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City of Anaheim
PUBLIC UTILITIES DEPARTMENT

June 26, 2018

California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Docket: 18-IRP-01 Integrated Resource Plan

RE: Anaheim Public Utilities (APU) Integrated Resource Plan (IRP) Submittal

To Whom It May Concern:

The Anaheim City Council has approved the 2018 Integrated Resource Plan on May 15, 2018. APU now submits the following documents to the IRP docket:

1. Public Submittal
    - IRP Checklist
    - APU 2018 IRP

2. Confidential Submittal
    - IRP Confidentiality Application
    - IRP Standardized Tables

Please do not hesitate to contact me if you have any questions.

Respectfully Submitted,

Carrie Thompson

Carrie Thompson
Principal Integrated Resources Planner
Anaheim Public Utilities

Attachments:

1. IRP Checklist
2. APU 2018 IRP

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Attachment 1: IRP Checklist

IRP Filing Contents (SB 350 Requirements)

IRP FILING CONTENTS PER CEC GUIDELINES	PUBLIC UTILITIES CODE	SECTIONS IN APU IRP	STARTING PAGE #
A. Planning Horizon	Section 9621(b) (1) and (2)	This IRP's planning horizon is 2018 – 2030.	Through-out this IRP
B. Scenarios and Sensitivity Analysis	Section 9621 (d)	VII. Resource Portfolio Evaluation	60
C. Standardized Tables	N/A	See separate confidential submittal: IRP Standardized Tables	N/A
D. Supporting Information	N/A	Supporting information may be found in the charts, graphs and narratives in the IRP.	Through-out this IRP
E. Demand Forecast	N/A	VI. Energy Demand and Peak Forecasts	41
1. Reporting Requirements	N/A	VI. Energy Demand and Peak Forecasts	41
2. Demand Forecast Methodology and Assumptions	N/A	VI. Energy Demand and Peak Forecasts A. Energy Demand Forecast - Methodology & Assumptions	43
3. Demand Forecast – Other Regions	N/A	VII. Resource Portfolio Evaluation C. Model Analysis – Production Cost Model	75
F. Resource Procurement Plan	Section 9621(b) and (d)	VII. Resource Portfolio Evaluation	60
1. Diversified Procurement Portfolio	Section 9621(d)(1)(D)	VII. Resource Portfolio Evaluation B. Resource Options	69
2. RPS Planning Requirements	Section 9621(b)(2) and Section 399.11	V. Renewable Energy Procurement Plan and Enforcement Program VII. Resource Portfolio Evaluation B. Resource Options Appendix A – Renewable Procurement Plan	30 69 171
3. Energy Efficiency and Demand Response Resources	Section 9621(d)(1)(A) Section 9615	VI. Energy Demand and Peak Forecasts A. Energy Demand Forecast - Methodology & Assumptions XII. Energy Efficiency and Demand Response Programs	43 155
4. Energy Storage	Section 9621(d)(1)(B) Chapter 7.7 (commencing with Section 2835) of Part 2 of	VII. Resource Portfolio Evaluation B. Resource Options B.3. Energy Storage	74

IRP Filing Contents (SB 350 Requirements)

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	Division 1		
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G. System and Local Reliability	Section 9621(d)(1)(E) and Section 9620 (a) and (b)	VIII. Reliability & Electric System Overview	106
1. Reliability Criteria	Section 9621(d)(1)(E) and Section 9620 (a) and (b)	VI. Energy Demand and Peak Forecasts B. Peak Forecast - Methodology & Assumptions VIII. Reliability & Electric System Overview C. CAISO Resource Adequacy Requirements	53 116
2. Local Reliability Area	Section 9621(d)(1)(E) and Section 9620 (a) and (b)	VIII. Reliability & Electric System Overview C. CAISO Resource Adequacy Requirements D. Distribution System Overview	116 120
3. Addressing Net Demand in Peak Hours	Section 9621(c)	VI. Energy Demand and Peak Forecasts B. Peak Forecast - Methodology & Assumptions B.3. Other Considerations Clean Peak Analysis	57
H. Greenhouse Gas Emissions	Section 9621(b)(1)	VII. Resource Portfolio Evaluation A. Portfolio Consideration and Performance Measures G. Optimum Portfolio Recommendation IX. Greenhouse Gas Emission Reduction	62 95 128
I. Retail Rates	Section 9621(b)(3) and Section 454.52.(a)(1)(C) and (D)	VII. Resource Portfolio Evaluation H. Rate Impact	100
J. Transmission and Distribution Systems	Section 9621(b)(3) and Section 454.52.(a)(1)(E) and (F)	VIII. Reliability & Electric System Overview	106
1. Bulk Transmission System	Section 9621(b)(3) and Section 454.52.(a)(1)(E) and (F)	VIII. Reliability & Electric System Overview	106

