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FINAL STAFF REPORT

Review of Anaheim Public Utilities 2018 Integrated Resource Plan

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ABSTRACT

Senate Bill 350 (De León, Chapter 547, Statutes of 2015), (Public Utilities Code section 9621) requires the Energy Commission to review the integrated resource plans of identified publicly owned utilities to ensure they meet various requirements specified in the law, including GHG emission reduction targets and renewable mandates. Integrated resource plans are long-term planning documents that outline how publicly owned utilities will meet demand reliably and cost effectively, while achieving state policy goals and mandates. Anaheim Public Utilities submitted their *2018 Integrated Resource Plan* and supplemental information, which the Anaheim City Council adopted on May 15, 2018, to the Energy Commission for review July 26, 2018. This staff paper presents the results of the Energy Commission staff review of the Anaheim Public Utilities' integrated resource plan.

Keywords: Publicly owned utility, integrated resource plan, demand, resources, portfolio, generation, transmission, distribution, Renewables Portfolio Standard, forecast, energy efficiency, transportation electrification, demand response, greenhouse gas, GHG, emissions, system reliability, integration, local reliability, energy storage, distributed generation,

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Executive Summary

Public Utilities Code (PUC) section 9621 requires publicly owned utilities meeting a size threshold to adopt an integrated resource plan (IRP) that meets certain requirements, targets, and goals, including greenhouse gas emission reduction targets and renewable energy procurement requirements. The Energy Commission's *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines* additionally require the utilities to file an IRP with data and supporting information sufficient to demonstrate that they meet these requirements and the various targets and planning goals from 2018 to 2030. The Energy Commission must review the IRPs to ensure consistency with the requirements of PUC section 9621.

Anaheim Public Utilities' IRP Filing (the IRP Filing) serves as a framework for their transition away from carbon intensive resources, such as coal, to clean renewable resources such as wind, geothermal, biogas, small hydro, and solar. The utility's long-term strategy is to procure additional intermittent renewable resources that increase the diversity of their largely baseload renewable portfolio and increase flexibility through shorter-term power purchases, including wholesale market purchases. Anaheim Public Utilities modeled and evaluated a variable renewable resource portfolio against alternative resource types and mixes and determined it was the optimal portfolio, as detailed in the IRP Filing.

In reviewing the Anaheim IRP and determining consistency with the requirements of PUC section 9621, Energy Commission staff relied on the four standardized reporting tables and narrative descriptions in the IRP Filing, as well as analysis and verification of these materials. Staff's review of the IRP Filing results in the following conclusions with respect to consistency with the requirements of PUC section 9621:

- *Achieving Greenhouse Gas Emissions Targets and Renewables Portfolio Standard Requirements:* The values reported in the standardized forms, along with the narrative discussion in the IRP Filing, demonstrate the utility plans to meet the greenhouse-gas emission reduction requirements of PUC section 9621(b)(1), and the renewable energy procurement requirement of PUC section 9621(b)(2).
- *Meeting Planning Goals:* The values reported in standardized forms, along with the analysis and discussion provided in the IRP Filing, demonstrate the utility intends to meet planning goals related to retail rates, reliability, transmission and distribution systems, localized air pollution, and disadvantaged communities as set forth in PUC section 9621(b)(3).
- *Considering Peak Needs:* The values reported in the standardized forms, along with analysis and narrative discussion, demonstrate the utility has considered the role of existing renewable generation, grid operational efficiencies, energy storage, and distributed resources (including energy efficiency) in helping to

ensure the utility's energy and reliability needs in the hours that encompass the peak hour as set forth in PUC section 9621(c).

- *Addressing Resource Procurement Types:* The IRP filing includes values reported in the standardized forms and narrative discussion that demonstrate the utility has addressed the procurements requirements for energy efficiency and demand response, energy storage, transportation electrification, portfolio diversification, and resource adequacy as set forth in PUC section 9621(d).

In addition to the provisions regarding IRPs, Senate Bill 350 requires the Energy Commission to establish statewide and utility specific targets to achieve a statewide doubling of energy efficiency by 2030. The IRP is consistent with the PUC section 9621 requirement in that they address energy efficiency and demand response. Energy Commission staff observe that aggressive energy efficiency and demand response programs will be needed for utilities and other energy efficiency deliverers to meet the 2030 energy efficiency doubling targets and capture the benefits of demand response. As part of the *2019 Integrated Energy Policy Report*, the Energy Commission will report on progress in achieving the doubling targets, including those for Anaheim Public Utilities, and update the targets as necessary.

Review of Anaheim Public Utilities 2018 Integrated Resource Plan

Introduction

California Public Utilities Code (PUC) section 9621 requires publicly owned utilities (POU) with an annual electrical demand exceeding 700 gigawatt hours to develop integrated resource plans (IRP). IRPs are electricity system planning documents that describe how utilities plan to meet their energy and capacity resource needs while achieving policy goals and mandates; meeting physical and operational constraints; and fulfilling other priorities such as reducing impacts on customer rates. PUC section 9621 requires the governing board of a POU to adopt an IRP and a process for updating it at least once every five years by January 1, 2019.

PUC section 9621 further requires the POUs meeting the size threshold to submit their IRP and updates to the Energy Commission for review to determine if they are consistent with the requirements of PUC section 9621. If the Energy Commission determines an IRP is inconsistent with these requirements the Energy Commission shall provide recommendations to correct the deficiencies. In August 2017 the Energy Commission adopted the *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines* (*POU IRP Guidelines*) to govern the submission of the POU's IRPs.[1] In August 2018 the Energy Commission adopted updated guidelines to govern the submission of information, data, and reports needed to support the review of IRPs[2], adding new requirements called for in Senate Bill 338.[3] Additional revisions to the POU IRP Guidelines, adopted in October 2018, include references to the greenhouse gas (GHG) emissions target range established by the California Air Resources Board (CARB), and make adjustments to the standardized tables and instructions.[4]

1 California Energy Commission. *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines*. August 2017, Publication Number CEC-200-2017-004-CMF. https://efiling.energy.ca.gov/GetDocument.aspx?tn=221045.

2 California Energy Commission. *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines*. Second Edition. August 2018, Publication Number CEC-200-2018-004-CMF. https://efiling.energy.ca.gov/GetDocument.aspx?tn=224476.

3 Anaheim addressed this new requirement under PUC section 9621(c) in its IRP Filing.

4 California Energy Commission. *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines*. Revised Second Edition. October 2018, Publication Number CEC-200-2018-004-CMF. https://efiling.energy.ca.gov/GetDocument.aspx?tn=224889.

PUC section 9622 requires the Energy Commission to review POU IRPs to ensure they achieve the following PUC section 9621 provisions:[5]

- Meet GHG emission reduction targets for the POU that reflect the electricity sector's percentage in achieving the economy-wide GHG emission reductions of 40 percent from 1990 levels by 2030 (PUC section 9621(b)(1))
- Procure at least 50 percent eligible renewable energy resources by 2030, consistent with the Renewables Portfolio Standard (RPS) requirements (PUC section 9621(b)(2))
- Meet the following goals (PUC section 9621(b)(3)):[6]
    - Enhance each POU's ability to fulfill its obligation to serve its customers at just and reasonable rates
    - Minimize impacts on ratepayer bills
    - Ensure system and local reliability
    - Strengthen the diversity, sustainability, and resilience of the bulk transmission and distribution systems, and local communities
    - Enhance distribution systems and demand-side energy management
    - Minimize localized air pollutants and other GHG emissions, with early priority on disadvantaged communities
- Consider the role of existing renewable generation, grid operational efficiencies, energy storage and distributed resources, including energy efficiency, in meeting energy and reliability needs in the hours encompassing peak demand (PUC section 9621(c))
- Address procurement for the following:
    - Energy efficiency and demand response resources (PUC section 9621(d)(1)(A))
    - Energy storage requirements (PUC section 9621(d)(1)(B))
    - Transportation electrification (PUC section 9621 (d)(1)(C))
    - A diversified procurement portfolio consisting of both short-term and long-term electricity, electricity-related, and demand response products (PUC section 9621(d)(1)(D))
    - Resource adequacy requirements (PUC section 9621(d)(1)(E))

5 Public Utilities Code Article 16 (commencing with Section 399.11) of Chapter 2.3 of Part 1 of Division 1.

6 Goals specified in PUC section 454.52(a)(1) subsections (D) to (H), inclusive, and PUC section 454.52(a)(1)(C) as that goal is applicable to each locally publicly owned electric utility.

Energy Commission IRP Review Process

On June 26, 2018, Anaheim Public Utilities (Anaheim) submitted their IRP and supporting documentation (IRP Filing), as outlined in the *POU IRP Guidelines,*[7] for the Energy Commission's review.[8] The Energy Commission staff's review of Anaheim's IRP Filing included two stages. Staff performed a completeness review to ensure the IRP Filing contained the POU board adopted IRP, the four standardized tables, and any supporting information Energy Commission staff needed to conduct its review. Staff then conducted a detailed review to determine if the IRP Filing was consistent with the requirements of PUC section 9621.

On August 7, 2018, the Energy Commission notified Anaheim that their IRP Filing was complete. On August 21, 2018, the Energy Commission posted the IRP Filing on its website for public comment and accepted comments for 30 days. The Energy Commission did not receive any public comments related to the consistency of the IRP with PUC section 9621.

In conducting its review, Energy Commission staff assessed the data in the standardized tables and narrative discussions provided in the IRP Filing, along with staff analysis, informal discussions with Anaheim's staff, and verification of data or information, as needed.[9] In assessing whether Anaheim's IRP is consistent with the requirements of PUC section 9621, staff considered the data supporting the assertions in the IRP.

Energy Commission staff also relied on staff subject matter experts to review sections of the IRP Filing including Anaheim's energy and peak demand forecasts, projections for renewable resource additions and whether they achieved RPS requirements, energy efficiency savings projections and programs, and plans for transportation electrification.

The following summarizes the main elements of Anaheim's IRP and provides staff's findings regarding the consistency of the IRP Filing with PUC section 9621 requirements and the Energy Commission's *POU IRP Guidelines*.

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7 The *POU IRP Guidelines* define an IRP Filing to include the IRP adopted by the governing board, along with standardized tables and other supporting information required to review the IRP for consistency with SB 350.

8 On June 26, 2018, Anaheim submitted an IRP Filing and requested the Energy Commission deem certain information confidential in accordance with the Energy Commission's confidentiality regulations. After discussions between Energy Commission and Anaheim staff, Anaheim resubmitted its IRP Filing, rescinding its earlier request for confidentiality.

