million. However, because Calaveras' variable operating and maintenance costs are relatively low, the project is dispatched regularly for the purpose of generating energy. Additionally, Calaveras has the ability to meet several CAISO compliance and operating requirements, including: following variations in the City's load in real-time (load following), ancillary services related to regulation energy and spinning reserves; and meeting some of the City's Resource Adequacy

¹⁵ NCPA members participating in the Calaveras Project via the Calaveras Third Phase Agreement with NCPA include the cities of Alameda, Biggs, Gridley, Healdsburg, Lodi, Lompoc, Palo Alto, Roseville, Santa Clara, and Ukiah, and the Plumas-Sierra Rural Electric Cooperative.

¹⁶ In anticipation of Direct Access and the possibility for load to leave CPAU, in 1996 Council approved a competitive-transition-charge (CTC) to be added as a non-by-passable fee on all CPAU customers electricity bills. This was done to collect the above market cost (stranded cost) associated with Calaveras debt and the funds were held in the Calaveras Reserve, which had been established in 1983 to help defray cost associated with Calaveras. The Calaveras Reserve was repurposed in 2011 and is now the Electric Special Project Reserve (see [Staff Report 2160](#)).

requirements, including flexible capacity and system capacity. Calaveras also serves as an energy storage asset, since water is stored in the main reservoir, New Spicer Meadow, and released at optimal times to meet energy and capacity needs. Long-term it is expected that the value of Calaveras will increase, assuming average or above average hydroelectric conditions and favorable regulatory requirements.

While there are no imminent decisions associated with Calaveras, a few issues may be worth evaluating in the context of the EIRP, including:

1. Assessment of Calaveras value and operating strategies, given the City's commitment to other large hydroelectric resources, RPS resources, and hydro risk management objectives;
2. How to best optimize Calaveras given its potential value to meet intermittent resource integration requirements; and
3. The value of the City's long-term stake in Calaveras, including the post-2032 period, when the current FERC license expires.

C. Renewable Energy Resources

i. Wind PPAs

Palo Alto currently has two long-term contracts for the output of wind power projects. Under separate contracts with Avangrid Renewables (formerly Iberdrola Renewables), the City receives a 25 MW share of the output of the Shiloh I project, and a 20 MW share of the output of the High Winds I project in Solano County, both of which are located in Solano County. The terms of these two contracts end in 2021 and 2028, respectively. Together, the two resources typically supply about 12% of Palo Alto's total electric supply needs. Both projects are considered fully deliverable, and are located in the Bay Area local reliability area.

ii. Landfill Gas (LFG) PPAs

Palo Alto currently has five long-term contracts with Ameresco for the output of landfill gas electricity projects. The five contracts include a 1.5 MW share of a project located in Watsonville, a 5.1 MW share of a project located in Half Moon Bay, a 1.9 MW share of a project located in Pittsburg, and the entire output of a 1.4 MW project located in Gonzales and a 4.1 MW project located in Linden. The terms of these agreements are all 20 years, with contract expiration dates between 2025 and 2034. Together, the five resources currently supply about 11% of Palo Alto's total electric supply needs. All five projects are also considered fully deliverable, with two of them located in the Bay Area local capacity area.

iii. Solar PPAs

Since the beginning of 2012, Palo Alto has executed six long-term contracts for utility-scale solar PV projects. These six contracts include three with sPower (the 26.7 MW Hayworth Solar project located in Bakersfield, and the 20 MW Western Antelope Blue Sky Ranch B project and the 40 MW Elevation Solar C project – both of which are located in Lancaster), two with Clēnera (the 20 MW EE Kettleman Land project in Kettleman City and the 20 MW Frontier Solar project located in Newman), and one with Hecate Energy (the 26 MW Wilsona Solar project, which is slated to be built near Palmdale). The first five of these projects are currently operational, and they provide roughly 33% of Palo Alto's total electricity needs; meanwhile, the Wilsona project is scheduled to begin energy deliveries in mid-2021. The terms of these agreements are all at least 25 years, with contract expiration dates starting in 2040.

The three projects operated by sPower are considered fully deliverable, with the Hayworth project located in the Kern local capacity area, and the other two located in the Big Creek-Ventura local capacity area.

D. Market Purchases & RECs

Palo Alto has nine active Master Agreements (with BP Energy, Shell Energy North America, Powerex Corp, Cargill Power Markets, Exelon Generation, Iberdrola Renewables, NextEra Energy Power Marketing, Turlock Irrigation District, and PacifiCorp) to facilitate competitive forward market purchases and sales to meet Palo Alto's loads in the short- to medium-term. As of June 30, 2018, Palo Alto had outstanding electricity purchase commitments for the period July 2018 to June 2020 totaling 79 GWh, and sales commitments for this period totaling 161 GWh. These market based purchases and sales are made within the parameters of Palo Alto's [Energy Risk Management Program](#).

In FY 2018, gross market-based purchases (including both forward transactions and spot-market transactions) provided approximately 14% of Palo Alto's electricity needs, while gross market-based sales were equivalent to 23% of Palo Alto's needs (i.e., the City was a net seller of market-based energy). The volume of market purchases and sales however is highly dependent on hydro conditions and long-term commitments to renewable resource-based supplies. During normal hydro conditions, gross market purchases are expected to meet approximately 15% of energy needs, while gross market sales will amount to approximately 25% of energy needs. NCPA serves as Palo Alto's scheduling and billing agent for all transactions, and acts as the interface with the CAISO under a Metered Subsystem Aggregation Agreement (MSSA).

Since 2013, Palo Alto has operated under a [Carbon Neutral Plan](#) for its electric supply portfolio, ensuring that all electrical generation that serves the City's needs produces zero GHG emissions on a net annual basis. To implement the Carbon Neutral Plan, in years when the City has been a net purchaser of market power (e.g., in very dry hydro years, or before the City's long-term solar contracts had started delivering power to Palo Alto), it has purchased Renewable Energy Certificates (RECs) in volumes equivalent to its net market power purchase volumes.

E. COBUG

In 2002, shortly after experiencing a series of rolling blackouts during the California energy crisis, the City decided to invest in a set of locally-sited natural gas-fired back-up generators in order to stave off such events in the future. These four generators, together known as the Cooperatively Owned Back-Up Generator (COBUG), total 5 MW in capacity but are seldom operated (generally only for maintenance purposes). They do, however, serve as an important source of local system reliability in the Bay Area local capacity area.

F. California-Oregon Transmission Project (COTP)

Fourteen Northern California cities and districts and one rural electric cooperative, including Palo Alto, are members or associate members of a California joint powers agency known as the Transmission Agency of Northern California (TANC). TANC, together with the City of Redding, WAPA, two California water districts, and Pacific Gas and Electric (PG&E) own the California-Oregon Transmission Project (COTP), a 339-mile long, 1,600 MW, 500 kV transmission power project between Southern Oregon and

Central California. Palo Alto is entitled to 4.0% of TANC's share of COTP transfer capability (50 MW). As a result of low utilization of the transmission capacity and therefore low value relative to costs (in addition to a focus on acquiring in-state renewable resources), in August 2008 Palo Alto effected a long-term assignment of its full share and obligations in COTP to the Sacramento Municipal Utility District (SMUD), Turlock Irrigation District (TID), and Modesto Irrigation District (MID). The long-term assignment is for 15 years (through 2023), with an option to extend the assignment for an additional five years.

G. Resource Adequacy Capacity

As described above, the majority of Palo Alto’s long-term generation contracts (and its one owned thermal generating asset) are deemed fully deliverable and provide the City with Resource Adequacy (RA) capacity to satisfy its CAISO regulatory requirements. The amounts of RA capacity provided by each resource are detailed in the CRAT standardized table in the appendices of this report, and a high-level overview is provided in Table 6 below.

Table 6: Palo Alto’s Resource Adequacy Capacity Portfolio

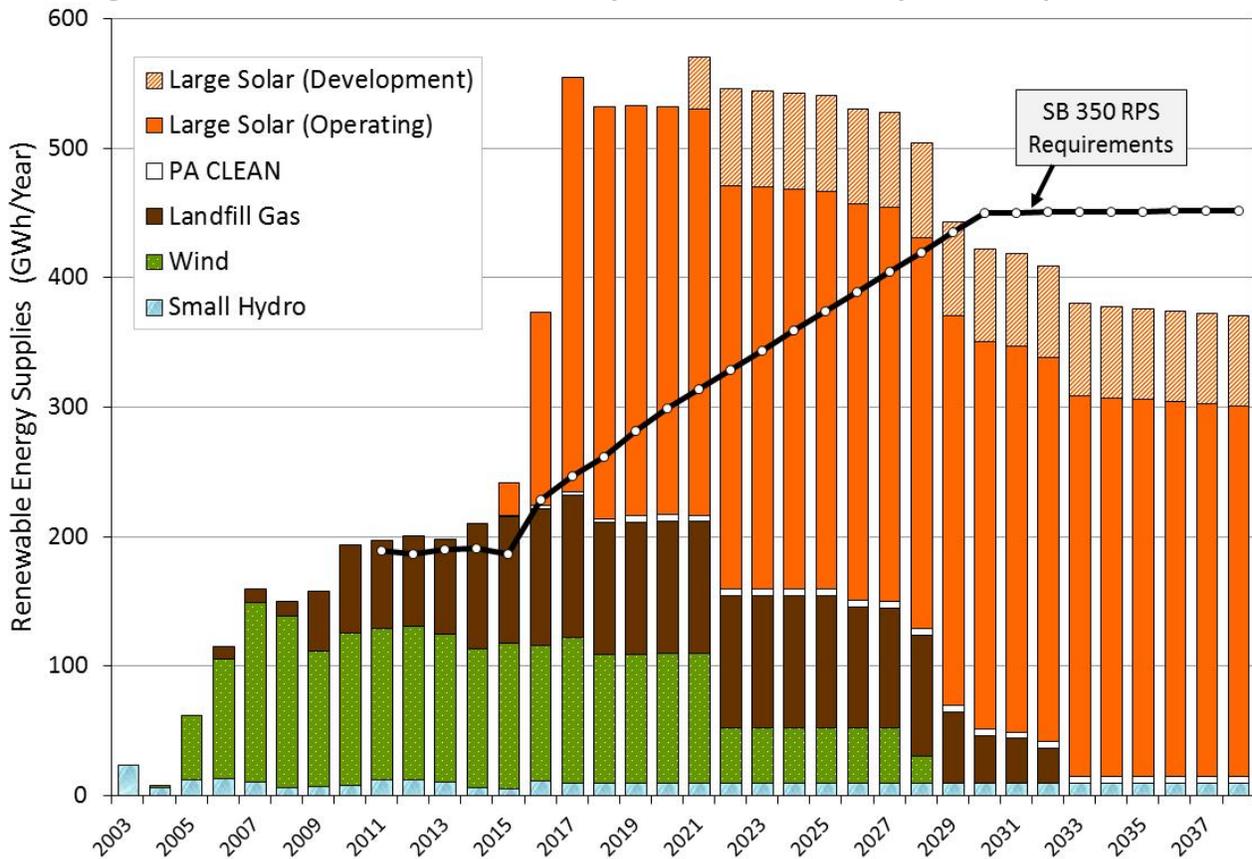
Project	Resource Type	Local Area	Flexible RA?	Average NQC (MW)
Western Base Resource	Hydroelectric	CAISO System	No	147.0
Calaveras	Hydroelectric	CAISO System	Yes	58.0
High Winds	Wind	Bay Area	No	4.5
Shiloh I	Wind	Bay Area	No	5.7
Santa Cruz LFG	Landfill Gas	CAISO System	No	1.5
Ox Mountain LFG	Landfill Gas	Bay Area	No	5.1
Keller Canyon LFG	Landfill Gas	Bay Area	No	1.9
Johnson Canyon LFG	Landfill Gas	CAISO System	No	1.4
San Joaquin LFG	Landfill Gas	CAISO System	No	4.1
Hayworth Solar	Solar PV	Kern	No	14.2
Elevation Solar C	Solar PV	Big Creek-Ventura	No	21.9
Western Antelope	Solar PV	Big Creek-Ventura	No	11.0
COBUG	Natural Gas	Bay Area	No	4.5

V. Future Procurement Needs and Portfolio Rebalancing

A. Needs Assessment: Energy, RPS, Resource Adequacy Capacity

Overall, Palo Alto’s resource portfolio has a surplus of energy, and a surplus of RPS generation (relative to its RPS procurement requirements under SB 350), as detailed in the Standardized Tables presented in Appendix D. Figure 6 below depicts the City’s projected supplies¹⁷ of eligible renewable generation for the period 2003 to 2038, as well as the City’s annual RPS generation procurement requirements under SB 350, based on its actual and forecasted retail sales volumes. Note that this figure presents only currently contracted resources; no additional resources are assumed to be procured, and no existing contracts are assumed to be extended.