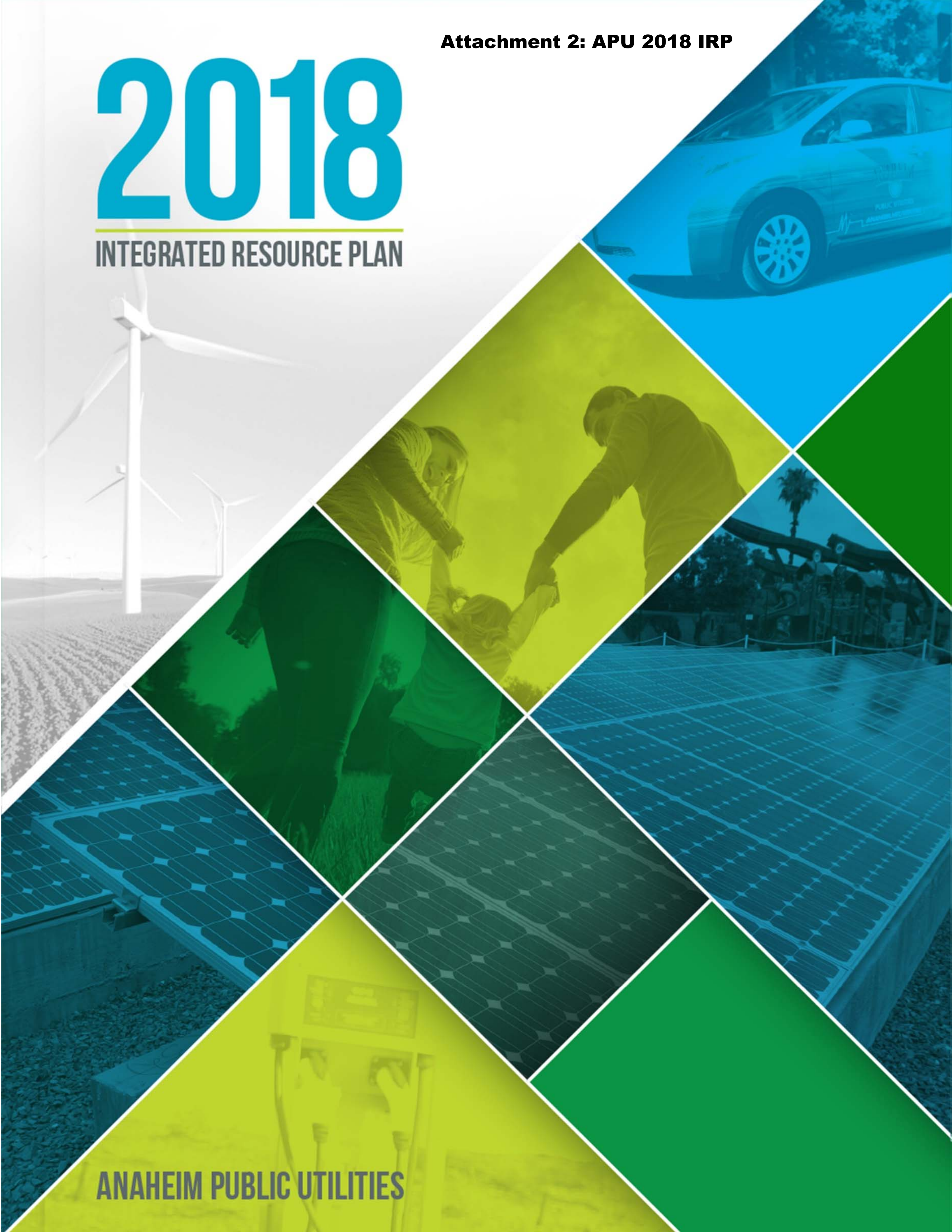
IRP Filing Contents (SB 350 Requirements)