9 In a number of cases, data presented in the IRP text and standardized tables differs. However, the differences are generally small enough that they do not change the overall findings from staff's review.

Overview of Anaheim Public Utilities

Anaheim is a city-owned, not-for-profit electric and water utility in Orange County, California as described below.

- Anaheim delivers more than 3.7 million megawatt-hours (MWh) of energy to 350,000 residents and more than 15,000 businesses
- Residential customers constitute up to 85 percent of total customer meters; however, commercial and industrial customers consume nearly 75 percent of the total load
- According to the 2015 U.S. Census, nearly 58 percent of Anaheim households are under the low-income designation
- Anaheim has over 700 megawatts (MW) of generation capacity that serves a forecasted (2019) peak demand of 553 MW
- Anaheim expects to have negative, or no, growth in energy demand in the planning horizon despite commercial and residential expansions
- The elected City Council of Anaheim has ultimate decision-making authority for Anaheim Public Utilities, with input from a citizen advisory Public Utilities Board

Anaheim Public Utilities' Planning Process

An Executive Oversight group consisting of Anaheim senior management guided the development of their IRP, which began in early 2017 and included customer outreach efforts. In March 2018, Anaheim presented a summary of their proposed IRP at public events held in each of City of Anaheim's six council districts. Anaheim reports that customer feedback indicates broad support for a responsible transition away from carbon intensive resources, including coal generation, to renewables and cleaner burning resources, including gas-fired generation. The Anaheim City Council adopted the *2018 IRP* on May 15, 2018.[10]

Demand Forecast

The *POU IRP Guidelines* (Chapter 2.E.1) identify the need for a forecast of energy and peak demand to determine whether a POU's IRP is consistent with the requirements of PUC section 9621.[11] In addition, under the POU IRP Guidelines (Chapter 2.E.2) the POU must provide information on the methodology used in developing the demand forecast, if a POU chooses to use a forecast other than the Energy Commission's adopted demand forecast.[12] Staff reviewed the demand forecast and supporting information provided in

10 Anaheim Public Utilities *2018 Integrated Resources Plan.* 2018. City of Anaheim. https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=18-IRP-01.

11 *POU IRP Guidelines,* Chapter 2, E., Pp 5-6.

12 The most recently adopted demand forecast is for the *2017 Integrated Energy Policy Report*. Kavalec, Chris, Asish Gautam, Mike Jaske, Lynn Marshall, Nahid Movassagh, and Ravinderpal Vaid. 2018. *California Energy Demand 2018 — 2030 Revised Forecast*. California Energy Commission, Electricity Assessments Division.

the IRP Filing and determines that it presents an adequate estimation of future energy and peak demand that meets the *POU IRP Guideline* requirements set forth above.

Energy Forecast, Methodology and Assumptions

Anaheim's demand forecast is consistent with the Energy Commission's demand forecast for Anaheim (*California Energy Demand 2018 — 2030 Revised Forecast*). Anaheim's energy and peak demand forecast values vary by roughly 4 percent in 2030,[13] which staff considers a small enough difference to be adequate for long-term planning purposes. Anaheim's energy and peak demand forecasts and methodology is described in more detail below.

Anaheim's energy demand forecast is determined in two steps. The first step establishes the base energy demand forecast. The second step adjusts the base energy demand forecast to include planned energy growth and the impact from system expansion, electric vehicle (EV) penetration, solar photovoltaic (PV) installation, and energy efficiency. Anaheim developed their base energy demand forecast using an econometric model with five years of historical hourly data. Variables accounted for in the model include expected hourly temperature, calendar (weekday versus holiday), month, and hour.

Anaheim presents a demand forecast with a total load reduction of 0.86 percent between 2018 and 2030, resulting in net energy for load of 2,429 GWh in 2030 and 2,344 GWh in retail sales to end-use customers.[14] Anaheim's forecast accounts for system expansions including commercial expansions such as Disneyland Resort construction, new hotel construction, and new condominium and apartment structures based on information from the city's permitting and engineering departments.

Anaheim estimates near-term growth in installed PV capacity using system size data from permit applications. Long-term estimates are based on a linear extrapolation of historical installation totals. The utility projects roughly 5 MW of (nameplate) capacity will be added each year for a total of 60 MW over 2018 — 2030. This value is roughly equal to the assumed additions in the mid-demand, mid-AAPV case in the Energy Commission's adopted forecast (55 MW). Anaheim's estimate of the peak capacity value of these additions is slightly lower than that in the Energy Commission's forecast (21 MW vs. 27 MW), which may be partially attributed to differences in the capacity

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Publication Number: CEC-200-2018-002-CMF.
http://www.energy.ca.gov/2017_energypolicy/documents/#demand.

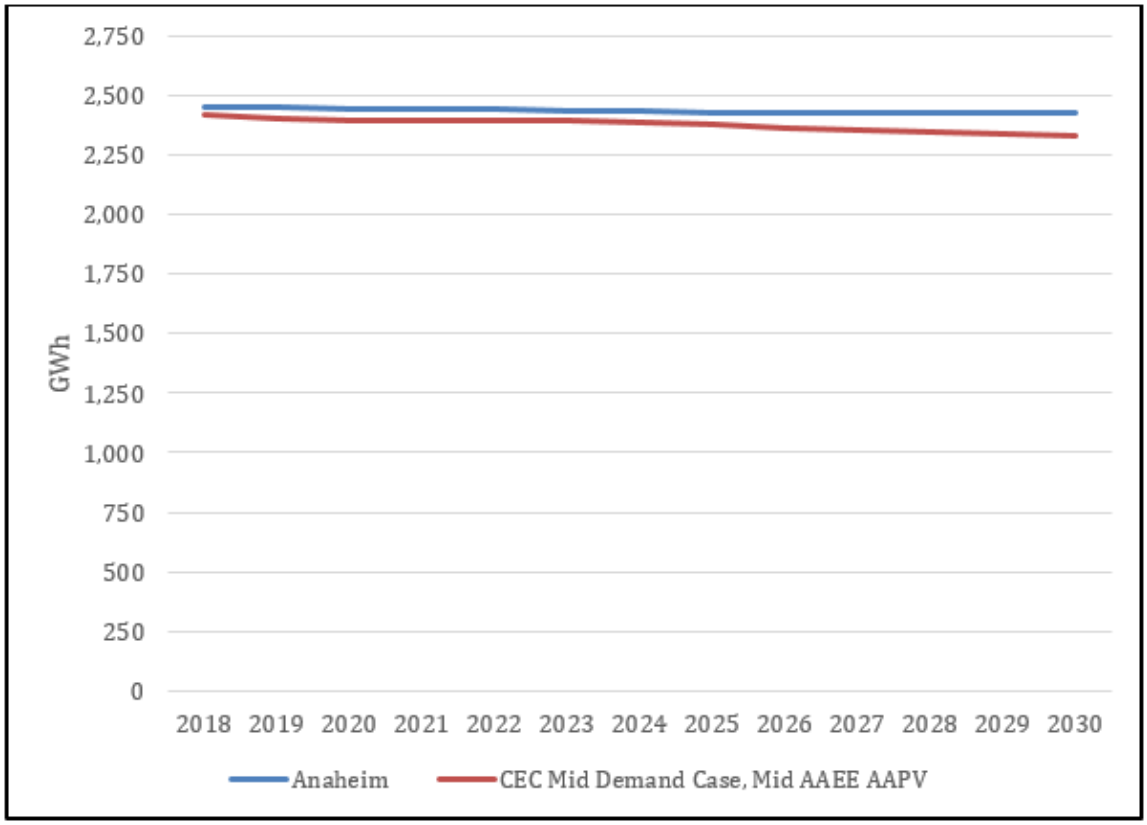
13 The 4 percent variation is in comparison to the mid-demand case of the Energy Commission's *California Energy Demand 2018 — 2030 Revised Forecast*. Anaheim's demand forecast falls between the high- and the low-demand cases of the Energy Commission's *California Energy Demand 2018 — 2030 Revised Forecast*.

14 Net energy for load is the total energy that a utility needs to procure to meet all of its load obligations, including unmetered city or utility loads, multi-hour storage loads, and retail sales. Retail sales only account for electricity sold by the utility to end use retail customers.

factor assumed by Anaheim. Anaheim used a capacity factor of 18.83 percent – that of the city-owned Anaheim Convention Center PV system – while the adopted agency forecast assumes a capacity factor just under 22 percent. Energy efficiency and transportation electrification assumptions are discussed in Additional Procurement Goals on page 25.

The Energy Commission's most recent forecast for Anaheim (*California Energy Demand 2018 — 2030 Revised Forecast*) is close to Anaheim's forecast, with a difference of 1.2 percent in 2018, increasing to 4.1 percent by 2030. The Energy Commission forecasts energy demand of 2,422 GWh in 2018 declining to 2,333 GWh in 2030, with average annual growth of -0.31 percent under the mid demand baseline case, with mid additional achievable energy efficiency (AAEE) and additional achievable PV (AAPV) savings, as shown in Figure 1.

Figure 1: Anaheim and Energy Commission Energy Forecasts 2018-2030 (GWh)



Source: California Energy Commission staff, Energy Assessments Division

The differences between Anaheim's and the Energy Commission's forecasted energy demand are likely attributed to Anaheim's exclusion of economic and demographic factors in their forecasting methodology, which are included in the Energy Commission's forecast. Anaheim explains that the City of Anaheim is a fully developed city with historically consistent growth in income and employment rates and notes that inclusion of economic and demographic factors lead to increased forecast variability.

However, Energy Commission staff observes that Anaheim's energy demand experienced a significant decline during the economic recession from 2008 to 2011, showing a correlation to economic conditions.

Anaheim also assessed the impacts of hotter and cooler than expected annual temperatures on energy demand. They determined that higher annual average temperatures increase demand by 81 GWh annually and lower temperatures decrease demand by 71 GWh. These changes in demand represent a variation of approximately 3 percent in the annual energy demand.