Figure 6: Palo Alto’s RPS Generation Projections and RPS Compliance Requirements



In terms of capacity, the City has a surplus of system RA capacity, but deficit positions in local and flexible RA capacity.¹⁸ The City makes up these deficits each year via bilateral RA capacity purchases. One of the challenges that CPAU faces over the IRP planning period is ensuring that it can continue to

¹⁷ Note that renewable energy supplies shown in Figure xx which are surplus to the City’s RPS procurement requirements may ultimately be sold or banked for use in future compliance periods.

¹⁸ For additional details on Palo Alto’s projected needs and supplies of electrical generation, RPS generation, and RA capacity, please see the EBT, RPT, and CRAT standardized tables in Appendix D to this report.

procure adequate supplies of local and flexible RA capacity – both to satisfy its regulatory compliance obligations, and to ensure the overall reliability of the CAISO bulk transmission system.¹⁹

However, during the IRP planning period, CPAU staff’s primary focus will be on determining whether to renew its Western Base Resource contract for a new 30-year term starting in 2025 – and if so, at what capacity share. As such, staff will be heavily focused on negotiating contract terms that provide the City with protection and flexibility, while also closely monitoring the many issues that are currently creating uncertainty around this resource’s long-term costs and generation levels. The remainder of this section of the EIRP will focus on exactly this question: whether to renew the Western Base Resource contract at the maximum possible level, or whether to “rebalance” the City’s electric supply portfolio by scaling back (or eliminating) the City’s Base Resource allocation and replacing it with a different generation resource.

B. Portfolio Rebalancing Analysis

As noted in the [September 2017 report](#) to the Palo Alto UAC, CPAU staff evaluated a very large number of potential new supply-side and demand-side resources in the portfolio analysis it performed related to the Western Base Resource contract renewal decision. However, as the analysis progressed, due to reasons of feasibility/availability and cost/uncertainty, staff narrowed the focus of the analysis to the following resources:

- A renewed Western Base Resource (Western) contract,
- In-state solar,
- Out-of-state wind,
- Geothermal,
- Local (Palo Alto) solar, and
- Market power purchases matched with renewable energy certificates (RECs).

The Western hydro resource and in-state solar resource characteristics are well understood, given the large role they each play in Palo Alto’s current resource portfolio. Western is a relatively low-cost, flexible resource – at least in average years – but it features a large amount of seasonal variability, as well as year-to-year uncertainty around its cost and level of output. In addition, there are several major issues currently pending that have the potential to significantly impact the cost and/or operation of the resource.²⁰ Solar also involves a great deal of seasonal variability and contributes towards the seasonal

¹⁹ Also, if Palo Alto opts not to renew its Western Base Resource contract in 2025 – or significantly scales back its share of this resource – then the City will face the additional challenge of ensuring it has adequate *system* RA capacity to meet its planning reserve margin requirements. As Table 6 indicates, the Western Base Resource contract is by far the City’s largest source of system RA capacity.

²⁰ For example: The State Water Resources Control Board has several proceedings underway that may have very significant impacts on Western operations, including the consideration of an “unimpaired flow” criteria as part of its Bay Delta Plan that could result in significantly less generation from Western, particularly in the summer months. There are also long-term risks associated with an increase in “Aid to Irrigation” payments that Power customers may be required to make to Water customers, litigation related to the Central Valley Project Improvement Act (CVPIA) Restoration Fund payments that Power customers make, potential cost impacts to Power customers related to the “Twin Tunnels” project, and the impacts of climate change on the resource. Staff hopes that many of these uncertainties will be better understood by 2024; however it is likely that a number of them will remain unresolved. These risks must be more closely examined before making a final contract commitment in 2024.

imbalance of the supply portfolio, but with far less uncertainty around its cost or annual output amount. And while its costs have decreased dramatically in recent years, the huge volume of recent capacity additions – which have been concentrated in areas with the best solar potential – have driven down the market value of this energy at least as much, leading to a sharp increase in negative market prices and curtailments. The rise of solar generation in the state has also led to the Duck Curve phenomenon²¹, which has in turn resulted in new regulatory requirements for each load-serving entity (LSE) to procure sufficient flexible generation capacity to maintain transmission grid reliability.

Out-of-state wind resources – e.g., from the Pacific Northwest or New Mexico – have also become very low-cost in recent years, in some cases even lower priced than solar.²² Wind resources from these areas typically have a generation profile that is a good fit for the City’s portfolio, producing somewhat more energy in the fall and winter months than in the spring and summer months. However, the cost of obtaining transmission access for them into the state significantly raises their total cost.²³

Geothermal resources have also experienced a price decline in recent years, although they are still less valuable compared with solar or out-of-state wind. New binary cycle geothermal technology also produces no GHG emissions and can be more flexibly dispatched compared to prior generations of geothermal technologies. This technology bears further consideration in the coming years as the City considers options to rebalance the portfolio.

Local solar is the only local supply resource considered in the portfolio analysis. While it would have a higher value than solar located in the central San Joaquin Valley²⁴ it is unlikely to be available in sufficient quantities to make a significant contribution to the City’s overall electric supply needs. The cost of such local systems would also be relatively high. For example, under the Palo Alto CLEAN program, even with a contract price of 16.5 cents/kWh, the program existed for several years before finally securing about 3 MW of participating capacity within the last two years. And the cost of solar energy from a 500 kW project at the Palo Alto golf course was estimated at 10 to 14 cents/kWh in

²¹ The Duck Curve refers to the graph shown in Figure 1, illustrating the impact of the increasing adoption of solar PV on CAISO’s net load (i.e., total load less generation from variable energy resources like wind and solar). Over time, as more solar generation came online, the CAISO net load curve went from having a slight mid-day peak to having a deep mid-day trough, bracketed by a steep downward ramp in the morning, as solar plants begins generating, and an even steeper upward ramp in the evening, as solar generation trails off with the sunset. For more information, see: https://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf.

²² Staff has received numerous proposals for out-of-state wind resources over the past several years, but such resources were found to be uneconomical compared to in-state solar when Palo Alto made long-term commitments for solar resources between 2012 and 2016.

²³ The availability of transmission pathways to bring this generation into CAISO on a reliable basis is also not assured. However, for Pacific Northwest wind resources, the City’s allocation of capacity on the California-Oregon Transmission Project (COTP) could prove very useful. The City laid off this transmission capacity for a 15-year period, but this layoff will end at the end of 2023.

²⁴ Local solar is currently at least 3 ¢/kWh more valuable than remote solar, given that it would provide enhanced local resiliency, would not be subject to transmission charges, would reduce the City’s resource adequacy capacity requirements, and would have a high locational value, due to its mitigating effect on Bay Area transmission congestion.

2017, which is more costly compared to other resource options, even with the greater value (primarily due to avoided transmission charges) inherent in local generation.

Finally, market energy purchases combined with unbundled RECs could present an attractive option in the short-term if the City wishes to reduce its Western contract allocation and seek a different low-cost solution. In the long-term, however, many forecasts indicate that as the state’s GHG reduction requirements ratchet up, the cost of carbon allowances will likewise climb, which in turn would raise market power prices and make this option uneconomic. In addition, this approach would perpetuate the City’s reliance on traditional GHG-emitting generators. On the other hand, shorter-term market purchases would provide the City with a great deal of flexibility in terms of contract duration and volume, and lower the risk of stranded energy resources if the electric loads available to be served by the City decline significantly.

Table 7 below summarizes the various resource types that staff considered most closely in its portfolio analysis and their relative merits. The key indicators used for comparing the different portfolio options are:

- Value: The net value of a resource; the projected revenue from selling the resource’s energy into the CAISO market less the resource’s bi-lateral contract cost;
- Portfolio Fit: Lower reliance on the grid for hourly load balancing;
- Diversification: Geographic and resource diversity;
- Term Flexibility: Flexibility in length of contract and termination provisions; and
- Cost Certainty: Degree of certainty of future resource costs.

Table 7: Relative Merits of Candidate Resources Considered to Rebalance Supply Portfolio
 * Ratings reflect relative changes from current portfolio of resources *

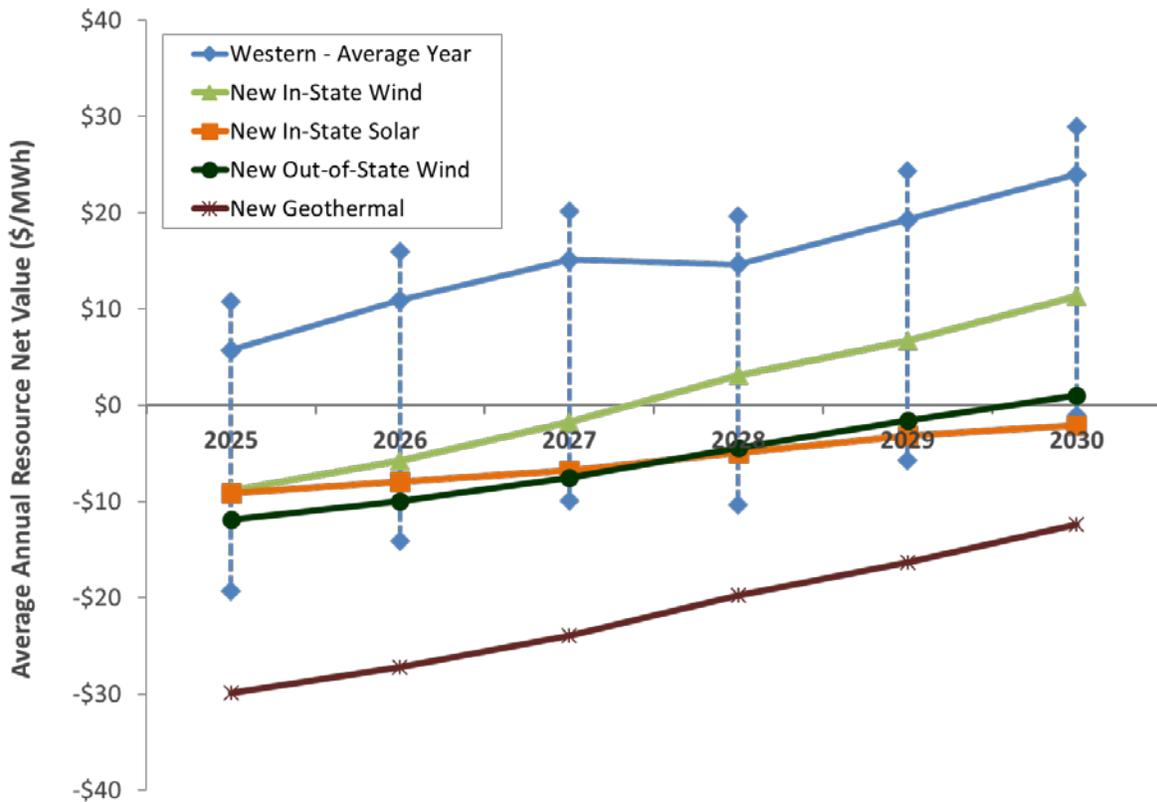
Post-2024 Resource Options	Value	Portfolio Fit	Diversification	Term Flexibility	Cost Certainty
Federal Hydro (WAPA)					
Out-of-State Wind					
In-State Solar					
Baseload Renewable					
Local Solar					
Market Purchases & RECs					

Legend: High → Medium → Low

i. Portfolio Expected Net Value

First, as far as the net value of a resource contract for the 2025 to 2030 period, Western has the potential to be a relatively valuable resource, but also has the most uncertainty when it comes to costs, for the reasons described above. The expected net value of Western and several potential new contracts, as determined by a scenario-based spreadsheet analysis, is shown in Figure 7. The net value of each resource is calculated based on its energy values (from each resource’s LMP forecast), along with the ancillary services value provided by Western, the value of the RECs generated by the renewable resources, and each resource’s RA capacity. Note that the expected net value of some resources is negative (less valuable than projected market value), due to the fact that the cost of all of the renewable resources includes the cost of renewable attributes in addition to energy, and because a primary goal of a long-term agreement such as a PPA is to hedge and manage exposure to future price volatility.