IRP FILING CONTENTS PER CEC GUIDELINES	PUBLIC UTILITIES CODE	SECTIONS IN APU IRP	STARTING PAGE #
2. Distribution System	Section 9621(b)(3) and Section 454.52.(a)(1)(E) and (F)	VIII. Reliability & Electric System Overview D. Distribution System Overview	120
K. Localized Air Pollutants and Disadvantaged Communities	Section 9621(b)(3) and Section 454.52.(a)(1)(H)	XIII. Programs for the Low Income and Disadvantaged Communities	165

Attachment 2: APU 2018 IRP

2018

INTEGRATED RESOURCE PLAN



ANAHEIM PUBLIC UTILITIES

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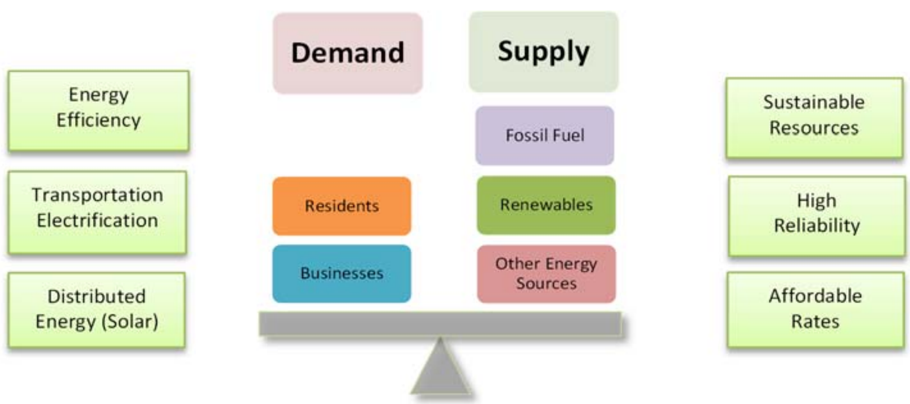
I. EXECUTIVE SUMMARY

Introduction

Anaheim Public Utilities (APU) operates a consumer-owned vertically integrated electric utility, which has the privilege and obligation to reliably serve electricity customers located within its 50 square mile service territory. As such, APU is responsible for planning adequate power generation resources to reliably meet customer demand for electricity after making adjustments for i) customer energy efficiency savings, ii) added energy demand from electric vehicles (EV), and iii) reductions from customer-owned power generation (e.g. roof-top solar), all while considering sustainability policy goals which call for reductions in greenhouse gas (GHG) emissions. As a not-for-profit utility, APU also considers the impact of resource additions on customer rates. The following graphic shows how APU balances adjustments to customer energy demand and sustainability goals to develop an integrated resource plan (IRP).

APU is responsible for planning adequate power generation resources to reliably meet customer demand for electricity after making adjustments for i) customer energy efficiency savings, ii) added energy demand from electric vehicles (EV), and iii) reductions from customer-owned power generation (e.g. roof-top solar), all while considering sustainability policy goals which call for reductions in greenhouse gas (GHG) emissions.