Peak Forecast, Methodology and Assumptions

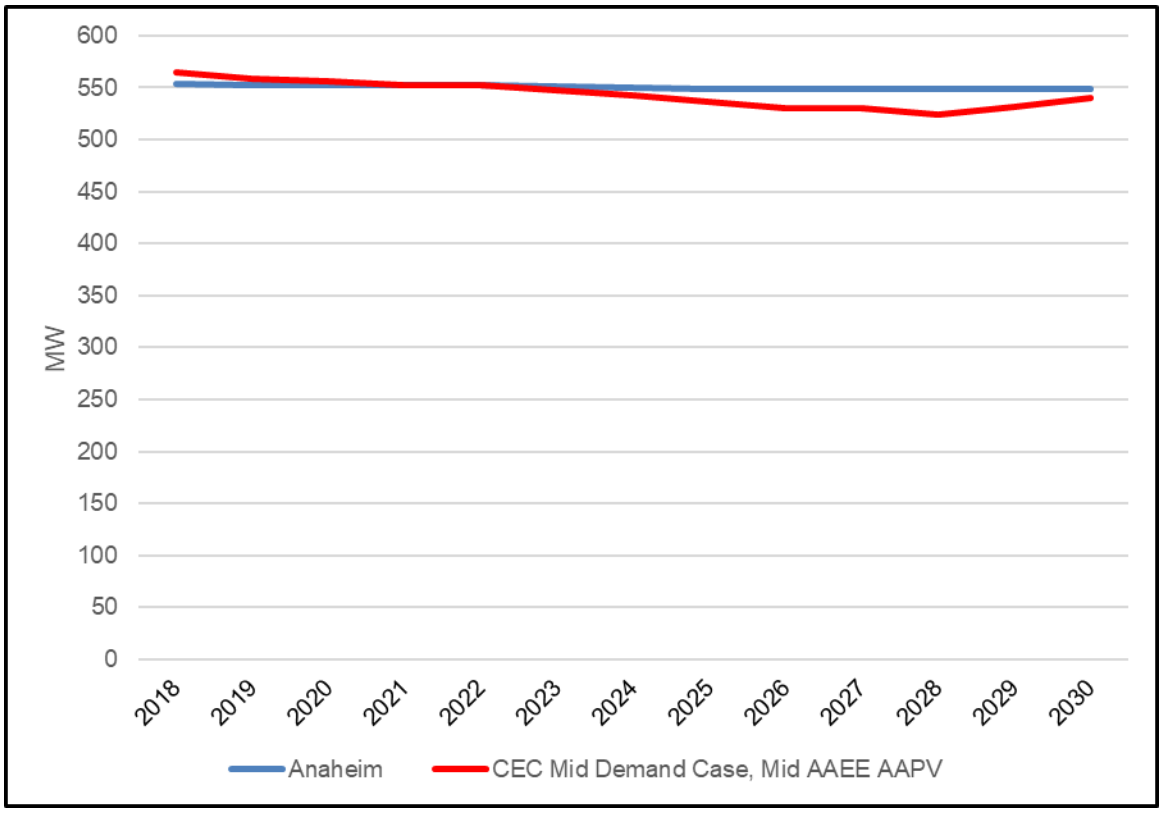
Anaheim developed a peak demand forecast to determine the resources needed to meet reliability requirements and for distribution system planning. Anaheim also used an hour-by-hour peak and energy profile analysis in the IRP to determine which resource portfolio would best match their needs and allow them to meet peak demand with clean energy. The peak demand forecast used historical average load factors for each month from the most recent five years.[15] Anaheim applies historical average load factors to the adjusted monthly energy demand forecast to develop the peak demand forecast. This is a common methodology used to forecast peak demand with historical load data.

Anaheim's peak forecast is close to the Energy Commission's forecast for Anaheim (*California Energy Demand 2018 — 2030 Revised Forecast*), mid demand baseline case, with mid AAEE and AAPV savings, as shown in Figure 2.

Anaheim forecasts a peak demand for utility-provided energy of 553 MW in 2019, with customer solar PV generating 3 MW. In 2030, the forecast for utility-provided energy at peak demand is 549 MW, with an additional 21 MW of power coming from customer solar PV. In 2018, the difference from the Energy Commission's peak forecast is -1.9 percent; this increases to 4.8 percent by 2028, and falls to 1.7 percent in 2030. The increasing peak demand in the last two years of the Energy Commission's forecast represents the shift in the timing of peak system load, which is pushed back an hour by significant amounts of solar PV. This later peak hour diminishes the impact of both efficiency savings and behind-the-meter PV.

15 A monthly load factor is the ratio of the average energy demand to the peak energy demand during the month. A constant load factor means that energy demand and peak demand are growing (or declining) at the same rate.

Figure 2: Anaheim and Energy Commission Peak Forecasts 2018 — 2030 (GWh)



Source: California Energy Commission staff, Energy Assessments Division

Anaheim examined the estimated future peak shift in energy demand using an hourly load shape for distributed solar PV generation. In 2018, Anaheim's peak occurs in hour 17, which shifts in their forecast to hour 18 in 2019 and hour 19 by 2030. Anaheim also performed an analysis to examine the extent to which renewable and other clean resources can help to meet peak demand, discussed in System and Local Reliability on page 20.

Resource Procurement Plan

The Energy Commission's *POU IRP Guidelines* require that a POU report the mix of resources they plan to use to meet demand from 2018-2030.[16] The guidelines also require a POU to provide an IRP with data and supporting information sufficient to demonstrate that the POU is meeting the various targets and goals. Based on staff's review, Anaheim's IRP Filing meets these guideline requirements. The following discusses Anaheim's existing resources, their procurement strategy, the portfolio analysis underlying resource selections, and the resources in 2030 identified in the standardized forms.

16 *POU IRP Guidelines*, Chapter 2.F., P. 6.

Existing Resources

Anaheim's current resource mix includes coal, natural generation, and renewable resources. Starting in the mid-1970s, the utility began securing long-term resources to serve their customer load,[17] purchasing ownership shares in the San Onofre Nuclear Generating Station (Units 2 and 3)[18] and acquiring participation shares in two coal facilities, the San Juan Generating Station in New Mexico and the Intermountain Power Project (IPP) in Utah. Anaheim also obtained a contracted share of power generated from the Hoover Dam, developed the Anaheim Combustion Turbine Generator (Anaheim CTG, also referred to as the Kramer Peaking Plant), and purchased energy sold into spot markets by utilities in the Western States. Anaheim also participated with Southern California Public Power Authority (SCPPA) members to construct the Magnolia Power Project, a combined cycle power plant that came on line in 2005, and the Canyon Peaking Power Plant, a 200 MW simple-cycle peaking project that came on-line in 2011.

Anaheim's natural gas and coal-fired resources produced 2,290 GWh of energy in 2017, an amount equal to almost 95 percent of the utility's energy requirements (1,480 GWh of this came from the coal plants). They sold almost 910 GWh, or nearly 40 percent of the energy procured from natural gas and coal resources into the spot market. Anaheim purchased 275 GWh from the spot market, making them a net seller into the spot market overall with 635 GWh of net sales.

In recent years, Anaheim's focus has been on divesting themselves from coal ownership shares and diversifying their resource mix to meet RPS requirements. In 2017, Anaheim divested the San Juan Generating Station and plans to divest the remaining coal resource, the Intermountain Power Project, at the conclusion of the contract in 2027.[19]

In 2017, Anaheim generated or procured renewable energy in an amount equal to 33 percent of retail sales and 31.6 percent of total energy requirements. A majority of this was from a handful of baseload resources: two biogas plants (49 percent of renewable energy procured) and two geothermal facilities (15 percent).

Anaheim is presently fully resourced, for example they have sufficient generation capacity under their control to serve their customer energy demand and meet resource adequacy requirements, see System and Local Reliability on page 20.

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17 Anaheim's resource supply up until the mid-1970s consisted primarily of purchased power from Southern California Edison, whose wholesale rates were increasing. In 1975, the voters approved an electric revenue bond to study, construct, and buy the rights to generation and transmission projects throughout the western United States.

18 In 2013, SCE permanently retired San Onofre Nuclear Generating Station Units 2 & 3, after an outage starting in early 2012 caused by a design defect in the steam generators.

19 Anaheim's obligation to take power from IPP ends in 2027. Pursuant to the California's Emissions Performance Standard (Public Utilities Code Sections 8340 — 8341), it cannot extend the existing agreement or enter into a new contract with the coal-fired facility.

Procurement Strategy

Anaheim's long-term planning strategy, outlined in the IRP Filing, includes procuring sufficient renewable resources to meet the 50 percent RPS, divesting remaining coal resources, using peaking resources to integrate additional renewable resources, and increasing flexibility with shorter-term resources, which include wholesale power purchases. Table 1 provides a summary of the amount of energy from the different resources in Anaheim's portfolio in 2019, 2025, and 2030. Table 2 provides a summary of the capacity resources they will rely on to meet peak demand and reliability requirements in the same years. Appendix A includes a table identifying the energy and capacity for individual resources for all years, see Table A-1 and Table A-2.

Table 1: Energy Resources by Type 2019, 2025, and 2030 (MWh)

		2019	2025	2030
Total Net Energy for Load		**2,447,982**	**2,429,103**	**2,429,150**
Non-RPS Resources	Natural Gas	866,026	746,449	794,119
	Large Hydro	38,204	38,243	38,339
	Coal	1,141,343	1,096,576	0
	Spot Purchases	250,562	330,650	1,021,073
	Spot Sales	(547,830)	(487,603)	(593,601)
RPS Resources	Biofuels	382,650	403,024	403,024
	Geothermal	128,897	128,897	128,897
	Small Hydro	13,770		
	Solar PV	6,989	122,591	122,495
	Wind	168,982	56,249	0
	Planned Baseload Contract	3,942	0	0
	Planned Intermittent Contract	0	0	130,812
	Short-Term RPS Contracts			386,838
Total Energy Procured		**2,453,535**	**2,435,076**	**2,431,995**
Surplus/Shortfall		**5,553**	**5,973**	**2,845**

Source: California Energy Commission, Energy Assessments Division, Based on Anaheim 2018 IRP Filing

Table 2: Capacity Resources by Type for 2019, 2025, and 2030 (MW)

		2019	2025	2030
Peak Demand		**553**	**549**	**549**
Planning Reserve Margin		**83**	**82**	**82**
Peak Procurement Requirement		**636**	**632**	**632**
Non-RPS Resources	Natural Gas	347	301	301
	Large Hydro	40	40	40
	Coal	236	236	
	Planned System Capacity Contract(s)			216
RPS Resources	Biofuels	47	50	50
	Geothermal	19	19	19
	Small Hydro	10		
	Solar PV	0	9	9
	Wind	12	3	0
	Planned Baseload Contract	1		
	Planned Intermittent Contract			15
Total Capacity Procured		**711**	**658**	**650**
Surplus/Shortfall		**75**	**26**	**18**

Source: California Energy Commission, Energy Assessments Division, Based on Anaheim 2018 IRP Filing

Resource Portfolio Evaluation

Anaheim used production cost modeling of three different resource portfolios as the basis for selecting a preferred portfolio to replace coal generation, retire Anaheim CTG, and meet the 50 percent RPS:

- A Baseload Portfolio with continued reliance largely on baseload renewable resources (geothermal, biomass, and biogas)
- A Mixed Portfolio that adds 50 percent baseload renewables and 50 percent variable-energy resources: solar and wind
- A Variable Portfolio with 100 percent variable-energy resources

After forecasting energy and peak demand, the supply-side analysis helped to determine the optimal mix of resources to meet three primary planning goals identified by Anaheim:

- Sustainable resources, as defined by meeting the 50 percent RPS and GHG reduction targets, along with reducing regulatory risk
- High reliability, as defined by meeting resource adequacy requirements and achieving portfolio diversification
- Affordable rates, as defined by low expected costs, as well as low market risk

The information on the production cost modeling included in Anaheim's IRP filing allowed for a cursory review of some of the major resource planning assumptions, which appear adequate for long-term planning and portfolio evaluation purposes.