Figure 7: Expected Net Value of New Resources and Western Relative to Market Value
*** Very High Cost Uncertainty around Western ***



One of the primary messages of Figure 7 is that there is a tremendous amount of uncertainty around the net value of Western, as indicated by the large uncertainty bars featured on that data series.²⁵ It should be noted that the uncertainty shown in Figure 7 is based on staff’s best estimate of the

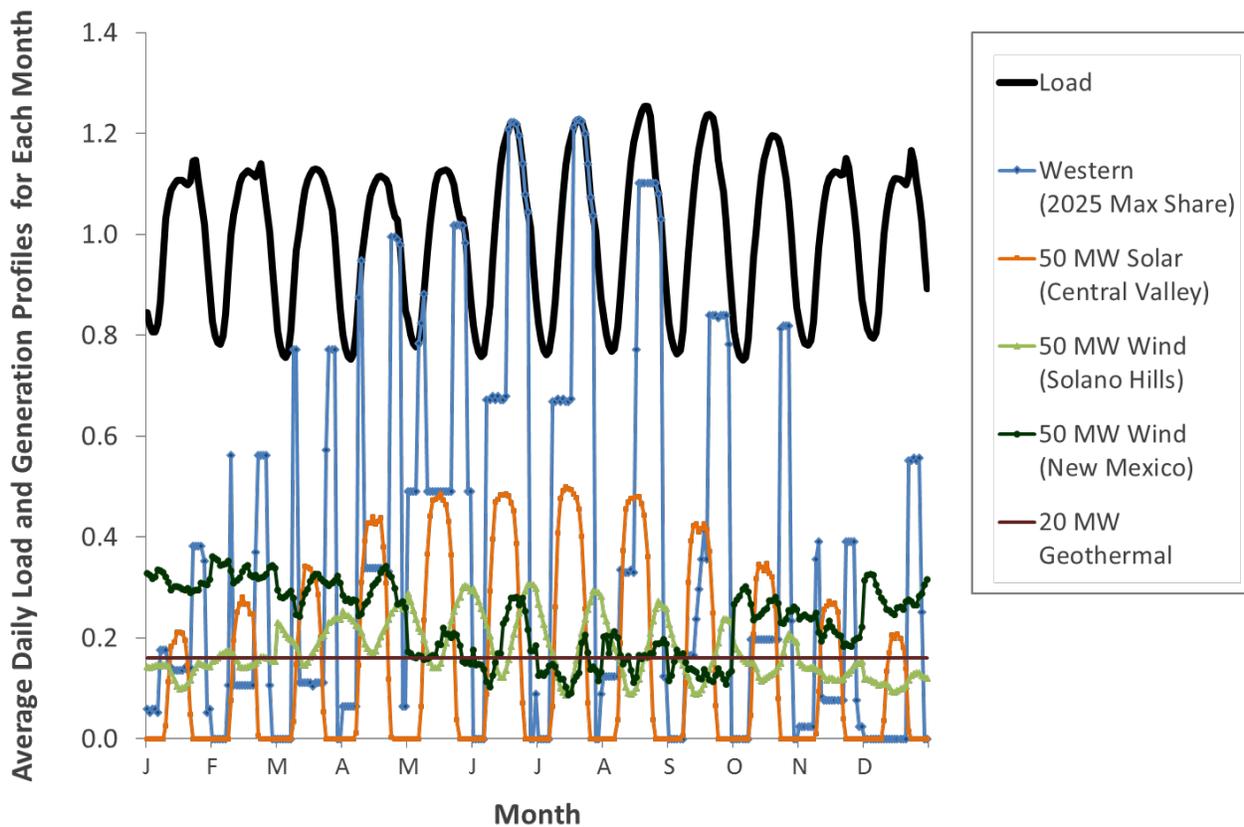
²⁵ Figure C-6 does not include market price uncertainty or hydrological uncertainty; the uncertainty range shown for Western represents purely regulatory and litigation-related cost uncertainty.

potential range of future Western contract costs. It should also be noted that this uncertainty is heavily biased toward the negative direction: there is limited “upside” uncertainty while there is a great deal of “downside” uncertainty, largely related to pending environmental regulatory issues.

ii. Portfolio Fit

Another key indicator is hourly portfolio fit, which will determine how reliant the portfolio is on grid power (and, as a result, how exposed it is to market prices). Figure 8 displays average hourly generation profiles for each month (one average day per month is shown) for Western and other potential new resources relative to the City’s average load. Although total resource supplies from long-term contracts exceed the City’s load in the spring and summer months, the opposite is true during the fall and winter months. Thus Figure 8 indicates that out-of-state wind, which produces more energy in the fall and winter months, would be a good complement to the City’s existing portfolio. In-state wind (in the Solano hills) and solar, on the other hand, exacerbate the City’s portfolio fit problem, as they produce more energy in the spring and summer months.

Figure 8: Average Hourly Load and Generation Profiles for Each Month for Western and Potential New Resources (Normalized to Average Hourly Load)
 * New Mexico Wind Resource Profile Complements Palo Alto Portfolio *



iii. **Portfolio Cost Uncertainty and Management**

The cost uncertainty of the electric supply portfolio in the short-term is primarily driven by the water available for hydroelectric production, and is estimated at \$10 to \$15 million per year at prevailing market prices. Palo Alto is well positioned to manage this cost uncertainty through its hydro rate adjustment mechanism²⁶ and by maintaining sufficient cash reserves. The cost uncertainty related to seasonally balancing the portfolio²⁷ is minimal since market price variability between seasons is highly correlated and because staff executes seasonal buy-sell transactions at the same time.

As noted above, in the long-term, there are a number of issues that could dramatically affect the value of the Western resource in the coming years. As such, a large focus of staff efforts in the next five years will be to better understand the long-term economics of the Western resource and mitigate the risks associated with it through flexible contractual terms.

There are also proceedings underway to investigate market restructuring to deal with issues related to the integration of variable renewable resources, such as over-generation, very steep evening ramp periods, and the appropriate valuation of dispatchable generation capacity. Volatility in market prices, as the CAISO and the CEC determine how to send price signals to ensure a reliable grid, could leave a seasonally unbalanced portfolio such as the City's current portfolio exposed. Increases in transmission charges could also make remote resources compare less favorably to local resources and demand-side management in the future.

²⁶ For additional detail on the hydro rate adjustment mechanism, please see Staff Report ID 8962 (March 2018): <https://www.cityofpaloalto.org/civicax/filebank/documents/63851>.

²⁷ Revenues received from the sale of surplus energy during the spring and summer periods are utilized to purchase electricity needs for the fall and winter periods.

VI. Supply Costs & Retail Rates

Critical to the success of an IRP, in addition to ensuring that the adopted plan leads to compliance with all regulatory requirements, is ensuring that it also results in supply cost minimization and (ideally) low and stable customer retail rates. As described in the [FY 2019 Electric Utility Financial Plan and Rate Proposal](#) to the Palo Alto City Council, CPAU staff projects supply costs to rise substantially for the next several years, largely driven by increases in transmission costs and new renewable energy projects coming online. Retail rates are also projected to rise due to substantial additional capital investment in the electric distribution system, and operational cost increases.

In order to ensure adequate revenue recovery, the Palo Alto City Council recently approved a 6% retail rate increase for FY 2019 (taking effect July 1, 2018), and adopted a Financial Plan that calls for an additional 3% rate increase for FY 2020 with 0-2% annual rate increases projected thereafter. However, it should be noted that the City's current electric rates are far lower than the statewide average electric retail rates, and, under the recommended portfolio presented in Section X of this report, staff projects that they will remain so. In fact, even under the worst-case scenarios staff evaluated the recommended portfolio against, as described in Section X.C of this report, the City's retail electric rates remain lower than the projected statewide average rates.

VII. Transmission & Distribution Systems

A. Transmission System

At the transmission level, CPAU staff has two main focuses during the EIRP planning period: (1) determining the optimal utilization of the COTP asset when Palo Alto's long-term layoff of this resource ends on January 1, 2024, as discussed above in the Existing Resource Portfolio section; and (2) pursuing an additional interconnection point with PG&E's transmission system. The new interconnection point with PG&E is being sought in order to provide redundancy, and therefore increased local reliability, in the event that an outage affects the three current interconnection lines – as happened in February 2010.²⁸ To minimize the possibility of a City-wide outage caused by an interconnection line outage, it is in the City's interest to find a physically diverse connection to the PG&E transmission system for power supply to the City. Staff has been investigating options for an alternative connection to the transmission grid for numerous years.²⁹

B. Distribution System

Palo Alto's electric distribution system is directly interconnected with the transmission system of Pacific Gas and Electric Company (PG&E) by three 115 kV lines, which have a delivery point at Palo Alto's Colorado substation. Palo Alto's distribution system consists of the 115 kV to 60 kV delivery point, two 60 kV switching stations, nine distribution substations, approximately 12 miles of 60 kV sub transmission lines, and approximately 469 miles of 12 kV and 4kV distribution lines – including 223 miles of overhead lines and 245 miles of underground lines.

In 2018 CPAU staff completed a [distribution system assessment report](#) to begin the process of understanding the distribution system upgrades that will be required to integrate increasing penetration levels of distributed energy resources, particularly electric vehicles. Staff's conclusion from this assessment was that at the system level, there is sufficient capacity to accommodate DER growth for the next five years. However, there are some subcomponents of the system that require further assessment and monitoring (e.g. residential distribution transformers). The City-wide implementation of Advanced Metering Infrastructure (AMI), which is planned to occur by 2022, will greatly enhance the visibility into distribution system operational characteristics and further enable the integration of DERs by offering new customer programs (such as, time varying rates).

Palo Alto's current five-year capital plan for electric distribution facilities contemplates spending approximately \$16.5 million per year over this five-year period, primarily to fund infrastructure replacement and new customer connections.

²⁸ Although three lines would normally provide redundancy and back-up power delivery to the City, all three lines run in a common corridor on the bay side of the City, a corridor that is in close proximity to the Palo Alto Airport. The common corridor and proximity to an airport means that the City's power supply is susceptible to single events that can affect all three lines, as happened in February of 2010 when a small aircraft hit the power lines resulting in a city-wide power outage for over 10 hours.

²⁹ See this January 2016 staff report for additional background on the efforts to secure an additional transmission interconnection point: <https://www.cityofpaloalto.org/civicax/filebank/documents/50608>.

VIII. Low-income Assistance Programs

CPAU has three programs to provide financial assistance to low-income customers:

- Residential Energy Assistance Program (REAP): This program provides qualifying low-income residents with free energy efficiency measures and access to the Rate Assistance Program (RAP) rate discount. For qualifying customers, a Home Assessment, an application to the RAP, and an on-site customer evaluation for weatherization and energy efficiency measure installation, including insulation and lighting, is provided. Customers may have refrigerators and/or furnaces replaced if the need is found.
- Rate Assistance Program (RAP): This program provides a 25% discount for electric and gas charges for qualified customers. Applicants can qualify based on medical or financial need.
- ProjectPLEDGE: This program provides a one-time contribution of up to \$750 applied to the utilities bill of qualifying residential customers. Eligibility criteria include experiencing recent employment and/or health emergency events. Administered by CPAU, this program is funded by voluntary customer contributions.

IX. Localized Air Pollutants

A. Electric Vehicle Programs

Given that Palo Alto's electricity supply is derived entirely from clean, carbon neutral generation resources, the most important thing that the City can do at this point to improve local air quality is to reduce the combustion of fossil fuels in the transportation sector – primarily through electrification of vehicles. The City of Palo Alto Utilities has a number of programs to promote the adoption of electric vehicles, a summary of which can be found in the [2017 Demand Side Management Annual Report](#). Two of the current programs are listed below.

EV Charger Rebate Program - In early 2017 CPAU launched an EV Charger Rebate program using funds from monetizing Low Carbon Fuel Standard (LCFS) credits. Rebates are targeted towards multifamily and mixed-use properties, schools and non-profits. Along with the launch, new online resources were created, including the EV calculator tool.