Anaheim concluded that the Variable Portfolio, which replaces IPP generation after 2027 with variable-energy resources, performed the best under base case assumptions, as well as under stress testing.[20] The portfolio had the lowest power supply costs and presented the least amount of regulatory risk and the greatest resource diversity.[21] The unpredictability of variable-energy resources output resources increases exposure to market price spikes and requires additional capacity purchases to meet resource adequacy requirements. However, the large amount of baseload resources under fixed price contracts helped mitigate market price risk. An analysis of the system-wide capacity market indicated that capacity purchases would be substantially lower than the cost of building new peaking power plants or utility-scale energy storage projects.

The following discusses how the portfolios performed with respect to portfolio diversification, portfolio costs, and market risk. Meeting planning requirements for GHG reduction, renewables, peak hour demand, resource adequacy (or reliability), and others are discussed in later sections.

Portfolio Diversification

Anaheim's current resources are primarily baseload facilities. With the expiration of the IPP contract in 2027, Anaheim is looking primarily at renewable additions as replacement power. This will allow Anaheim to meet RPS requirements and the GHG emission reduction targets established by CARB.[22]

The estimated portfolio diversification for each of the scenarios Anaheim examined to meet future needs in 2030 is:

- Variable Portfolio: 68 percent baseload and 32 percent intermittent resources, with 31 percent renewable generation from intermittent resources
- Mixed Portfolio: 81 percent baseload and 19 percent intermittent resources, with 8 percent renewable generation from intermittent resources

20 Anaheim conducted additional analysis of the candidate portfolios using stress tests to examine performance under extreme market and load changes, including expected costs, carbon prices, solar growth, market risks, resource adequacy, and portfolio diversification.

21 Anaheim determined that a preferred portfolio should have enough flexibility to absorb additional renewables beyond the 50 percent and should be sufficiently diversified to avoid technological risk where one technology becomes obsolete or less cost-effective.

22 PUC section 9621(b)(1) requires CARB, in coordination with the Energy Commission and the California Public Utilities Commission, to establish GHG emissions reduction targets for the electricity sector and each local publicly owned utility that reflect the electricity sector's percentage in achieving the economy wide GHG emissions reductions of 40 percent from 1990 levels by 2030.

- Baseload Portfolio: 85 percent baseload and 15 percent intermittent, with 1 percent renewable generation from intermittent resources

Anaheim concluded that the Variable Portfolio is the preferred portfolio, since the highest level of diversity increases the flexibility, reliability, and performance of generation resources, while also reducing costs.

Anaheim Portfolio Costs

The estimated cost for the Variable Portfolio is $3.2 billion from 2019 through 2030. The Mixed Portfolio costs an additional $15.1 million above the Variable Portfolio, with the Baseload Portfolio costing an additional $17.4 million above the Variable Portfolio. These differences represent approximately 0.5 percent of the total portfolio costs. The total annual power supply costs for each portfolio are similar until 2027, when the cost difference grows rapidly as new contracts come on-line. The annual costs for the Variable Portfolio remain lower than the other two portfolios in the later years.

Market Risks

Anaheim estimated financial exposure for the portfolios by determining the percentage of wholesale energy purchases compared to system load, as well as the cost impact of these purchases. The market purchase percentages from 2019 to 2030 for the Variable, Mixed and Baseload Portfolios were very close at 41.21 percent, 41.20 percent, and 41.27 percent, respectively. However, by 2030, the Baseload Portfolio requires an additional $139,000 annually in energy purchases compared to the Variable Portfolio, and the Mixed Portfolio requires an additional $1.2 million in annual wholesale energy purchases. Anaheim concluded that the Variable Portfolio had the least amount of risk due to the lower amount of energy purchases required.

Greenhouse Gas Emission Reduction Targets

POUs are required to meet the GHG targets established by the CARB, in coordination with the Energy Commission and California Public Utilities Commission.[23] These GHG targets reflect the electricity sector's percentage in achieving the economy-wide GHG emission reductions of 40 percent from 1990 levels by 2030. Energy Commission staff reviewed the GHG emissions associated with Anaheim's portfolio of resources in 2030, as identified in their IRP and standardized reporting tables. Staff also independently assessed the emission factors associated with various resources in Anaheim's portfolio to ensure they are consistent when compared with other data and information available to staff.

Based on this review staff finds that Anaheim plans to achieve the GHG emission target range established by CARB of 0.305 to 0.538 million metric tons of carbon dioxide equivalent (MMT CO_2e). Anaheim's resource portfolio results in roughly 0.505 MMT

23 Public Utilities Code Section 9621(b)(1).

CO_2e, which is at the high end of the GHG target range, which is consistent with the requirement of PUC section 9621(b)(1). Anaheim estimated their emissions for each plant by multiplying a plant, or spot market, specific emission intensity by the total generation from each plant and the spot market for the planning horizon. Table 3 shows GHG emissions for Anaheim's portfolio of resources in 2019, 2025, and 2030. Appendix A includes a table identifying the emission intensities and total emissions for individual resources for all years; see Table A-3.

Table 3: Greenhouse Gas Emissions from Anaheim's Resources Portfolio

	Fuel Type	GHG Intensity (MT CO_2e/MWh)	Total Emissions (MMT CO_2e)		
			2019	2025	2030
Anaheim CT	natural gas	0.555	0.025	0.004	0.000
Magnolia Power Project	natural gas	0.388	0.276	0.247	0.276
Canyon Power Project	natural gas	0.555	0.061	0.057	0.045
Intermountain 1	coal	0.916	0.548	0.525	0.000
Intermountain 2	coal	0.916	0.497	0.479	0.000
Spot market purchases	system	0.428	0.107	0.142	0.437
Spot market sales	system	0.428	(0.234)	(0.209)	(0.254)
Total Portfolio emissions	**NA**	**NA**	**1.280**	**1.245**	**0.505**

Source: California Energy Commission, Energy Assessments Division, Based on Anaheim 2018 IRP Filing

Renewable Portfolio Standard Planning Requirements

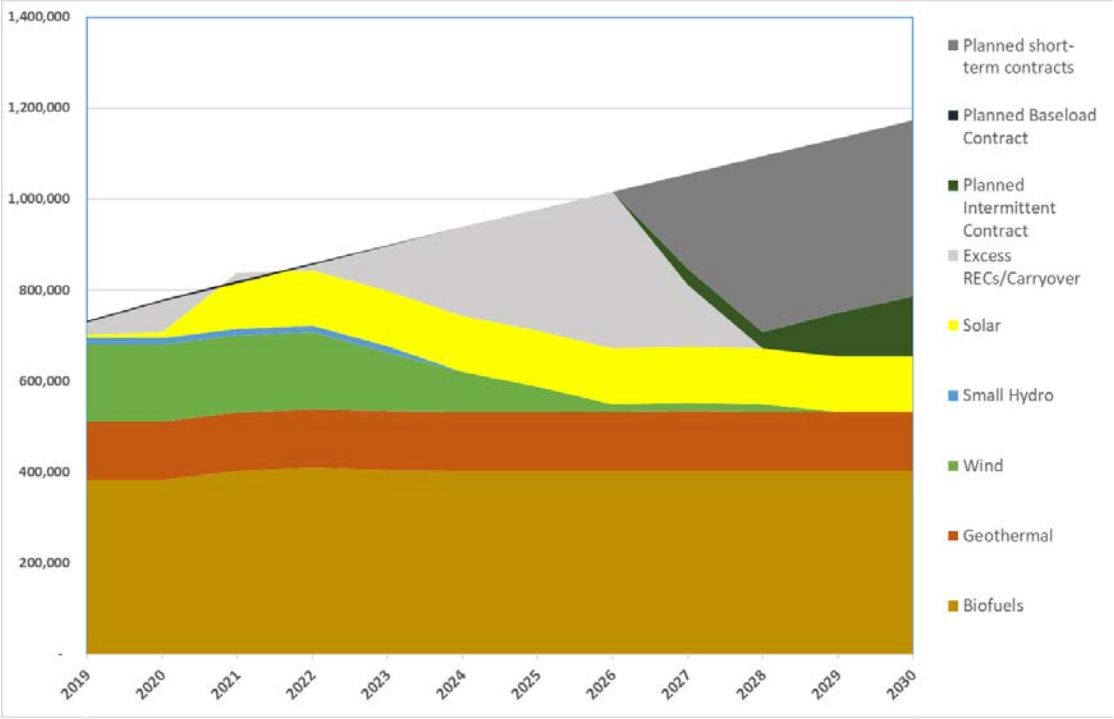
PUC section 9621(b)(2) requires that POU IRPs ensure procurement of at least 50 percent renewable portfolio standard by 2030 consistent with Article 16 (commencing with section 399.11) of Chapter 2.3. Energy Commission staff reviewed the renewable procurement standardized reporting table, the discussion in the IRP Filing, and the renewable procurement plan submitted by Anaheim. Energy Commission staff finds that Anaheim plans to meet the RPS procurement requirements and all interim compliance periods, and is consistent with requirements of PUC section 9621(b)(2).

Meeting the 50 percent RPS target requires that Anaheim procure an annual average of 1,133 GWh of renewable energy from 2018 to 2030. Anaheim's resource portfolio meets the 2030, as well as the interim, renewable energy procurement requirements. Figure 3 shows, over the planning horizon, roughly half of Anaheim's renewable resources are baseload (biofuels and geothermal). Solar resources remain relatively constant beginning in 2021, while wind resources start decreasing in 2023 and are non-existent by 2030. Anaheim expects to move into 2019 with a strong excess balance, which they will use through 2028, only adding to it in 2021.[24] Once they deplete their excess balance in

24 Excess Balance is defined in the *POU IRP Guidelines,* Appendix A, pg. A-1, as "any amount of RPS eligible RECs that a utility holds at the end of a compliance period that may be used to meet their compliance

2028, Anaheim will increasingly rely on short-term contracts for renewables beginning in 2027. Anaheim's Renewable Procurement Table (RPT), part of the standardized tables of the IRP Filing, includes forecasted retail sales and RPS procurement targets.

Figure 3: Sources of Renewable Portfolio Standard Eligible Energy 2019 — 2030 (MWh)



Source: California Energy Commission, Energy Assessments Division, based on Anaheim 2018 IRP Filing

Anaheim reported in the standardized tables procuring enough RPS eligible resources from either existing contracts or planned baseload and intermittent resources to meet or exceed their targets in Compliance Periods 3-6, including 50 percent renewable by 2030, when combined with excess balances from previous compliance periods.[25]

Anaheim's procurement of renewables in Compliance Periods 1-2 was greater than their RPS targets, allowing Anaheim to procure less than their targets in Compliance Periods 4 and 5 and still retire enough renewable energy credits (RECs) to remain in compliance with the RPS. For Compliance Period 6, Anaheim forecasts they will procure enough renewable resources, through a combination of procurement from existing contracts and new contracts for electricity products classified as portfolio content categories 1 or

obligation in the next compliance period. Excess Balance can include excess procurement, historic carryover, or purchased RECs that have not been retired."

25 Public Utilities Code section 399.30 (b) established the following RPS Compliance Periods: (1) January 1, 2011, to December 31, 2013. (2) January 1, 2014, to December 31, 2016 (3) January 1, 2017, to December 31, 2020. (4) January 1, 2021, to December 31, 2024. (5) January 1, 2025, to December 31, 2027. (6) January 1, 2028, to December 31, 2030.

2 to meet their target without relying on procurement from previous compliance periods.[26]

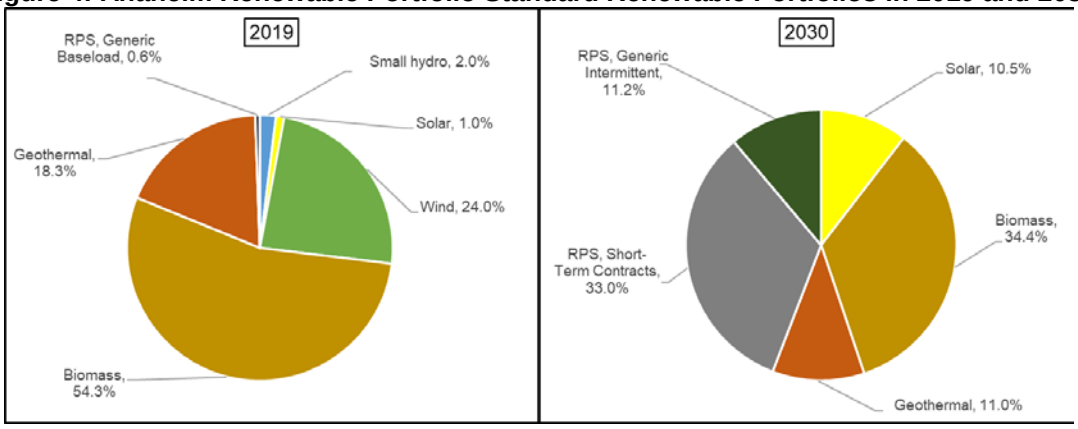
Anaheim's forecasted procurement and REC retirement also demonstrates expected compliance with the portfolio balance requirement, as they forecasted procurement of Category 3 RECs is below the maximum of 10 percent in Compliance Period 3-6, and their future procurement Category 1 RECs is above the minimum of 75 percent in Compliance Periods 3-6. Additionally, Anaheim's reported renewables meet or exceed the 65 percent long-term contracting requirement in Compliance Periods 4-6.

Anaheim expects to meet roughly 55 percent of their renewable energy need in 2030 with existing resources. These include

- Bowerman Power and Brea Power, landfill-gas facilities that jointly provide almost one-third of the needed renewable energy in 2030
- Ormat Heber II and Thermo No. 1, geothermal facilities that jointly provide more than 10 percent of the renewable energy need
- Desert Harvest II, a solar PV facility expected on-line in 2020, that will provide more than 10 percent of renewable energy need in 2030
- Three wind contracts that currently provide 22 percent of Anaheim's renewable energy will expire prior to 2030

Anaheim expects to meet much of the remainder of their renewable energy needs in 2030 with longer-term contracts with variable-energy resources and short-term contracts. Figure 4 shows the resource mix of Anaheim's renewable portfolio in 2019 and 2030.

Figure 4: Anaheim Renewable Portfolio Standard Renewable Portfolios in 2019 and 2030



Source: California Energy Commission, Energy Assessments Division, based on Anaheim Public Utilities 2018 Integrated Resource Plan Filing

26 The portfolio content categories are defined for POUs in the *Enforcement Procedures for the Renewables Portfolio Standard for Local Publicly Owned Electric Utilities*, section 3203

Three existing wind contracts that currently provide 24 percent of Anaheim's RPS energy needs will expire during 2023 to 2028. During 2023 — 2026, Anaheim plans to rely on their excess balances from previous compliance periods to meet a share of their requirements, with use of these reaching 25 percent of the total procurement requirement in the 2025 to 2027 compliance period. In the compliance period from 2028 to 2030, short-term contracts meet roughly a third of the energy needed to satisfy the RPS.

The Renewable Resource Procurement Plan, incorporated within Anaheim's IRP, shows renewable resources that reach each of their compliance period requirements, including the procurement target, the long-term contracting requirement, and the portfolio balance requirement.[27] Anaheim achieves these requirements through a continuation of many of their existing long-term agreements, and the addition of a number of long-term Category 1 resources during Compliance Periods 3-6.

Retail Rates

PUC section 9621(b)(3) requires POUs to develop IRPs that enhance each POU's ability to fulfill their obligation to serve their customers at just and reasonable rates and minimize impacts in ratepayer bills. Staff reviewed the analysis and information Anaheim presented in their IRP Filing on the rate and bill impacts from different resource portfolios they evaluated. Staff finds that in identifying their future resources, Anaheim plans to acquire resources that are cost-effective and minimize rate and bill impacts, while still meeting their compliance obligations for increased renewables and lower GHG emissions consistent with PUC section 9621(b)(3), as discussed below.

Anaheim notes that by divesting their coal assets and utilizing their peaking resources to integrate more renewable purchases, they have maintained affordable rates in recent years. Anaheim expects their resource portfolio to help maintain affordable rates over the planning horizon, with net annual power supply costs expected to increase by an average of 1.34 percent, which is less than expected inflation.

Under the Anaheim City Charter, Anaheim is required to base electric rates on the cost of service for each customer class. This is similar to rate requirements for most POUs. Anaheim designs their rate schedules to maintain simplicity and send appropriate price signals, offering several base rates and optional rates that customers may choose to use. Since Anaheim is fully resourced to meet local demand, they have attempted to leverage existing resources and minimize customer impacts in selecting an optimum resource portfolio.

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27 Eligibility requirements and process for certifying renewable resources for the RPS, along with the process to verify compliance, and are described in more detail in: Green, Lynette, Christina Crume. 2017. *Renewables Portfolio Standard Eligibility Guidebook*, Ninth Edition (Revised). California Energy Commission, Publication Number: CEC-300-2016-006-ED9-CMFREV.

Anaheim analyzed rate impacts under high, medium, and low load growth scenarios. Anaheim performs financial modeling to monitor and forecast their financial performance and identify necessary rate adjustments. For the IRP, Anaheim overlaid the load scenarios on the existing forecasts of capital, O&M, debt service, and other cost of service requirements to identify a bandwidth of potential rate impacts. The results of the study show that the high consumption scenario results in lower average rate increases, approximately $0.04 per kWh increase in 2030 from the $0.16 per kWh system-wide average rate in 2018, compared with the other scenarios (expected consumption scenario rate increase of $0.05 per kWh and the low consumption scenario rate increase of approximately $0.07 per kWh). The increased consumption allows Anaheim to spread system wide costs over a larger quantity of energy sales. Similarly, the low consumption case results in higher average rates due to the smaller quantity of energy sales, but similar system costs.

The monthly bills for residential customers is expected to increase by approximately 21 percent, and commercial customers to increase by approximately 27 percent from 2018 to 2030. For both residential and commercial customers the difference between the high consumption scenario and the low consumption scenario is approximately 10 percent in 2030.

System and Local Reliability

SB 350 requires filing POUs to adopt an IRP that ensures system and local reliability and addresses resource adequacy requirements.[28] Energy Commission staff reviewed the IRP and the capacity reporting table and discussion in the IRP filing and finds that Anaheim has planned for sufficient resources to maintain a reliable electric system over the planning horizon. Anaheim's selected portfolio of resources contains sufficient capacity to meet anticipated resource adequacy requirements in 2030. The staff finds that the IRP is consistent with the reliability requirements in PUC section 9621(b)(3) and resource adequacy requirements in PUC section 9621(d)(1)(E).

As a distribution utility operating under the California Independent System Operator (California ISO), Anaheim is required to provide certain levels and types of resource adequacy capacity based on their forecasted peak load and the profile of resources used to meet customer load. These include system capacity, local capacity, and flexible capacity. Anaheim turned over operational control of their contracted transmission resources to the California ISO in 2006. As such, the California ISO, not Anaheim, is responsible for evaluating the regional short-term and long-term infrastructure needs for reliability during their annual Transmission Planning Process.

28 Public Utilities Code section 9621(b)(3).

System Reliability

To ensure system reliability, Anaheim plans for a 15 percent reserve margin. This is consistent with the resource adequacy requirement imposed on the utility by the California ISO, and results in a projected capacity need of 632 MW in 2030, down slightly from 636 MW in 2019. The 2019 portfolio contains 711 MW of capacity, roughly 80 MW more than is needed. The shortfall in 2027 to 2030 resulting from the divestiture of the IPP coal plant (236 MW) and retirement of Anaheim CTG (43 MW) is filled with short-term capacity purchases of 216 to 226 MW.

Local Capacity Needs

Anaheim's service territory lies in the California ISO-defined Los Angeles Basin Local Reliability Area. The utility estimates a California ISO-imposed local capacity requirement of 230 MW throughout the planning horizon. This need is largely met with four resources: Canyon Power Plant (natural gas, 195 MW), Anaheim CTG (natural gas, 43 MW), the Bowerman Power Facility (landfill gas, 20 MW), and Brea Power II (landfill gas, 27 MW), totaling 285 MW of capacity.[29]

Anaheim may retire the Anaheim CTG as early as mid-2025; the decision to do so will be based on a number of factors, such as the price of energy and capacity from other sources needed to maintain reliability, variable energy resource integration costs, as well as cost impacts on retail customers. Even with the retirement of Anaheim CTG, local capacity in Anaheim's facility will exceed its local capacity requirements with 242 MW of capacity.