Online EV/PV Calculator - CPAU launched an online calculator tool for residents to evaluate the costs and benefits of installing rooftop solar. In addition, residents can now evaluate different electric vehicles and see the financial impacts and environmental benefits of charging vehicles using Palo Alto's carbon neutral electricity. The online calculator uses satellite imagery of Palo Alto homes as well as current CPAU electricity rates to produce rooftop solar system designs and cost estimates tailored to Palo Alto.

B. Local Renewable Energy Programs

In addition to the local renewable electricity generation programs previously mentioned, Palo Alto also has a Solar Hot Water Program which can replace natural gas combustion and thereby improve local air quality.

Solar Hot Water Program - Palo Alto launched the solar water heating (SWH) program in May 2008, in advance of a State law requiring natural gas utilities to offer incentives. This program offers rebates of up to \$2,719 for residential systems and up to \$100,000 for commercial and industrial systems. A sample of these installations is inspected for quality and program compliance by an independent contractor. The program was recently extended through 2020. A total of 60 systems have been installed as of June 30, 2017; 54 of these are residential. From 2008 to 2017 \$337,911.37 in rebates were disbursed. In the fiscal year 2017 this program resulted in annual energy savings of 19,826 therms and 13,387 kWh.

C. Electrification of Space and Water Heating Programs

The [Electrification Work Plan](#) highlighted the potential of lowering carbon emissions and improving local air quality by electrification of building water and space heating loads thereby removing local combustion of natural gas. A description of more programs to promote electrification of space and water heating can be found in the [2017 Demand Side Management Report](#). Two of the current electrification programs are listed below.

Heat Pump Water Heater Pilot Program - The goal of this program is reduction of greenhouse gas (GHG) emissions through switching from natural gas appliances to high-efficiency electric appliances. Installation of heat pump water heaters (HPWHs) has been identified as a good starting candidate for a pilot program. The pilot program—launched in the spring of 2016—was designed to facilitate the installation of HPWHs in single-family homes. In April 2017, the City hosted its first HPWH workshop to educate the community, including contractors, on the technology and installation of HPWHs.

Multifamily Gas Furnace Retrofit Pilot Program - CPAU has been awarded a 2018 Climate Protection Grant Program from the Bay Area Air Quality Management District (BAAQMD) for a Multifamily Gas Furnace Pilot Program. The grant period is two years from 2019-2020.

The Multifamily Gas Furnace Retrofit Pilot targets apartment buildings to replace existing in-unit gas wall furnaces with high efficiency air source heat pumps. Heat pump systems are far more energy efficient than gas furnaces, eliminate GHG emissions associated with gas-fired space heaters, while improving air quality within the dwelling units. However, many questions still exist regarding cost-effectiveness, building electrical capacity and other technological and logistical hurdles for replacing gas furnace to heat pump systems in multifamily buildings. This pilot will identify the technical and logistical hurdles as well as potential solutions, and will document the retrofit cost, energy savings, avoided GHG emissions as well as other indoor air pollutants from the gas furnace.

D. Refrigerant Recycling Program

Ensuring that refrigerants are properly disposed of also improves local air quality. CPAU has also been awarded a 2018 Climate Protection Grant Program from the BAAQMD for a Refrigerator Recycling Program. The grant period is two years from 2019-2020.

Although the City's GreenWaste contractor can pick up and remove old refrigerators from customer houses, they are not certified to recycle the foams and refrigerant chemicals to the level that the US EPA Responsible Appliance Disposal (RAD) program requires. RAD requirements go above and beyond the State of California minimum recycling requirements.

This BAAQMD grant will to cover a portion of the cost of recycling in order to enable us to both claim EE savings as well as meet the RAD standards in a cost-effective manner.

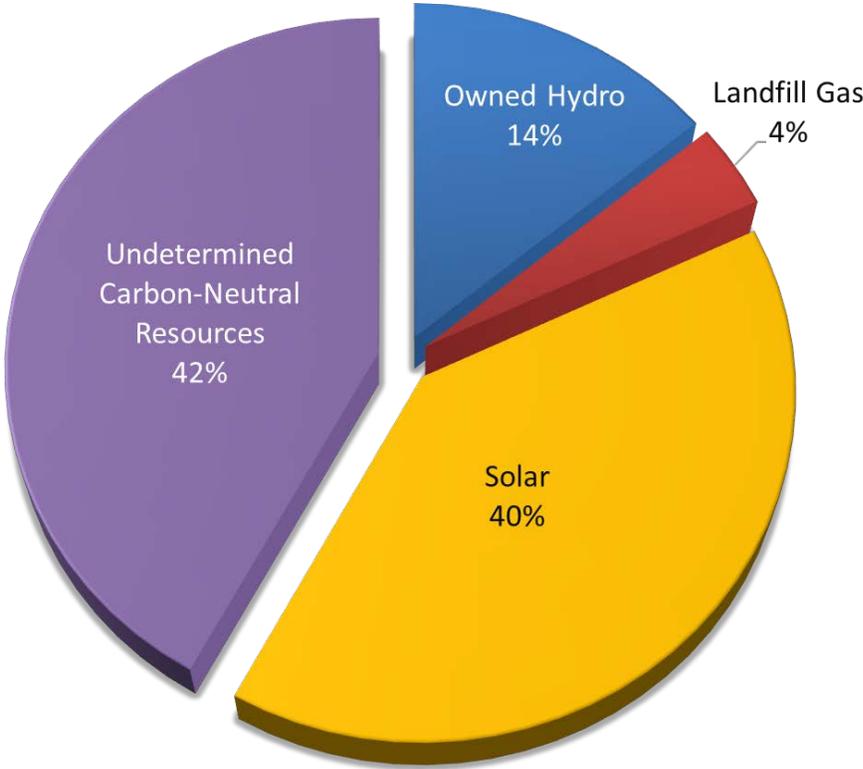
X. Path Forward & Next Steps

A. Recommended Portfolio

Because almost six years remain before Palo Alto must make its major planning decision of the EIRP planning period (the Western contract renewal decision), it is difficult to definitively identify a single recommended portfolio at this time. The base case in this IRP assumes that Palo Alto will renew the Western contract at the maximum allocation level. However, given the substantial amount of uncertainty related to the cost and output levels of this resource (as described in the Future Procurement Needs and Portfolio Rebalancing section of this report), staff is actively reviewing attractive alternatives which could replace the entire Western contract when it expires in 2024.

If, in fact, Palo Alto determines that the costs associated with a renewed Western contract are too high, or too uncertain, CPAU staff would immediately begin working to replace this resource (which currently supplies nearly 40% of the City’s electric load) with a different carbon neutral supply resource. As such, the City would continue on its path to meeting or exceeding both the state’s RPS procurement requirements and GHG emission reduction targets. Figure 9 below depicts Palo Alto’s projected electric resource supply mix in 2030 where a large portion of this mix currently consists of undetermined carbon-neutral resources. Given the City’s current policies and the state’s RPS and GHG emissions mandates, staff can confidently say that these resources will either be hydroelectric or renewable.

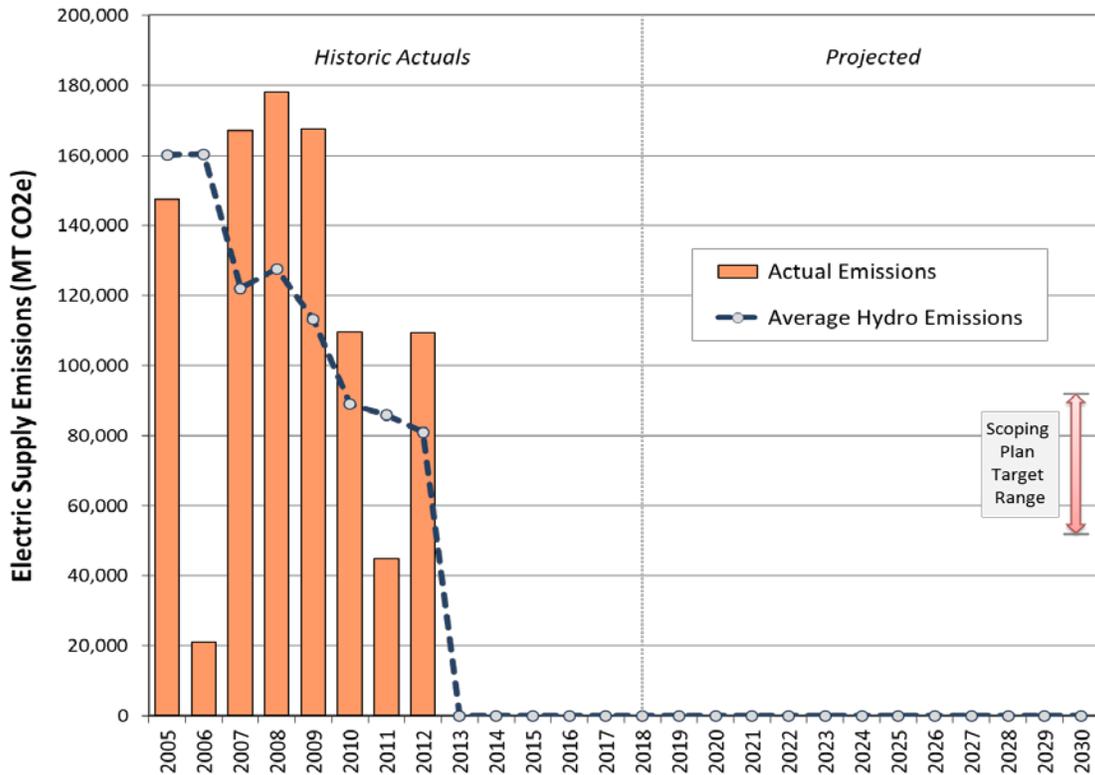
Figure 9: Palo Alto’s Projected Resource Supply Mix in 2030



B. GHG Emissions

CARB’s [2017 Scoping Plan](#) identified GHG emissions targets for the entire state, as well as individual economic sectors, including the electricity industry. The Scoping Plan established an overall electric sector GHG target for 2030 of 30 to 53 million metric tonnes (MMT) of CO₂e, of which Palo Alto’s pro rata share (based on load) is 0.174%, or 52,049 to 92,103 MT CO₂e. As Figure 10 indicates, given its electric supply portfolio consisting entirely of carbon-free resources (hydroelectric, wind, solar, and biogas), Palo Alto is on track to emit far less than even the most aggressive end of the target range identified in the CARB Scoping Plan.

Figure 10: CPAU Electric Supply GHG Emissions (2005-2030)



C. Scenario Analysis

As described in Section II.D of this report, an important element of integrated resource planning is to put the recommended portfolio through scenario and risk analysis, to assess its performance under a range of potential conditions. Staff has performed such a scenario analysis around the recommended portfolio presented in this report, evaluating its performance while varying the following factors: market prices, hydrological conditions, environmental regulations affecting hydro resource operations, DER adoption rates, and natural customer load growth rates. Under all cases examined, however, the City’s supply portfolio remained in compliance with the RPS and GHG emissions targets set forth in SB 350, all while keeping Palo Alto customers’ retail rates lower than the statewide average retail rates.

D. Next Steps

As there is so much uncertainty regarding the Western resource, and because the decision is such a consequential one, it merits a follow-up analysis closer to the contract renewal date, which is currently scheduled for mid-2020. Even after that, WAPA's [2025 Power Marketing Plan](#) indicates that the City will have until July 2024 to make a decision to reduce or reject its allocated share of the future Western contract, which is expected to be approximately as large as its current share. The additional analysis regarding this decision should include:

1. An examination of the City's net load forecast and associated uncertainties, in line with the Draft DER Plan discussed with the UAC in November 2017, with particular emphasis on how it may be affected by customer adoption of DERs (EVs, Demand Response, Energy Efficiency, Solar PV, storage, and building electrification) in order to avoid stranding assets.
2. An update and extension of CPAU's supply portfolio analysis, including updates to the hourly LMP forecasts and the costs, assumptions, and uncertainties associated with all resource options.
3. Analysis of the projected costs, output, and flexibility of the renewed Western contract, to reduce the amount of outstanding uncertainty around this resource.
4. Advocating for flexible contractual provisions in the new Western contract, and examining the legal and economic merits and risks associated with committing to the Western resource for 30 more years.