Flexible Capacity Needs

Anaheim has an estimated flexible capacity need of 78 MW from 2019 to 2026, increasing gradually to 93 MW in 2030.[30] This increase is due to the planned addition of a contract with an intermittent renewable resource in 2027, which will provide 15 MW of peak capacity in 2030, but increase flexible capacity needs by an equivalent amount. Anaheim has a surplus of flexible capacity throughout the planning period, with Canyon Power Plant providing 195 MW of flexible capacity.

Transmission and Distribution Systems

PUC section 9621(b)(3) also requires filing POUs to adopt an IRP that ensures that the POU achieves the goal of strengthening the diversity, sustainability, and resilience of the bulk transmission and distribution systems, and local communities. Energy Commission

29 The capacity values for the Bowerman and Brea Power facilities are those reported in the IRP and differ slightly from the 2018 and 2019 Net Qualifying Capacity values used by the California ISO. The differences are not significant, however, and do not change the conclusion that Anaheim has a surplus of capacity with which to meet local capacity requirements

30 Anaheim's peak flexible capacity need, which occurs in December. The average flexible capacity need is 40 MW

staff reviewed data and information presented in Anaheim's IRP Filing to ensure they adequately plan to maintain and enhance their transmission and distribution systems. Staff finds Anaheim has planned for enough transmission contracts to adequately deliver resources to their service area to meet the requirement as discussed below. Staff also finds that Anaheim conducts adequate planning to address the adequacy of their distribution system. As such, staff finds the IRP is consistent with the transmission and distribution requirements set forth above.

Transmission System

Anaheim has several transmission contracts through SCPPA and the Los Angeles Department of Water and Power (LADWP) to ensure delivery of owned or contracted energy from outside the California ISO balancing authority area. As mentioned in System and Local Reliability on page 20 — 21, the California ISO operates Anaheim's transmission resources and is responsible for ensuring bulk transmission system reliability. Anaheim has the following transmission resources:

- A contract with SCPPA for a 150-MW share of the Mead Adelanto Transmission Project, a 500 kV AC line that brings power from the Marketplace Substation near Boulder City, Nevada to the Adelanto Substation near Victorville, California.
- A contract with SCPPA for a 155-MW share of the Mead-Phoenix Transmission Project, a 500 kV AC line that delivers power from the Westwing Substation near Phoenix, Arizona, that connects to Mead Substation near Boulder City, Nevada and terminates at the nearby Marketplace Substation.
- A contract with LADWP for a 257-MW share of the Northern Transmission System that extends from IPP near Delta, Utah to the Adelanto Substation.
- A firm bi-direction transmission service contract with LADWP for a 110-MW share of transmission between the Adelanto and Victorville Substations and the midpoint of the Lugo/Victor 500 kV line.

Distribution System

Anaheim's efforts to ensure the adequacy of their distribution system, including emergency planning, regular maintenance, regular system evaluations, and ongoing upgrades and expansions, as discussed below, are consistent with the requirement of PUC section 9621(b)(3). Anaheim's distribution system consists of a 69 kV radial network serving eleven 69/12 kV distribution substations and 110 distribution circuits, to transform and distribute power to homes and businesses. Anaheim's IRP states that there are emergency procedures and redundancy built into the system to address contingency events such as a catastrophic failure of a substation. The utility has installed a number of remotely controlled field switches to improve outage restoration times and replace old direct-buried cable with cable encased in conduit. Anaheim has also implemented Smart Grid automation control systems, including advanced sensors and relays that can identify and resolve momentary outages, minimizing impacts to customers and the system.

Anaheim evaluates their distribution system on an annual basis to ensure they can meet peak demand over a 5-year planning horizon, as well as to maintain and improve their reliability performance under normal and emergency conditions. The following recent projects include:

- A new Harbor Substation, expected to be on-line in 2019, to add needed transformer capacity to serve new and planned hotels and residential/commercial construction in the fast growing Platinum Triangle and Anaheim Resort areas.
- A new 69/12 kV transformer, expected to be on-line in 2019, to accommodate new industrial and commercial load in Eastern Anaheim area.
- Upgrading the 12 kV switchgears to higher ampacity rating at a substation to serve load growth in the east end of the City.[31]
- A new Vermont 220/69 kV Substation to improve system reliability. It acts as a back-up source for Anaheim load in the event of the loss of the Lewis 69 kV Substation.

Anaheim continues to monitor potential impacts on their distribution system from distributed generation and EV charging stations to make the infrastructure investments needed to maintain reliability and resilience of their system. Anaheim has not experienced, nor do they expect, any significant distribution system impacts from EV charging since charging stations are not concentrated in one area. To prevent any significant distributions due to EV charging, Anaheim monitors commercial customer plans to install charging stations, and plans to upgrade the local transformers when multiple charging stations are expected in a concentrated area.

Disadvantaged Communities and Localized Air Pollutants

PUC section 9621(b)(3) requires POUs to minimize localized air pollutants and GHG emissions with early priority on disadvantaged communities. Energy Commission staff reviewed information presented in Anaheim's IRP Filing to determine the extent to which they are minimizing local air pollutants with a priority on disadvantaged communities. Staff finds that Anaheim has made efforts to address these issues in selecting the resources they plan to include in their portfolio consistent with the requirement set forth above.

The natural gas-fired Canyon and Anaheim CTG facilities, totaling 238 MW (more than one-third of their generating capacity), are located within the City of Anaheim. However, Anaheim uses these plants to meet resource adequacy requirements and provide reliability services, including black-start capability (see System and Local Reliability**.** The

31 Ampacity is the maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

utility's preferred portfolio retires Anaheim CTG in 2025 and projects generation at Canyon over 2027 — 2030 at levels 30 percent below their 2014 — 2017 values and almost 50 percent below their 2017 output.

Anaheim has incorporated programs that assist disadvantaged communities as defined in SB 535 (De León, Chapter 830, Statutes of 2012) and the most current version of California Environmental Protection Agency California Communities Environmental Health Screening Tool, also referred to as CalEnviroScreen. Anaheim's programs serve expanded disadvantaged communities, which include low-income areas defined by the Department of Housing and Urban Development as Community Development Block Grant areas. Anaheim helps low income customers use energy efficiently to reduce bills and has historically provided discounts to income-qualified seniors, military veterans, and disabled customers.

Anaheim intends to improve local air quality and support sustainability goals by promoting transportation electrification through electric vehicle (EV) time-of-use rates, rebate incentives for public access and private use charging stations, and electrification of Anaheim's field service vehicles. These programs are discussed in Transportation Electrification on page 28.

To ensure that energy efficiency, transportation electrification, and renewable energy are accessible to low income and disadvantaged communities (LI-DAC), Anaheim offers program incentives and works closely with other city departments. Examples of programs and marketing efforts include:

- Rebates for schools and project developers to install enhanced energy efficiency and publicly accessible EV charging stations located at schools and affordable housing developments.
- Grant opportunities to support EV charging stations and shade trees for qualified commercial, industrial, and residential projects, as well as multi-family developments in LI-DAC areas near freeways.
- LED street lights and partnerships with Southern California Gas Company to offer no-cost weatherization services frequently located within LI-DAC areas.
- EV charging stations at park sites in LI-DAC areas through grant funding opportunities.
- Consumer education and community outreach efforts for energy efficiency, renewables resource, and income-qualified programs.

Anaheim's data analytics show that a majority of the customers who participate in the energy efficiency program, Home Utility Checkup Program, are within LI-DAC areas. Anaheim enhances their weatherization program by providing eligible customers for the Home Utility Checkup Program with free weatherization installations. Residential solar rebates are evenly distributed throughout Anaheim's territory, including LI-DAC areas. This is likely attributable to the higher, income-qualified solar rebates. Finally, eight of the nine Solar for Schools sites are located in LI-DAC areas.

Net Energy Demand in Peak Hours

PUC section 9621(c) requires POUs to consider existing renewable generation portfolio, grid operation efficiency, energy storage, distributed energy resources, and energy reduction measures (such as energy efficiency and demand response) in an effort to reduce the need for new or additional gas-fired generation, distribution and transmission resources. Anaheim's IRP includes a discussion of how they consider preferred resources can contribute to meeting peak demand when selecting resources for its portfolio. This is consistent with the requirement that filing POUs address how they can meet peak hour demand with renewable and other preferred resources.

Anaheim's resource plan includes over 80 MW of peak capacity from utility owned and contracted renewable generation, and an additional peak demand reduction of 19 MW from behind the meter solar. At certain times of the year, Anaheim can serve peak system demand with higher percentages of renewable energy. For example, in April 2017, IPP underwent scheduled maintenance and Anaheim made up the reduction in generating capacity with energy from two firmed and shaped renewable contracts, supplemented by wind and hydro. On April 16, 2017, Anaheim served a system peak of 246 MW with 195 MW of renewables, or about 80 percent of their peak load for that day.

However, Anaheim faces challenges meeting peak needs with renewables during other times of the year, generally due to the higher peak demand, renewable resource availability, and California ISO dispatch signals. On September 1, 2017, the peak day for the year, about 60 MW or 11 percent of the total peak hour load of 562 MW was available to meet demand. During the peak hour, extreme heat caused the derating of landfill and geothermal units, small hydro was operating at 60 percent of the April output, and there was near-zero wind output. In addition, the California ISO dispatched Anaheim's fossil units to meet not only Anaheim's peak, but also the system demand of other California load serving entities.

Anaheim states that they take into consideration how renewable and other zero emission resources can meet peak demand. In particular, they consider the location and generation profile of the new renewable projects to select resources most aligned with Anaheim's demand profile.

Additional Procurement Goals

PUC section 9621(d)(1) requires filing POUs to address procurement of energy efficiency and demand response, energy storage, transportation electrification, and a diversified portfolio, which are discussed below. The resource adequacy provisions of this code section are discussed in system reliability section on pages 20-22.