Aside from the Western contract decision, staff will be actively following state regulators' activities related to electric supply portfolio GHG emissions accounting and allocation of statewide GHG emissions reduction targets. While the City's current GHG emissions accounting methodology (adopted by the City Council in 2013 with the Carbon Neutral Plan) for electric supplies is based on a net annual accounting of the City's market power purchases (which are assumed to have the statewide average GHG emissions intensity), staff is aware that state regulators are evaluating alternative GHG emissions accounting methodologies, including various types of hourly accounting approaches.

And of course, staff will continue its activities in pursuit of lowering the overall cost to serve customer loads. These include continuing to optimize the use of the City's Calaveras resource, evaluating the benefits of the NCPA pool, and/or the procurement of alternative scheduling services for its renewable resources.

E. Key Issues to Monitor & Attempt to Influence

In the course of developing this EIRP, CPAU staff has identified a number of important issues and sources of uncertainty to closely monitor and attempt to positively influence over the course of the planning period. Some of the primary issues and uncertainties that staff will be focused on include:

- Cost and operations of Western hydroelectric resource: environmental restoration cost, water delivery timing and priorities, Western transmission upgrade needs, environmental regulations affecting water releases, and long-term climate change
- Frequency and magnitude of economic curtailment of solar PV resources
- Renewing the FERC license of the Calaveras hydroelectric project

- Seasonal variation in CAISO energy market prices, given the overall generation profile of CPAU's resource portfolio
- Changes in overall energy market price and changes in carbon allowance prices associated with State's cap-and-trade program
- Increased market prices related to load-following capacity and ancillary services
- Customer load profiles change and loss of customer loads available for the City to serve
- New legislative and regulatory mandates

XI. Appendices

A. Key Supplemental Reports and Documents

1. [NCPA-CAISO Metered Sub-System Agreement](#)
2. [Ten-Year Electric Energy Efficiency Goals \(2017\)](#)
3. [Energy Storage Assessment Report \(2017\)](#)
4. [Proposed Distributed Energy Resources Plan \(2017\)](#)
5. [Distribution System Assessment Report \(2018\)](#)
6. [Demand Side Management Annual Report \(2018\)](#)

B. RPS Procurement Plan



**CITY OF PALO ALTO'S
RENEWABLE PORTFOLIO STANDARD
PROCUREMENT PLAN**

**Version 3
December 2018**

REVISION HISTORY

Version	Date	Resolution	Description
3	12/3/18		Updated to reflect Senate Bill 350 (2015) requirements
2	11/12/13	9381	Updated to reflect adoption of final CEC regulations, effective 10/1/13, permitting the City to adopt rules for Excess Procurement, Compliance Delay, Cost Limitations, Portfolio Balancing Reductions, and Historic Carryover. Other non-substantive clean up.
1	12/12/11	9215	Original version per Senate Bill X1 2 (2011) requirements

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INTRODUCTION

This document presents the City of Palo Alto Utilities' (CPAU) Renewable Portfolio Standard Procurement Plan (RPS Procurement Plan), as required for compliance with Senate Bill (SB) 350.³⁰ This legislation, which was signed into law in the 2015 Session of the Legislature, modified the state's renewable portfolio standard (RPS) program and set forth RPS requirements applicable to all load-serving entities in the state. Pursuant to Public Utility Code § 399.30(a) and Section 3205 of the California Energy Commission's (CEC) "Enforcement Procedures for the Renewables Portfolio Standard for Local Publicly Owned Electric Utilities"³¹ (RPS Regulations), each POU must adopt and implement a renewable energy resources procurement plan (RPS Procurement Plan). SB X1 2, signed into law in 2011, directed the CEC to adopt regulations specifying procedures for enforcement of the RPS for Publicly Owned Utilities.

This RPS Procurement Plan replaces the RPS Procurement Plan approved by the Palo Alto City Council (City Council) on November 12, 2013 (Resolution No. 9381, Staff Report No. 4168) and is consistent with the provisions set forth in the CEC's RPS Regulations, which have been adopted by the CEC and approved by the Office of Administrative Law, with an effective date of April 12, 2016.³²

CPAU's RPS Procurement Plan consists of:

- A. Purpose of the plan;
- B. Plan Elements;
- C. Measures that address each of the optional provisions set forth in §399.30(d) and RPS Regulations Section 3206; and
- D. Additional provisions.

Where appropriate, this RPS Procurement Plan includes section citations to the Public Utilities Code (PUC) and the CEC's RPS Regulations.

A. PURPOSE OF THE PLAN (PUC § 399.30(A))

In order to fulfill unmet long-term generation resource needs, the City Council adopts and implements this RPS Procurement Plan. This Plan requires the utility to procure a minimum quantity of electricity

³⁰ SB 350 (2015) was signed by California's Governor on October 7, 2015, and made significant revisions to Public Utilities Code sections 399.11-399.32, the California Renewable Portfolio Standard Program.

³¹ California Code of Regulations, Title 20, Division 2, Chapter 13, Sections 3200 - 3208 and Title 20, Division 2, Chapter 2, Section 1240.

³² At the time of writing for this edition of CPAU's RPS Procurement Plan, the RPS Regulations had not been updated with SB 350 and subsequent legislative requirements. Where both Public Utility Codes and RPS Regulations are cited but the RPS Regulations are outdated, CPAU's RPS Procurement Plan will reflect the more current Public Utility Codes.

products from eligible renewable energy resources, including renewable energy credits (RECs), as a specified percentage of CPAU’s total kilowatt-hours of electrical energy sold to its retail end-use customers, during each compliance period, to achieve the targets specified in SB 350 and the RPS Regulations. This RPS Procurement Plan establishes the framework for achieving the minimum requirements under SB 350 and the RPS Regulations, and does not include or preclude actions taken by CPAU to achieve the City Council’s goals.

B. PLAN ELEMENTS

CPAU will comply with the requirements for renewables procurement targets set forth in SB 350 and the applicable enforcement procedures codified in the CEC’s RPS Regulations, including implementation of the following Plan Elements:

1. Compliance Period Definitions

CPAU has adopted the relevant compliance period definitions identified in PUC § 399.30(b).

2. Procurement Requirements

CPAU shall meet or exceed the following procurement targets of renewable energy resources for each compliance period per PUC §§ 399.30(c)(1) and (2) and the CEC’s RPS Regulations:

Compliance Period 1 Target $\geq 20\% \times (\text{CPAU Retail Sales}_{2011} + \text{CPAU Retail Sales}_{2012} + \text{CPAU Retail Sales}_{2013})$.

Compliance Period 2 Target $\geq 20\% \times \text{CPAU Retail Sales}_{2014} + 20\% \times \text{CPAU Retail Sales}_{2015} + 25\% \times \text{CPAU Retail Sales}_{2016}$

Compliance Period 3 Target $\geq 27\% \times \text{CPAU Retail Sales}_{2017} + 29\% \times \text{CPAU Retail Sales}_{2018} + 31\% \times \text{CPAU Retail Sales}_{2019} + 33\% \times \text{CPAU Retail Sales}_{2020}$

Compliance Period 4 Target $\geq 34.75\% \times \text{CPAU Retail Sales}_{2021} + 36.5\% \times \text{CPAU Retail Sales}_{2022} + 38.25\% \times \text{CPAU Retail Sales}_{2023} + 40\% \times \text{CPAU Retail Sales}_{2024}$

Compliance Period 5 Target $\geq 41.67\% \times \text{CPAU Retail Sales}_{2025} + 43.33\% \times \text{CPAU Retail Sales}_{2026} + 45\% \times \text{CPAU Retail Sales}_{2027}$

Compliance Period 6 Target $\geq 46.67\% \times \text{CPAU Retail Sales}_{2028} + 48.33\% \times \text{CPAU Retail Sales}_{2029} + 50\% \times \text{CPAU Retail Sales}_{2030}$

Annually thereafter, CPAU shall procure renewable energy resources equivalent to at least fifty percent (50%) of retail kilowatt-hour sales.

The procurement targets listed for each individual year above are soft targets. That is, by the end of each Compliance Period, CPAU's RPS total for the period has to equal the sum of the annual targets, but the targets do not have to be achieved in any one year.

3. Portfolio Content Categories (PCC)

CPAU adopts the definitions for qualifying electric products and Portfolio Content Categories (PCC) per Sections 3202 and 3203 of the CEC's RPS Regulations.

a. *How CPAU Plans to Achieve its RPS Requirements per Section 3205(a)(1) of the CEC's RPS Regulations*

CPAU's RPS portfolio will include grandfathered contracts (commonly referred to as "PCC 0"), which are executed prior to June 1, 2010, and PCC 1 eligible resources, which are typically directly or dynamically connected to a California balancing authority. CPAU's RPS portfolio may also include PCC 2 eligible resources that are scheduled into a California balancing authority, and PCC 3 eligible resources, which are typically unbundled renewable energy credits (RECs). PCC 0 resources are defined in Section 3202(a)(2) of the CEC's RPS Regulations, while PCC 1, 2, and 3 resources are defined in Section 3203 of the CEC's RPS Regulations. CPAU shall determine the category to which each procured resource belongs.

In its 2011 through 2017 RPS Compliance Reports, CPAU listed a total of five PCC 0 contracts. All five of these contracts extend through the end of Compliance Period 3, and all have achieved commercial operation. On their own, these PCC 0 contracts were sufficient to enable CPAU to meet its Compliance Period 1 and 2 RPS targets.

CPAU has currently executed six contracts for PCC 1 resources. The first five of these, executed between 2012 and 2014, have all commenced operation, between 2014 and 2016. The sixth PCC 1 contract, executed in 2016, is contracted to commence operation in 2021. With these six PCC 1 resources, along with its five PCC 0 contracts, CPAU forecasts that its renewable energy supplies will be well in excess of its procurement requirements through at least Compliance Period 6.

4. Portfolio Balancing Requirements

In satisfying the procurement requirements listed in section B.3 of this RPS Procurement Plan, CPAU shall also satisfy the legally-required portfolio balancing requirements specifying the limits on quantities for PCC 1 and PCC 3 per PUC § 399.30(c)(3), §§ 399.16(c)(1) and (2). CPAU shall apply the formulae specified in Section 3204(c) of the CEC's RPS Regulations to determine these portfolio balance requirements. Renewable energy procured from PCC 0 contracts shall be excluded from these portfolio balancing requirement formulae.

5. Long-Term Contract Requirement

In meeting the RPS procurement requirements identified in section B.3 of this RPS Procurement Plan, CPAU is subject to long-term contract requirements. Consistent with Public Resources Code § 399.13(b), CPAU may enter into a combination of long- and short-term contracts for electricity and associated renewable energy credits. Beginning January 1, 2021, at least 65 percent of CPAU's procurement that counts toward the RPS requirement of each compliance period shall be from its contracts of 10 years or longer or in its ownership or ownership agreements for eligible renewable energy resources.

6. Reasonable Progress

CPAU shall demonstrate that it is making reasonable progress towards ensuring that it shall meet its compliance period targets during intervening years per PUC §§ 399.30(c)(2).

C. OPTIONAL COMPLIANCE MEASURES

As permitted by Section 3206(a) of the CEC's RPS Regulations, the City Council hereby adopts rules permitting the use of each of the following five optional compliance measures included in the CEC's RPS Regulations: Excess Procurement, Delay of Timely Compliance, Cost Limitations, Portfolio Balance Requirement Reduction, and Historic Carryover. The City Council also hereby adopts rules permitting the use of the Large Hydro Exemption as described in PUC § 399.30(l).

1. Excess Procurement (PUC §399.13(a)(4)(B))

a. *Adoption of Excess Procurement Rules*

The City Council has elected to adopt rules permitting CPAU to apply excess procurement in one compliance period to a subsequent compliance period, as described in Section 3206(a)(1) of the CEC's RPS Regulations.

b. *Limitations on CPAU's Use of Excess Procurement*

CPAU shall be allowed to apply Excess Procurement from one compliance period to subsequent compliance periods as long as the following conditions are met:

1. Excess Procurement shall only include generation from January 1, 2011 or later.
2. In calculating the quantity of Excess Procurement, CPAU shall deduct from actual procurement quantities, the total amount of procurement associated with contracts of less than ten (10) years in duration.

3. Eligible resources must be from Content Category 1 or Content Category 2 or Grandfathered Resources to be Excess Procurement. Resources from Content Category 3 will not count towards Excess Procurement.

c. *Excess Procurement Calculation*

CPAU shall calculate its Excess Procurement according to formulae in section 3206 (a)(1)(D) of the CEC's RPS Regulations.

d. *City Council Review*

CPAU's use of the Excess Procurement to apply towards CPAU's RPS procurement target in any compliance period will be reviewed by the City Council during its annual review as per section D.3 of this RPS Procurement Plan.

2. Delay of Timely Compliance (§ 399.30(d)(2), § 399.15(b)(5))

a. *Adoption of Delay of Timely Compliance Rules*

The City Council has elected to adopt rules permitting it to make a finding that conditions beyond CPAU's control exist to delay timely compliance with RPS procurement requirements, as described in Section 3206(a)(2) of the CEC's RPS Regulations.

b. *Delay of Timely Compliance Findings*

The City Council may make a finding, based on sufficient evidence presented by CPAU staff, and as described in this Section C.2, that is limited to one or more of the following causes of delay, and shall demonstrate that CPAU would have met its RPS procurement requirements but for the cause of the delay:

(1) *Inadequate Transmission*

i. There is inadequate transmission capacity to allow for sufficient electricity to be delivered from CPAU's proposed eligible renewable energy resource projects using the current operational protocols of the California Independent System Operator's Balancing Authority Area.

ii. If the City Council's delay finding rests on circumstances related to CPAU's transmission resources or transmission rights, the City Council may find that:

a.) CPAU has undertaken, in a timely fashion, reasonable measures under its control and consistent with its obligations under local, state, and federal laws and regulations, to develop and construct new transmission lines or upgrades to existing lines intended to transmit

electricity generated by eligible renewable energy resources, in light of its expectation for cost recovery.

b.) CPAU has taken all reasonable operational measures to maximize cost-effective purchases of electricity from eligible renewable energy resources in advance of transmission availability.

(2) *Permitting, interconnection, or other factors that delayed procurement or insufficient supply.*

i. Permitting, interconnection, or other circumstances have delayed procured eligible renewable energy resource projects, or there is an insufficient supply of eligible renewable energy resources available to CPAU.

ii. In making its findings relative to the existence of this condition, the City Council's deliberations shall include, but not be limited to the following:

a) Whether CPAU prudently managed portfolio risks, including, but not limited to, holding solicitations for RPS-eligible resources with outreach to market participants and relying on a sufficient number of viable projects;

b) Whether CPAU sought to develop its own eligible renewable energy resources, transmission to interconnect to eligible renewable energy resources, or energy storage used to integrate eligible renewable energy resources.

c) Whether CPAU procured an appropriate minimum margin of procurement above the minimum procurement level necessary to comply with the renewables portfolio standard to compensate for foreseeable delays or insufficient supply;

d) Whether CPAU has taken reasonable measures, under its control to procure cost-effective distributed generation and allowable unbundled renewable energy credits;

(3) *Unanticipated curtailment to address needs of the balancing authority.*

c. *Procedures upon Approving Waiver:*

In the event of a Waiver of Timely Compliance due to any of the factors set forth above, CPAU shall implement the following procedures:

(1) Establish additional reporting for intervening years to demonstrate that reasonable actions under the CPAU's control are being taken (§399.15(b)(6)).

- (2) Require a demonstration that all reasonable actions within the CPAU's control have been taken to ensure compliance in order to grant the waiver (§ 399.15(b)(7)).

3. Cost Limitations for Expenditures (PUC § 399.30(d), § 399.15(c))

a. *Cost Limitations for Expenditures*

The City Council has elected to adopt rules for cost limitations on the procurement expenditures used to comply with CPAU's procurement requirements, as described in Section 3206(a)(3) of the CEC's RPS Regulations. These cost limitation rules are intended to be consistent with PUC §399.15(c).

b. *Considerations in Development of Cost Limitation Rules*

In adopting cost limitation rules, the City Council has relied on the following:

- 1) This Procurement Plan;
- 2) Procurement expenditures that approximate the expected cost of building, owning, and operating eligible renewable energy resources;
- 3) The potential that some planned resource additions may be delayed or canceled; and
- 4) Local and regional economic conditions and the ability of CPAU's customers to afford produced or procured energy products. These economic conditions may include but are not limited to unemployment, wages, cost of living expenses, the housing market, and cost burden of other utility rates on the same customers. The City Council may also consider cost disparities between customer classes within Palo Alto, and between Palo Alto customers and other Publicly Owned Utility and Investor Owned Utility customers in the region.

c. *Cost Limitations*

The City of Palo Alto's current RPS policy requires that CPAU pursue a target level of renewable purchases of 33% while "[e]nsuring that the retail rate impact for renewable purchases does not exceed 0.5 ¢/kWh on average," i.e., the cumulative incremental cost of all renewable resources over and above the estimated cost of an equivalent volume and shape of alternative non-RPS resources shall not cause a retail rate impact in excess of 0.5 ¢/kWh on average. This limit was first established by the City Council in October 2002 based on public input, and the goal of balancing resource reliability and cost considerations in the consideration of investment in renewable and energy efficiency resources.

d. *Actions to be Taken if Costs Exceed Adopted Cost Limitation*

If costs are anticipated to exceed the cost limitations set by the City Council, staff will present proposals to the City of Palo Alto's Utilities Advisory Commission to either reduce the RPS requirements or increase the cost limitation. Staff and the Commission's recommendations will then be taken to the City Council for action.

4. Portfolio Balance Requirement Reduction (PUC § 399.16(e))

a. *Adoption of Portfolio Balance Requirement Reduction Rules*

The City Council has elected to adopt rules that allow for the reduction of the portfolio balance requirement for PCC 1 for a specific compliance period, consistent with PUC §399.16(e), as described in Section 3206(a)(4) of the CEC's RPS Regulations.

b. *Portfolio Balance Requirement Reduction Rules*

CPAU may reduce the portfolio balance requirement for PCC1 for a specific compliance period, consistent with PUC §399.16 (e) and the following:

1. The need to reduce the portfolio balance requirements for PCC 1 must have resulted because of conditions beyond CPAU's control, as provided in Section 3206(a)(2) of the CEC's RPS Regulations.
2. CPAU may not reduce its portfolio balance requirement for PCC 1 below 65 percent for any compliance period after December 31, 2016.
3. Any reduction in portfolio balance requirements for PCC 1 must be adopted at a publicly noticed meeting, providing at least 10 calendar days' notice to the CEC, and include an updated renewable energy resources procurement plan detailing the portfolio balance requirement changes.

5. Historic Carryover

a. *Adoption of Historic Carryover Rules*

The City Council has elected to adopt rules to permit its use of Historic Carryover, as defined in Section 3206(a)(5) of the RPS Regulations, to meet its RPS procurement targets. Current calculations indicate that CPAU has Historic Carryover due to CPAU's early investment in renewable energy resources.

b. *Historic Carryover Procurement Criteria*

CPAU's use of Historic Carryover is subject to section 3206 (a)(5) of the CEC's RPS Regulations, including the following:

- 1) Procurement generated before January 1, 2011 may be applied to CPAU's RPS procurement target for the compliance period ending December 31, 2013, or for any subsequent compliance period; and
- 2) The procurement must also meet the criteria of Section 3202 (a)(2) of the CEC's RPS Regulations; and
- 3) The procurement must be in excess of the sum of the 2004-2010 annual procurement targets defined in Section 3206(a)(5)(D) of the CEC's RPS Regulations; and
- 4) The procurement cannot have been applied to the RPS of another state or to a voluntary claim.
- 5) The Historic Carryover must be procured pursuant to a contract or ownership agreement executed before June 1, 2010.
- 6) Both the Historic Carryover and the procurement applied to CPAU's annual procurement targets must be from eligible renewable energy resources that were RPS-eligible under the rules in place for retail sellers at the time of execution of the contract or ownership agreement, except that the generation from such resources need not be tracked in the Western Renewable Energy Generation Information System.

c. *Historic Carryover Formula*

CPAU will calculate its Historic Carryover according to formulae in section 3206 (a)(5)(C) and (D) of the CEC's RPS Regulations.

d. *Historic Carryover Claims*

The number of RECs qualifying for Historic Carryover is dependent upon the acceptance by the CEC of CPAU's applicable procurement claims for January 1, 2004 – December 31, 2010, which are due to the CEC within 90 calendar days after the effective date of the CEC's RPS Regulations (October 30, 2013). The Historic Carryover submittal shall also include baseline calculations, annual procurement target calculations, and any other pertinent data.

e. *Council Review*

CPAU's use of the Historic Carryover to apply towards CPAU's RPS procurement target in any compliance period will be reviewed by the City Council during its annual review as per section D.3 of this RPS Procurement Plan.

6. Large Hydro Exemption (PUC § 399.30(l))

a. *Adoption of Large Hydro Exemption Rules*

The City Council has elected to adopt rules permitting CPAU to reduce its annual RPS procurement requirements, as described in PUC §399.30(l).

b. *Limitations on CPAU's Use of the Large Hydro Exemption*

CPAU shall be allowed to invoke the Large Hydro Exemption as long as the following conditions are met:

1. During a year with in a compliance period, CPAU shall have received greater than 50% of its retail sales from large hydroelectric generation, which is defined as electricity generated from a hydroelectric facility that is not an eligible renewable energy resource.
2. The large hydroelectric generation is produced at a facility owned by the federal government as a part of the federal Central Valley Project or a joint powers agency.
3. Only large hydroelectric generation that is procured under an existing agreement effective as of January 1, 2015, or an extension or renewal of that agreement, shall counted in the determination that CPAU has received more than 50 percent of its retail sales from large hydroelectric generation in any year.

c. *Large Hydro Exemption Calculation*

CPAU's annual RPS procurement target for a year in which the Large Hydro Exemption is invoked shall equal the lesser of (a) the portion of CPAU's retail sales unsatisfied by its large hydroelectric generation or (b) the annual RPS procurement soft target for that year, as listed in section B.2 of this RPS Procurement Plan. CPAU's RPS procurement requirement for the compliance period that includes said year shall be adjusted to reflect any reduction in CPAU's annual RPS procurement target pursuant to this section.

d. *City Council Review*

CPAU's use of the Large Hydro Exemption to reduce its annual RPS procurement target in any compliance period will be reviewed by the City Council during its annual review as per section D.3 of this RPS Procurement Plan.

D. ADDITIONAL PLAN COMPONENTS

1. Exclusive Control (PUC § 399.30(n))

In all matters regarding compliance with the RPS Procurement Plan, CPAU shall retain exclusive control and discretion over the following:

- a. The mix of eligible renewable energy resources procured by CPAU and those additional generation resources procured by CPAU for purposes of ensuring resource adequacy and reliability.
- b. The reasonable costs incurred by CPAU for eligible renewable energy resources owned by it.

2. Deliberations & Reporting (PUC § 399.30(e), § 399.30(f))

- a. *Deliberations on Procurement Plan (§399.30(f)):*
 - (1) *Public Notice:* Annually, CPAU shall post notice of meetings if the CPA Council will deliberate in public regarding this RPS Procurement Plan.
 - (2) *Notice to the California Energy Commission (CEC):* Contemporaneous with the posting of a notice for such a meeting, CPAU shall notify the CEC of the date, time and location of the meeting in order to enable the CEC to post the information on its Internet website.
 - (3) *Documents and Materials Related to Procurement Status and Plans:* When CPAU provides information to the CPA Council related to its renewable energy resources procurement status and future plans, for the City Council's consideration at a noticed public meeting, CPAU shall make that information available to the public and shall provide the CEC with an electronic copy of the documents for posting on the CEC's website.
- b. *Compliance Reporting (Section 3207 of the CEC RPS Regulations)*
 - (1) CPAU shall submit an annual report to the CEC by July 1. The annual reports shall include the information specified in Section 3207(c) of the CEC RPS Regulations.
 - (2) By July 1, 2021; July 1, 2025; July 1, 2028; July 1, 2031; and by July 1 of each year thereafter, CPAU shall submit to the CEC a compliance report that addresses the annual reporting requirements of the previous section, and information for the preceding compliance period as specified in Section 3207(d) of the CEC RPS Regulations.