Energy Efficiency and Demand Response Resources

Staff finds that Anaheim's IRP is consistent with the requirement in PUC section 9621(d)(1)(A), as they include a discussion of energy efficiency and demand response programs they plan to implement and quantifies the amount of energy efficiency

savings they plans to achieve. The demand forecast relied on in the IRP incorporates energy efficiency. Anaheim shows reductions of 283 GWh by 2029. From 2018 — 2025 Anaheim energy efficiency estimated savings fall below their targets, while 2026 — 2029 their estimates are above their targets. Table 4 shows Anaheim's estimated additional achievable energy efficiency values compared to their targets under SB 350.

Table 4: Anaheim Additional Achievable Energy Efficiency Estimates (GWh)

	AAEE (GWh)	SB 350 targets (GWh)
2018	28	92
2019	56	108
2020	83	124
2021	109	140
2022	134	157
2023	159	174
2024	182	190
2025	204	206
2026	225	221
2027	244	235
2028	264	248
2029	283	260
2030	303	

Source: Anaheim IPR Filing Supplementation Information received on September 9, 2018

By 2030, Anaheim's IRP includes 303 GWh of cumulative energy efficiency savings, including additional achievable energy efficiency savings. Anaheim's IRP states that they intends to leverage internal and external resources to meet energy efficiency targets through continuation of existing programs, recognition of challenges, and the development of new programs.

Residential energy efficiency programs include: incentives for air conditioning tune ups, an on-line home utility check-up program that provides up to 5 LEDs, home utility check-up audits, rebates for high efficiency appliances and measures, a refrigerator recycling program, a holiday light exchange, and several education and outreach programs. Of the efficiency savings achieved from these programs in fiscal year 2016 — 2017, 64 percent were from LED lighting.

Programs for commercial customers include incentives for high efficiency equipment, energy audits, rebates for stocking and selling high efficiency equipment, incentives for high efficiency heat pumps, lighting incentives, a small business energy management assistance program, small/medium business audits, an air compressor audit program, and incentives for new construction that exceeds the Energy Commission's Building Efficiency Standards. Similar to the residential savings, about 60 percent of the commercial efficiency savings achieved in fiscal year 2016 — 2017 came from lighting incentives.

Anaheim recognizes that the unit costs of implementing energy efficiency programs will decline with increases in scale, but at some point, the unit costs for first year savings will increase due to diminishing returns.[32] To meet SB 350 energy efficiency doubling targets cost-effectively, Anaheim states they must identify programs and technologies not impacted by this phenomenon. Anaheim is pursuing research and investment in new and emerging energy efficiency technologies, such as lighting, HVAC, and plug loads. Anaheim is looking to enhance existing programs and expand customer participation in multi-family developments, commercial, industrial and institutional upgrades, new construction projects, and residential and business customer equipment rebates.

Anaheim offers a Voluntary Load Reduction Program for large commercial, industrial, and institutional customers who can curtail a minimum 200 kW of their load within 30 minutes of notification of a California ISO Stage 3 Alert or a transmission system emergency.[33] Currently, Anaheim has 10.5 MW of load in this voluntary load reduction program. The program does not provide financial incentives for curtailing load, so the benefit to the customers is eliminating the risk of unplanned system outages. Anaheim also has a one-year pilot residential demand response program, the myPower Savings Program, in which Anaheim sends high price or potential system emergency signals to customers to influence behavioral responses. However, Anaheim characterizes the expected peak and load impact from the pilot program as negligible. Phase 2 of the myPower Savings Program from July 2018 through June 2019 will expand the program City-wide.

Staff observes that the Energy Commission set a SB 350 energy efficiency doubling target for Anaheim at 260 GWh of cumulative savings in 2030 (or 0.80 percent of retail electric sales), which is a fairly small amount.[34] A significant effort will be necessary for the state to achieve the energy efficiency savings to meet the SB 350 doubling targets.

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32 First year savings represent energy and demand savings achieved by a set of energy efficiency programs or measures in the first year of measure implementation. Assumptions do not include the additional savings the measure will produce over the life of the equipment or measure.

33 California ISO calls a Stage 3 Alert when statewide operating reserves for electric generation fall below three percent, to help mitigate or avoid system outages.

34 Cumulative savings are the savings that accrue in each year over the life of an energy efficiency measure or program.

The Energy Commission plans to address progress in meeting these doubling targets utilities and other energy efficiency deliverers as part of the *2019 IEPR*.

Energy Storage

Staff finds that Anaheim's IRP is consistent with the requirement in PUC section 9621(d)(1)(B) to address procurement of energy storage as they discussed the potential role of energy storage on their system. Anaheim currently has a storage procurement target of up to 11 MW of energy storage by the end of 2026, subject to the Anaheim City Council authorization of future capital expenditures.[35] Anaheim's pilot energy storage project (1 MW) at the Harbor substation is scheduled for completion by the end of 2021. Depending on the results of the pilot and future storage technology availability and costs, Anaheim's target may include an additional 10 MW at the Canyon Power Plant by the end of 2026.

As Anaheim currently has very little solar in their portfolio and a surplus of flexible capacity, they do not need energy storage to meet ramping needs. They are looking at storage, particularly lithium-ion technology, primarily as a potentially cost-effective means of self-providing ancillary services, noting that the costs of regulation and spinning reserves in the California ISO market increased significantly between 2014 and 2016. The utility acknowledges that, as the IPP coal contract expires in 2027 and as they diversify their mostly-baseload renewable portfolio to include wind and solar resources, they may consider energy storage as a tool for balancing their system, especially if technological breakthroughs make it a viable and cost effective replacement.

Transportation Electrification

Staff finds that Anaheim's IRP is consistent with the requirement of PUC section 9621(d)(1)(C), in that they address transportation electrification, primarily for light-duty vehicles. Anaheim includes qualitative descriptions of their customer programs and efforts to align with state transportation electrification policy initiatives. Anaheim has a number of programs to encourage the use of electric vehicles (EVs), including EV charger rebates, increased access to public EV charging, and time of use rates for EV charging. By the end of 2017, Anaheim installed 69 EV charging stations, 70 percent of which are open to the public. By 2030, Anaheim estimates 16,280 electric vehicles in their service territory will increase load for charging by 63,000 MWh, and increase GHG emissions by 17,000 $MTCO_2e$. The number of vehicles is consistent with Anaheim maintaining their current share of statewide light duty EVs as the total number of such vehicles reaches 1.5 million in 2025.

Energy Commission staff observes that 63,000 MWh of incremental load, which includes both the retail sales and transmission losses, will require the procurement of roughly

35 Assembly Bill 2514 (Skinner, Chapter 469, Statutes of 2010) requires POUs to establish storage targets, if determined appropriate, and reevaluate storage target determinations at least every three years.

28,500 MWh of renewable energy to meet an RPS of 50 percent of retail sales. The remaining 34,500 MWh of energy needed to meet their net energy for load, if assigned the emissions intensity of spot market power (0.428 $MTCO_2e$/MWh), would yield 14,900 $MTCO_2e$.[36] Anaheim also estimates GHG emissions reductions of 28,675 MTCO2e from gasoline vehicles displaced by light-duty EVs, by 2030. Anaheim currently has time-of-use EV charging rates for residential customers and plans to implement commercial time of use EV charging rates. Anaheim also provides rebates for residential, commercial, and industrial customers who purchase EV charging stations. A customer survey that Anaheim conducted for the IRP indicates EV charging station rebates will make customers more likely to purchase an EV. The IRP Customer Survey finds that 6 percent of customers currently own EVs and 14 percent of customers anticipate acquiring an EV in the next 3 years. Over half of these prospective EV purchasers are renters. Furthermore, based on survey results, renters are more supportive of renewables initiatives than compared to homeowners. This survey highlights the importance of programs that increase the availability of public charging and offer incentives for customers.

Anaheim includes descriptions of customers' positive responses to incentive programs thus far, supporting the continued provision of charging rebates and expansion to additional sectors. Anaheim also highlights particular efforts targeted at harder to reach customers, including renters, multi-unit dwelling occupants, and residents of disadvantaged communities. Prior funding opportunities from public and private investment drove the development of much of the existing infrastructure developed in the city of Anaheim, and, in some cases, the need to repower outdated charging equipment.

Anaheim plans to expand the EV charging station rebate programs for disadvantaged and low-income communities, as well as K-12 schools. The rebates are generally from $5,000 to $10,000 per charging station. Anaheim funds these programs through Low Carbon Fuel Standard credits, GHG emission allowance programs, and Anaheim's public benefits funds. Outreach shows that customers generally support these programs.[37] Anaheim also plans to develop more public EV charging stations, and is currently developing a pilot program for public charging located in a disadvantaged community. The results of this pilot will inform the level of expansion of the program. Anaheim is also developing plans to construct a number of DC fast charging stations near their major freeway corridors.

In addition to light duty vehicles, Anaheim promotes EV use for medium and heavy-duty vehicles, as well as school buses and mass transit. Anaheim owns a hybrid electric

36 Anaheim's estimate of GHG emissions associated with incremental demand due to transportation does not affect its estimate of its total portfolio GHG emissions.

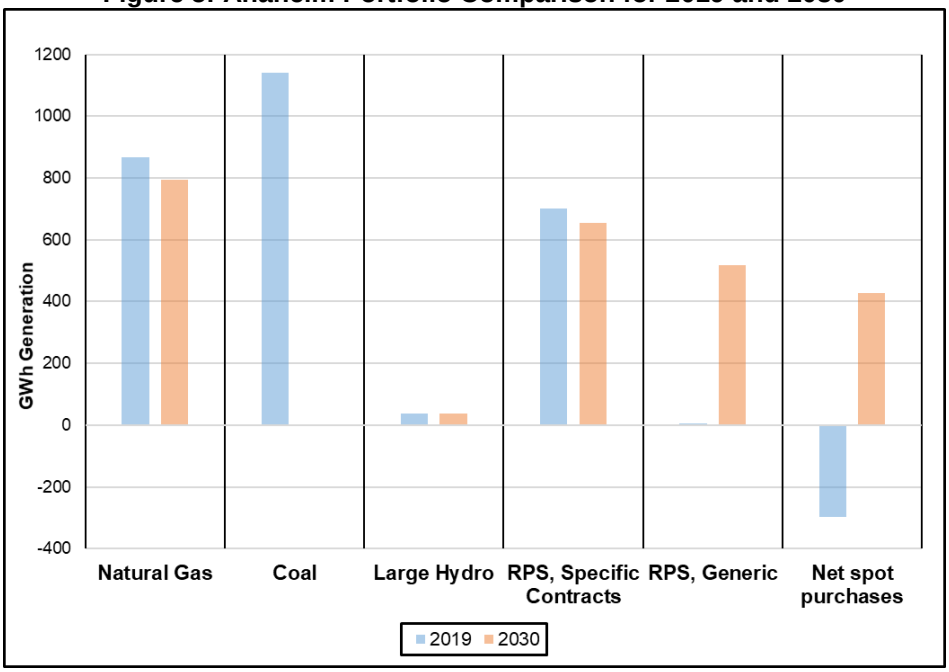
37 Outreach includes customer education events, surveys, phone interviews, and emails to customers.

bucket truck, which it purchased to gain experience working with heavy-duty low emission vehicles, and plans to continue to evaluate heavy-duty EVs. Anaheim is working with three school districts that received grants for electric school buses. Anaheim provides advice to the schools on charging infrastructure and energy management. Anaheim's IRP estimates that implementing transportation electrification resources could result in a small net reduction of GHG emissions over the planning horizon (11,690 MTCO2e in net reductions in 2030).[38]

Portfolio Diversification

PUC section 9621(d)(1)(D) requires that POUs address the procurement of a diversified portfolio of resources consisting of both short-term and long-term electricity, electricity related, and demand response products. Based on staff's review of Anaheim's existing resources, their portfolio analysis, and the selection of resource additions in their IRP staff concludes that Anaheim has fulfilled this requirement. Figure 5 shows a comparison of the energy mix by resource in Anaheim's preferred portfolio in 2019 and 2030.