3. Annual Review

CPAU's RPS Procurement Plan shall be reviewed annually by the City Council in accordance with CPAU's RPS Enforcement Program.

4. Plan Modifications/Amendments

This RPS Procurement Plan may be modified or amended by an affirmative vote of the City Council during a public meeting. Any City Council action to modify or amend the plan must be publicly noticed in accordance with Section D.2.a.

Effective Date: This plan shall be effective on _____, 2018.

APPROVED AND ADOPTED this _____ day of _____, 2018.

C. RPS Enforcement Program



CITY OF
**PALO
ALTO**
UTILITIES

**CITY OF PALO ALTO’S
RENEWABLE PORTFOLIO STANDARD ENFORCEMENT
PROGRAM**

**Version 2
December 2018**

REVISION HISTORY

Version	Date	Resolution	Description
2	12/3/18		Updated to reflect Senate Bill 350 (2015) requirements
1	12/12/11	9215	Original version per Senate Bill X1 2 (2011) requirements

1. The City shall have a program for the enforcement of a Renewable Portfolio Standard (RPS) program, which shall include all of the provisions set forth herein and shall be known as the City's RPS Enforcement Program;
2. The RPS Enforcement Program shall be effective on January 1, 2012;
3. Not less than ten (10) days advance notice shall be given to the public before any meeting is held to make a substantive change to the RPS Enforcement Program;
4. Annually, the City Manager or his designee, the Utilities General Manager, shall cause to be reviewed the City's RPS Procurement Plan to determine compliance with the RPS Enforcement Program;
5. Annual review of the RPS Procurement Plan shall include consideration of each of the following elements:
 - A. By December 31, 2017, December 31, 2018, and December 31, 2019:
 1. Ensure that the City is making reasonable progress toward meeting the December 31, 2020 compliance obligation of 33% renewable resources electricity, consistent with the RPS Procurement Plan.
 - B. December 31, 2020 (end of Compliance Period 3),
 1. Verify that that the City procured sufficient electricity products to meet the sum of 27% of its 2017, 29% of its 2018, 31% of its 2019, and 33% of its 2020 retail sales with eligible renewable resources from the specified Content Categories, consistent with the RPS Procurement Plan;
 - C. By December 31, 2021, December 31, 2022, and December 31, 2023:
 1. Ensure that the City is making reasonable progress toward meeting the December 31, 2024 compliance obligation of 40% renewable resources electricity, consistent with the RPS Procurement Plan.
 - D. December 31, 2024 (end of Compliance Period 4),
 1. Verify that that the City procured sufficient electricity products to meet the sum of 34.75% of its 2021, 36.5% of its 2022, 38.25% of its 2023, and 40% of its 2024 retail sales with eligible renewable resources from the specified Content Categories, consistent with the RPS Procurement Plan;

- E. By December 31, 2025 and December 31, 2026:
 - 1. Ensure that the City is making reasonable progress toward meeting the December 31, 2027 compliance obligation of 45% renewable resources electricity, consistent with the RPS Procurement Plan.

- F. December 31, 2027 (end of Compliance Period 5),
 - 1. Verify that that the City procured sufficient electricity products to meet the sum of 41.67% of its 2025, 43.33% of its 2026, and 45% of its 2027 retail sales with eligible renewable resources from the specified Content Categories, consistent with the RPS Procurement Plan;

- G. By December 31, 2028 and December 31, 2029:
 - 1. Ensure that the City is making reasonable progress toward meeting the December 31, 2030 compliance obligation of 50% renewable resources electricity, consistent with the RPS Procurement Plan.

- H. December 31, 2030 (end of Compliance Period 6),
 - 1. Verify that that the City procured sufficient electricity products to meet the sum of 46.67% of its 2028, 48.33% of its 2029, and 50% of its 2030 retail sales with eligible renewable resources from the specified Content Categories, consistent with the RPS Procurement Plan;

- I. December 31, 2031 and annually thereafter,
 - 1. Verify that that the City procured sufficient electricity products to meet 50% of its retail sales with eligible renewable resources from the specified Content Categories, consistent with the RPS Procurement Plan;

- J. If targets in any compliance period are not met, the City must:
 - 1. Review the applicability of applying Excess Procurement from a previous Compliance Period or Historic Carryover consistent with the provisions of the RPS Procurement Plan;
 - 2. Ensure that any Waiver of Timely Compliance was compliant with the provisions in the RPS Procurement Plan;
 - 3. Ensure that any Portfolio Balance Requirement Reduction was compliant with the provisions in the RPS Procurement Plan; and
 - 4. Review applicability and appropriateness of excusing performance based on the Cost Limitations on Expenditures or the Large Hydro Exemption provisions of the RPS Procurement Plan.

6. If it is determined that the City has failed to comply with the provisions of its RPS Procurement Plan, the City Council shall take steps to correct any untimely compliance, including requiring the City Manager or his designee, the Utilities General Manager to:
 - A. review the City’s RPS Procurement Plan to determine what changes, if any, are necessary to ensure compliance in the next Compliance Period;
 - B. report quarterly to the City Council regarding the progress being made toward meeting the compliance obligation for the next Compliance Period; and
 - C. report to the City Council regarding the status of meeting subsequent compliance targets, and all steps being taken to ensure that the obligation is timely met.

D. Standardized IRP Tables

i. Capacity Resource Adequacy Table (CRAT)



Scenario Name: Expected

Yellow fill relates to an application for confidentiality.
Data input by user are in dark green font.

Units = MW														
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
PEAK LOAD CALCULATIONS														
1 Forecast Total Peak-Hour 1-in-2 Demand	185	155	166	165	164	163	162	161	160	158	156	155	153	151
2 (Customer-side solar: nameplate capacity)	15	17	19	21	22	24	25	27	29	32	34	37	41	44
2a (Customer-side solar: peak hour output)	12	14	15	16	17	18	20	21	23	25	27	29	32	34
3 (Peak load reduction due to thermal energy storage)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 (Light Duty PEV consumption in peak hour)	1	1	2	2	3	4	5	6	7	8	9	10	11	11
5 Additional Achievable Energy Efficiency Savings on Peak Demand Response / Interruptible Programs on Peak	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Demand Response / Interruptible Programs on Peak	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Managed Peak Demand (1-5-9)	185	155	166	165	164	163	161	160	158	155	152	150	147	144
8 Planning Reserve Margin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 Firm Sales Obligations	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Total Peak Procurement Requirement (7+8+9)	185	155	190	190	189	188	186	184	182	179	175	172	169	166

EXISTING AND PLANNED CAPACITY SUPPLY RESOURCES

Utility-Owned Generation and Storage (not RPS-eligible):	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
(list resource by name)														
Collerville														
Long-Term Contracts (not RPS-eligible):														
(list contracts by name)														
Western Base Resource Generation				191	183	175	175	175	175	175	175	175	175	175
Total peak dependable capacity of existing and planned supply resources (not RPS-eligible) [sum of 11a...11n]	0	0	247	240	232	232	232	232	232	232	232	232	232	232
Utility-Owned RPS-eligible Resources:														
(list resource by plant or unit)														
New Spicer Hydroelectric	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Long-Term Contracts (RPS-eligible):														
(list contracts by name)														
PROJECT #1 - HIGHWINDS				10	10	12	10	10	10	10	10	10	0	0
PROJECT #2 - SHLOHFI				12	12	10	0	0	0	0	0	0	0	0
Santa Cruz (Buena Vista Landfill)				2	2	2	2	2	2	2	2	2	2	2
Ox Mountain (Half Moon Bay)				5	5	5	5	5	5	5	5	5	5	5
Keller Canyon				2	2	2	2	2	2	2	2	2	2	2
Johnson Canyon (Amersco)				1	1	1	1	1	1	1	1	1	1	1
San Joaquin (Amersco)				4	4	4	4	4	4	4	4	4	4	4
EE Kettleman Land				0	0	0	0	0	0	0	0	0	0	0
Elevation Solar C				34	34	34	34	34	34	34	34	34	34	34
Western Antelope Blue Sky Ranch B				17	17	17	17	17	17	17	17	17	17	17
Frontier Solar				0	0	0	0	0	0	0	0	0	0	0
Hayworth Solar				22	22	22	22	22	22	22	22	22	22	22
Wilsons Solar				0	0	0	0	0	0	0	0	0	0	0
Palatoclean Projects				1	1	1	1	1	1	1	1	1	1	1
Total peak dependable capacity of existing and planned RPS-eligible resources (sum of 12a...12n)	1	1	29	29	29	29	17	17	17	16	16	16	6	1
Total peak dependable capacity of existing and planned supply resources (11+12)	1	1	277	269	261	249	249	249	249	248	248	238	233	233

GENERIC ADDITIONS

NON-RPS ELIGIBLE RESOURCES:	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
(list resource by name or description)												
None	0	0	0	0	0	0	0	0	0	0	0	0
Total peak dependable capacity of generic supply resources (not RPS-eligible)	0	0	0	0	0	0	0	0	0	0	0	0
RPS-ELIGIBLE RESOURCES:												
(list resource by name or description)												
Total peak dependable capacity of generic RPS-eligible resources	0	0	0	0	0	0	0	0	0	0	0	0
Total peak dependable capacity of generic supply resources (14+15)	0	0	0	0	0	0	0	0	0	0	0	0

CAPACITY BALANCE SUMMARY

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total peak procurement requirement (from line 10)	185	155	190	190	189	188	186	184	182	179	175	172	169	166
Total peak dependable capacity of existing and planned supply resources (from line 13)	1	1	277	269	261	249	249	249	249	248	248	238	233	233
Current capacity surplus (shortfall) (18-17)	(184)	(154)	86	79	72	61	64	66	68	69	73	66	64	67
Total peak dependable capacity of generic supply resources (from line 16)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planned capacity surplus/shortfall (shortfalls assumed to be met with short-term capacity purchases) (19-20)	(184)	(154)	86	79	72	61	64	66	68	69	73	66	64	67

ii. Energy Balance Table (EBT)

State of California California Energy Commission Standardized Reporting Tables for Public Owned Utility IRP Filing Energy Balance Table Form CEC 110 (May 2017)				Historical Data												
Scenario Name: Expected		Units = MWh														
		Yellow fill relates to an application for confidentiality.														
NET ENERGY FOR LOAD CALCULATIONS		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
1	Retail sales to end-use customers															
2	Other loads															
3	Unmanaged net energy for load															
4	Managed retail sales to end-use customers															
5	Managed net energy for load															
6	Firm Sales Obligations	0														
7	Total net energy for load (5+6)	941,423	941,423	941,423	938,410	934,782	932,532	931,063	930,216	930,201	930,358	930,553	931,173	931,787	933,453	
8	[Customer-side solar generation]	18,005	20,277	22,674	24,065	25,620	27,360	29,304	31,474	33,897	36,599	39,614	42,975	46,719	50,890	
9	[Light Duty PEV electricity procurement requirement]	7,316	9,510	11,967	14,704	17,685	20,933	24,444	28,246	32,275	36,579	41,144	46,008	51,073	56,406	
10	[Other transportation electricity consumption/procurement requirement]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	[Other electrification/fuel substitution/consumption/procurement requirement]	146	288	476	730	1,049	1,423	1,876	2,431	3,083	3,831	4,639	5,507			
EXISTING AND PLANNED GENERATION RESOURCES																
Utility-Owned Generation Resources (not RPS-eligible):																
[list resource by name]																
12a	Collierville	241,017	92,779	115,701	131,668	131,668	131,668	131,668	131,668	131,668	131,668	131,668	131,668	131,668	131,668	
Long-Term Contracts (not RPS-eligible):																
[list contracts by name]																
12h	Western Base Resource Generation	541,539	411,405	409,511	385,814	364,289	364,289	364,289	364,289	364,289	364,289	364,289	364,289	364,289	364,289	
12	Total energy from existing and planned supply resources (sum of 12a...12h)	782,556	504,184	525,212	517,482	495,957	495,957	495,957	495,957							
Utility-Owned RPS-eligible Generation Resources:																
[list resource by plant or unit]																
13a	New Spicer Hydroelectric	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Long-Term Contracts (RPS-eligible):																
[list contracts by name]																
13i	PROJECT #1 - HIGHWINDS	48,207	42,664	42,668	42,754	42,721	42,708	42,672	42,711	42,671	42,709	42,722	12,615	0	0	
13j	PROJECT #2 - SHILOH #1	64,513	57,281	57,290	57,425	57,366	0	0	0	0	0	0	0	0	0	
13k	Santa Cruz (Buena Vista Landfill)	9,852	8,961	8,961	8,986	8,961	8,961	8,961	8,961	8,961	1,449	0	0	0	0	
13l	Ox Moomin (Half Moon Bay)	43,880	42,459	42,459	42,575	42,459	42,459	42,570	42,459	42,459	42,459	42,459	42,575	13,959	0	
13m	Keller Canyon	10,894	13,827	13,827	13,865	13,827	13,827	13,827	13,863	13,827	13,827	13,827	13,865	9,205	0	
13n	Johnson Canyon (Ameresco)	10,433	9,200	9,200	9,225	9,200	9,200	9,224	9,200	9,200	9,200	9,200	9,225	9,200	9,200	
13...	San Joaquin (Ameresco)	30,283	27,468	27,468	27,544	27,468	27,468	27,468	27,468	27,468	27,468	27,468	27,544	27,468	27,468	
13...	EE Kettleman Land	53,056	52,791	52,527	52,264	52,003	51,743	51,484	51,227	50,971	50,716	50,462	50,210	49,959	49,709	
13...	Elevation Solar C	100,695	100,191	99,690	99,192	98,696	98,203	97,712	97,223	96,737	96,253	95,772	95,293	94,817	94,343	
13...	Western Antelope Blue Sky Ranch B	50,367	50,115	49,864	49,615	49,367	49,120	48,874	48,630	48,387	48,145	47,904	47,665	47,426	47,189	
13...	Frontier Solar	52,338	52,077	51,816	51,557	51,299	51,043	50,788	50,534	50,281	50,030	49,780	49,531	49,283	49,037	
13...	Hayworth Solar	63,402	63,085	62,770	62,456	62,144	61,833	61,524	61,216	60,910	60,606	60,302	60,001	59,701	59,402	
13...	Wilsona Solar	0	0	0	0	45,136	74,774	74,400	74,028	73,658	73,290	72,924	72,559	72,196	71,835	
13...	Palo Alto CLEAN Projects	2,062	2,052	2,042	2,031	2,021	2,011	2,001	1,991	1,981	1,971	1,961	1,951	1,942	1,932	
13...	Small Part of Western Area Power Association	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
13...	Total energy from RPS-eligible resources (sum of 13a...13z)	553,984	532,171	530,582	529,489	527,668	525,889	524,160	522,481	520,852	519,273	517,744	516,265	514,836	513,457	
13z	Undelivered RPS energy	279,647	180,530	286,651	280,085	283,889	267,401	268,341	268,959	263,937	260,465	260,927	248,251	231,363	223,885	
14	Total energy from existing and planned supply resources (12+13)	1,336,540	1,036,355	1,055,794	1,046,970	1,068,625	1,039,307	1,037,327	1,035,700	1,033,468	1,024,080	1,020,739	988,991	941,114	916,073	
GENERIC ADDITIONS																
NON-RPS ELIGIBLE RESOURCES:																
[list resource by name or description]																
15a																
15	Total energy from generic supply resources (not RPS-eligible)			0	0	0	0	0	0	0	0	0	0	0	0	
RPS-ELIGIBLE RESOURCES:																
[list resource by name or description]																
16a																
16	Total energy from generic RPS-eligible resources			0	0	0	0	0	0	0	0	0	0	0	0	
17	Total energy from generic supply resources (15+16)			0	0	0	0	0	0	0	0	0	0	0	0	
17z	Total energy from RPS-eligible short-term contracts															
ENERGY FROM SHORT-TERM PURCHASES																
18	Short term and spot market purchases:	81,940	79,524	154,110	182,370	160,888	170,642	172,094	173,495	177,953	184,029	188,028	207,719	239,323	258,553	
ENERGY BALANCE SUMMARY																
19a	Total energy from supply resources (14+17+17z)	1,336,540	1,036,355	1,055,794	1,046,970	1,068,625	1,039,307	1,037,327	1,035,700	1,033,468	1,024,080	1,020,739	988,991	941,114	916,073	
19b	Undelivered RPS energy (from 13z)	279,647	180,530	286,651	280,085	283,889	267,401	268,341	268,959	263,937	260,465	260,927	248,251	231,363	223,885	
20	Short term and spot market purchases (from 18)	81,940	79,524	154,110	182,370	160,888	170,642	172,094	173,495	177,953	184,029	188,028	207,719	239,323	258,553	
21	Total delivered energy (19-19a+20)	1,138,833	935,349	923,253	949,255	945,624	942,548	941,081	940,236	947,485	947,643	947,840	948,459	949,074	950,741	
22	Total net energy for load (from 7)	941,423	941,423	941,423	938,410	934,782	932,532	931,063	930,216	930,201	930,358	930,553	931,173	931,787	933,453	
23	Surplus/Shortfall (21-22)	197,409	(6,075)	(18,170)	10,845	10,842	10,016	10,018	10,020	17,284	17,286	17,287	17,287	17,287	17,288	

iii. GHG Emissions Accounting Table (GEAT)

State of California California Energy Commission Standardized Reporting Tables for Public Owned Utility IRP Filing GHG Emissions Accounting Table Form CEC 111 (May 2017)																
Scenario Name: Expected		Yellow fill relates to an application for confidentiality.														
GHG EMISSIONS FROM EXISTING AND PLANNED SUPPLY RESOURCES		Emissions Intensity Units = mt CO2e/MWh Yearly Emissions Total Units = Mmt CO2e														
Utility-Owned Generation (not RPS-eligible):		Emissions Intensity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1a	[list resource by name]	#RPS?	0		0	0	0	0	0	0	0	0	0	0	0	0
Long-Term Contracts (not RPS-eligible):																
[list contracts by name]		Emissions Intensity														
1h	Western Base Resource Generation	0			0	0	0	0	0	0	0	0	0	0	0	0
1n																
1	Total GHG emissions of existing and planned supply resources (not RPS-eligible) (sum of 1a...1n)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utility-Owned RPS-eligible Generation Resources:																
[list resource by plant or unit]		Emissions Intensity														
2a	New Spicer Hydroelectric	0			0	0	0	0	0	0	0	0	0	0	0	0
Long-Term Contracts (RPS-eligible):																
[list contracts by name]		Emissions Intensity														
2h	PROJECT #1 - HIGHWINDS	0														
2i	PROJECT #2 - SHILOH #1	0														
2j	Santa Cruz (Buena Vista Landfill)	0														
2k	Ox Mountain (Half Moon Bay)	0														
2l	Keller Canyon	0														
2m	Johnson Canyon (Ameresco)	0														
2n	San Joaquin (Ameresco)	0														
2...	EE Keulegan Land	0														
2...	Elevation Solar C	0														
2...	Western Antelope Blue Sky Ranch B	0														
2...	Frontier Solar	0														
2...	Hayworth Solar	0														
2...	Wilson Solar	0														
2...	Palo Alto CLEAN Projects	0														
2...	Small Part of Western Area Power Association	0														
2	Total GHG emissions from RPS-eligible resources (sum of 2a...2n)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Total GHG emissions from existing and planned supply resources (1+2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
EMISSIONS FROM GENERIC ADDITIONS																
NON-RPS ELIGIBLE RESOURCES:																
[list resource by name or description]		Emissions Intensity			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4a																
4b																
4	Total GHG emissions from generic supply resources (not RPS-eligible)				0	0	0	0	0	0	0	0	0	0	0	0
RPS-ELIGIBLE RESOURCES:																
[list resource by name or description]		Emissions Intensity														
5a																
5b																
5	Total GHG emissions from generic RPS-eligible resources				0	0	0	0	0	0	0	0	0	0	0	0
6	Total GHG emissions from generic supply resources (4+5)				0	0	0	0	0	0	0	0	0	0	0	0
GHG EMISSIONS OF SHORT TERM PURCHASES																
[list resource by name or description]		Emissions Intensity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
7	Short term and spot market purchases:	0.428	35,070	34,036	65,959	78,054	68,860	73,035	73,656	74,256	76,164	78,764	80,476	88,904	102,430	110,661
TOTAL GHG EMISSIONS			2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
8	Total GHG emissions to meet net energy for load (3+6+7)		35,070	34,036	65,959	78,054	68,860	73,035	73,656	74,256	76,164	78,764	80,476	88,904	102,430	110,661
EMISSIONS ADJUSTMENTS																
8a	Undelivered RPS energy (MWh from EBT)	279,647	180,530	286,651	280,085	283,889	267,401	268,341	268,959	263,937	260,465	260,927	248,251	231,363	223,885	
8b	Firm Sales Obligations (MWh from EBT)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8c	Total energy for emissions adjustment (8a+8b)	279,647	180,530	286,651	280,085	283,889	267,401	268,341	268,959	263,937	260,465	260,927	248,251	231,363	223,885	
8d	Emissions intensity (portfolio gas/short-term and spot market purchases)	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	0.428	
8e	Emissions adjustment (8c*8d)	119,689	77,267	122,687	119,877	121,505	114,448	114,850	115,114	112,965	111,479	111,677	106,251	99,023	95,823	
PORTFOLIO GHG EMISSIONS																
8f	Portfolio emissions (8-8e)		-84,619	-43,231	-56,728	-41,822	-52,645	-41,413	-41,193	-40,859	-36,801	-32,715	-31,201	-17,348	3,407	14,838
GHG EMISSIONS IMPACT OF TRANSPORTATION ELECTRIFICATION																
[list resource by name or description]		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
9	GHG emissions reduction due to gasoline vehicle displacement by LD PEVs	0.02	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
10	GHG emissions increase due to LD PEV electricity loads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
GHG emissions reduction due to fuel displacement - other transportation electrification																
11																
GHG emissions increase due to increased electricity loads - other transportation electrification																
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0	

iv. RPS Procurement Table (RPT)



State of California
California Energy Commission
Standardized Reporting Tables for Public Owned Utility RFP Filing
RPS Procurement Table
Form CEC-1212 (Rev. 2015)

		Units – MWh													
		Compliance Period 3			Compliance Period 4			Compliance Period 5			Compliance Period 6				
Beginning balances Start of 2017		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	(Managed) Retail sales to end-use customers (From EBT)	913,986	913,986	913,986	911,077	902,553	904,572	903,349	902,329	902,293	902,447	902,638	903,238	903,835	905,452
2	Green pricing program/hydro exclusion	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201	28,201
3	Soft Target (%)	27.00%	29.00%	31.00%	33.00%	34.75%	36.50%	38.25%	40.00%	41.67%	43.33%	45.00%	46.67%	48.33%	50.00%
4	Required procurement for compliance period	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982
5	Excess balance/historic carryover at beginning/end of compliance period	626,376	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746	756,746
6	RPS-eligible energy produced (excluding from EBT)	153,084	153,171	153,258	153,489	153,668	153,850	154,033	154,217	154,401	154,585	154,769	154,953	155,137	155,321
6A	Net purchases of REC applied to procurement obligation	293,142	252,878	0	0	0	0	0	0	331,491	346,053	360,752	375,695	390,450	405,183
7	Net purchases of Category 0, 1 and 2 RECs	0	0	(530,924)	(529,489)	(572,668)	(543,850)	(498,233)	(222,886)	(206,020)	(182,656)	(164,629)	(117,388)	(54,707)	(14,254)
7A	Carryover and REC purchases applied to procurement obligation	0	0	314,822	144,922	272,831	287,131	306,784	0	0	0	0	0	0	0
8	Net change in balance/carryover (67.6A-7A)	314,822	275,293	(314,822)	(144,922)	(272,831)	(287,131)	(306,784)	0	0	0	0	0	0	0
9	Excess balance/historic carryover at beginning/end of compliance period	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Net purchases of Category 3 RECs	0	0	106,598	0	32744	32744	32744	32744	32744	32744	32744	32744	32744	32744
11	Carryover and REC purchases applied to procurement obligation	0	0	106,598	0	32744	32744	32744	32744	32744	32744	32744	32744	32744	32744
12	Net change in REC balance/carryover	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Total generation plus RECs (all Categories) applied to procurement requirement (6A + 7A + 11)	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982	1,061,982
14	Over/under procurement for compliance period (11 - 4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0