Figure 5: Anaheim Portfolio Comparison for 2019 and 2030



Source: California Energy Commission, Energy Assessments Division, Based on Anaheim 2018 IRP Filing Energy Balance Table

In 2030, Anaheim becomes a net purchaser of energy from the spot market, though they plan to actively purchase and sell energy into the spot market to balance their supply

38 Net GHG emissions are the increase in GHG emissions from electric charging load, minus the decrease in GHG emissions from the displacement of gasoline vehicles by light-duty EVs. This measures GHG changes from both the transportation and electricity sectors.

and demand throughout the planning horizon. This mix of resources eliminates reliance on coal resources and increases the amount of renewable resources and short-term market purchases. As previously discussed, Anaheim concluded that the preferred portfolio has the highest level of diversity, which increases the flexibility, reliability, and performance of generation resources, while also reducing costs.

Appendix A

Table A-1: Energy Resources, All Years (MWh)

	7.3	Technology	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Net Energy for Load			**2,447,982**	**2,445,565**	**2,442,281**	**2,438,584**	**2,435,146**	**2,432,002**	**2,429,103**	**2,428,898**	**2,428,840**	**2,428,886**	**2,428,999**	**2,429,150**
Non-RPS Resources	Anaheim CT	natural gas	**45,553**	**41,881**	**38,136**	**38,771**	**36,547**	**36,120**	**6,472**	**0**	**0**	**0**	**0**	**0**
	Magnolia	natural gas	**711,068**	**712,339**	**636,945**	**711,023**	**710,637**	**714,687**	**637,768**	**709,633**	**710,895**	**713,515**	**636,917**	**712,426**
	Canyon	natural gas	**109,405**	**103,760**	**95,383**	**102,780**	**100,731**	**97,337**	**102,208**	**97,045**	**83,931**	**84,802**	**86,004**	**81,693**
	Hoover	large hydro	**38,204**	**38,347**	**38,219**	**38,281**	**38,238**	**38,367**	**38,243**	**38,276**	**38,333**	**38,447**	**38,339**	**38,339**
	Intermountain	coal	**598,365**	**526,564**	**573,710**	**541,113**	**557,498**	**526,150**	**573,557**	**531,381**	**248,398**	**0**	**0**	**0**
	Intermountain	coal	**542,978**	**552,315**	**526,879**	**567,358**	**511,401**	**553,848**	**523,020**	**559,897**	**203,548**	**0**	**0**	**0**
	Spot Purchases	N/A	**250,562**	**285,588**	**303,700**	**272,972**	**295,070**	**292,948**	**330,650**	**327,331**	**762,305**	**1,092,028**	**1,127,934**	**1,021,073**
	Spot Sales	N/A	**(547,830)**	**(522,487)**	**(605,188)**	**(674,491)**	**(609,193)**	**(566,370)**	**(487,603)**	**(503,414)**	**(531,214)**	**(592,253)**	**(590,144)**	**(593,601)**
RPS resources	Brea Power	biomethane	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**	**216,617**
	Bowerman	biomethane	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**	**159,677**
	Magnolia	biomethane	**0**	**0**	**20,047**	**26,729**	**26,729**	**26,729**	**26,729**	**26,729**	**26,729**	**26,729**	**26,729**	**26,729**
	ARP-Loyalton	biomass	**6,355**	**6,355**	**6,355**	**6,355**	**1,589**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	OrHeber 2	geothermal	**63,022**	**63,022**	**63,022**	**63,022**	**63,022**	**63,022**	**63,022**	**63,022**	**65,875**	**63,022**	**63,022**	**63,022**
	Thermo No. 1	geothermal	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**	**65,875**
	MWD hydro	small hydro	**13,770**	**13,770**	**13,770**	**13,770**	**13,770**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Anaheim CC	solar PV	**3,220**	**3,200**	**3,190**	**3,170**	**3,156**	**3,140**	**3,124**	**3,109**	**3,093**	**3,078**	**3,062**	**3,047**
	Desert Harvest	solar PV	**0**	**5,855**	**115,714**	**115,710**	**115,706**	**115,703**	**115,699**	**115,695**	**115,691**	**115,687**	**115,683**	**115,679**
	Westlands	solar PV	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**	**3,769**
	High Winds	wind	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**17,520**	**0**	**0**
	Pleasant Valley	wind	**71,352**	**71,352**	**71,352**	**71,352**	**71,352**	**71,352**	**38,729**	**0**	**0**	**0**	**0**	**0**
	San Gorgonio	wind	**80,110**	**80,110**	**80,110**	**80,110**	**40,055**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Planned Baseload	not reported	**3,942**	**3,942**	**3,942**	**3,942**	**1,971**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Planned Intermittent	not reported	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**35,676**	**35,827**	**95,136**	**130,812**
	Short-Term RPS	N/A	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**208,077**	**386,086**	**383,277**	**386,838**
Total Energy		N/A	**2,453,535**	**2,449,371**	**2,448,744**	**2,445,426**	**2,441,737**	**2,436,492**	**2,435,076**	**2,432,161**	**2,434,794**	**2,430,426**	**2,431,897**	**2,431,995**
Surplus/Shortfall		N/A	**5,553**	**3,806**	**6,463**	**6,843**	**6,591**	**4,490**	**5,973**	**3,263**	**5,955**	**1,540**	**2,899**	**2,845**

Table A-2: Capacity Resources, All years (MW)

		Technology	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peak Demand			553	553	552	551	551	550	549	549	549	549	549	549
Planning Reserve Margin			83	83	83	83	83	82	82	82	82	82	82	82
Peak Procurement Requirement			**636**	**635**	**635**	**634**	**633**	**632**	**632**	**632**	**632**	**632**	**632**	**632**
Non-RPS Resources	Anaheim CT	natural gas	43	43	43	43	43	43						
	Magnolia Power Project	natural gas	109	109	107	106	106	106	106	106	106	106	106	106
	Canyon Power Project	natural gas	195	195	195	195	195	195	195	195	195	195	195	195
	Hoover	large hydro	40	40	40	40	40	40	40	40	40	40	40	40
	Intermountain	coal	118	118	118	118	118	118	118	118	118			
	Intermountain	coal	118	118	118	118	118	118	118	118	118			
	Planned System Capacity Contract(s)	N/A									226	226	220	216
RPS resources	Brea Power	biomethane	27	27	27	27	27	27	27	27	27	27	27	27
	Bowerman Power	biomethane	20	20	20	20	20	20	20	20	20	20	20	20
	Magnolia Power Project	biomethane			2	3	3	3	3	3	3	3	3	3
	ARP-Loyalton Biomass	biomass	1	1	1	1								
	OrHeber 2 (Ormat)	geothermal	8	8	8	8	8	8	8	8	8	8	8	8
	Thermo No. 1	geothermal	11	11	11	11	11	11	11	11	11	11	11	11
	MWD hydro facilities	small hydro	10	10	10	10	10							
	Anaheim Convention Center	solar PV	0	0	0	0	0	0	0	0	0	0	0	0
	Desert Harvest II (EMF)	solar PV	0	9	9	9	9	9	9	9	9	9	9	9
	Westlands	solar PV	0	0	0	0	0	0	0	0	0	0	0	0
	High Winds (PPM)	wind	1	1	1	1	1	1	1	1	1	1		
	Pleasant Valley (PPM)	wind	3	3	3	3	3	3	3					
	San Gorgonio Wind Farm	wind	8	8	8	8	8							
	Planned Baseload Contract	not reported	0.5	0.5	0.5	0.5	0.5							
	Planned Intermittent Contract	not reported									4	4	11	15
Total Capacity Procured			**711**	**720**	**720**	**720**	**720**	**701**	**658**	**656**	**885**	**649**	**650**	**650**
Surplus/Shortfall			**75**	**85**	**86**	**86**	**86**	**69**	**26**	**24**	**253**	**17**	**18**	**18**

Table A-3: GHG Emissions from Anaheim's Resource Portfolio, All Years

	Fuel Type	GHG Intensity (MT CO_2e/ MWh)	Total Emissions (MMT CO_2e)											
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Anaheim CT	natural gas	0.555	0.025	0.023	0.021	0.022	0.020	0.020	0.004	0.000	0.000	0.000	0.000	0.000
Magnolia Power Project	natural gas	0.388	0.276	0.276	0.247	0.276	0.276	0.277	0.247	0.275	0.276	0.277	0.247	0.276
Canyon Power Project	natural gas	0.555	0.061	0.058	0.053	0.057	0.056	0.054	0.057	0.054	0.047	0.047	0.048	0.045
Intermountain 1	coal	0.916	0.548	0.482	0.526	0.496	0.511	0.482	0.525	0.487	0.228	0.000	0.000	0.000
Intermountain 2	coal	0.916	0.497	0.506	0.483	0.520	0.468	0.507	0.479	0.513	0.186	0.000	0.000	0.000
Spot market purchases	system	0.428	0.107	0.122	0.130	0.117	0.126	0.125	0.142	0.140	0.326	0.467	0.483	0.437
Spot market sales	system	0.428	(0.234)	(0.224)	(0.259)	(0.289)	(0.261)	(0.242)	(0.209)	(0.215)	(0.227)	(0.253)	(0.253)	(0.254)
Portfolio emissions	portfolio	NA	1.280	1.244	1.200	1.198	1.197	1.224	1.245	1.253	0.835	0.538	0.525	0.505