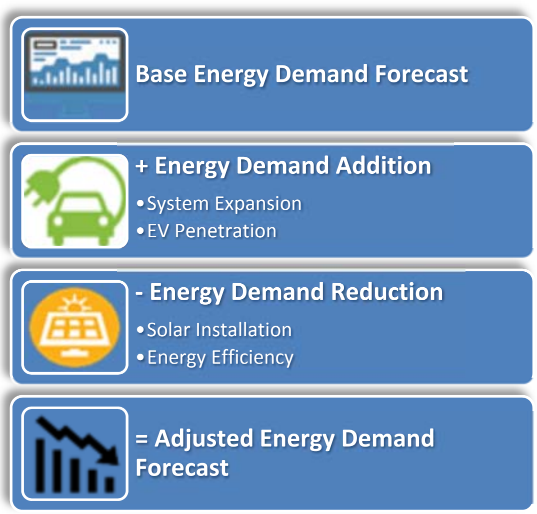
The IRP serves as a long-term comprehensive roadmap to continue APU's long standing focus on customers by balancing the demand and supply-side factors of the electric utility. The IRP provides a framework showing how APU will transition away from carbon intensive resources such as coal, to clean renewable resources such as wind, geothermal, biogas, small hydro and solar. This aligns with APU's GHG emission reduction targets and is in accordance with the State's policy goals required by Senate Bill (SB) 350, including the requirement to establish an IRP by January 1, 2019.

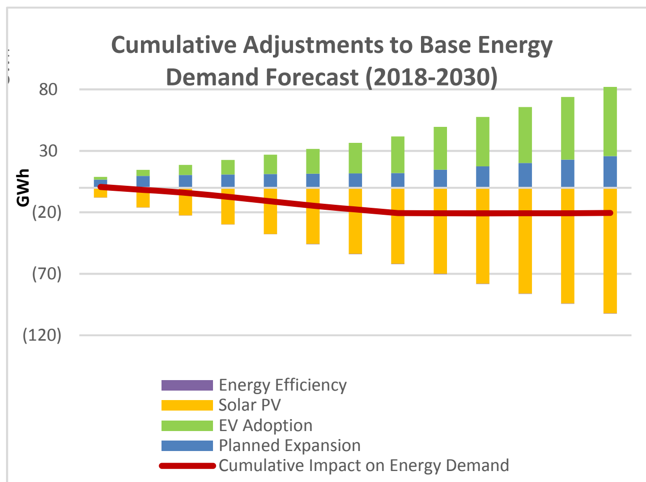
The IRP process commenced in early 2017 with customer outreach efforts, which played an important role in APU's selection herein of the optimum power generation resource mix to reliably serve customer demand while meeting the goals established in the IRP. Customer feedback indicated broad support for

APU's responsible transition away from carbon intensive energy resources to an increased procurement of renewable energy resources supplemented by cleaner burning resources.

Assessment of Customer Energy Demand

APU uses a statistical model to forecast a baseline customer energy demand, which is adjusted up or down based on i) planned customer additions, ii) expected electric vehicle usage, iii) estimated customer-owned rooftop solar installations, and iv) expected customer energy efficiency reductions. Based on the results of this modeling, APU expects a cumulative reduction in customer energy demand of 0.86 percent between 2018 and 2030, which is effectively a zero-growth energy demand forecast. In summary, this zero-growth forecast is primarily the result of simultaneous, opposing dynamics of i) expected system expansion and EV growth that increase energy demand being offset by ii) customer solar installation and energy efficiency reductions that reduce energy demand. The following graphic shows the various additions and subtractions to the baseline energy demand forecast.





Transition to Clean Energy Resources

In planning to serve the customer energy demand forecast established above, APU must consider its existing power generation resource mix and plan the resource changes necessary to meet its reliability and sustainability goals outlined in the IRP. Although APU's current resource mix is adequate to reliably serve the zero-growth energy demand forecast, it currently includes a significant amount of coal energy. APU recognizes the importance of having reliable, sustainable, and cost-effective electricity supplies to drive the regional economy, support residents, businesses, schools and visitors, as well as protecting the local environment. Carbon dioxide is the primary GHG associated with electricity generation. APU has been steadily transforming its electric power supply portfolio since 2003 through increased procurement of renewable resources and accelerating the exit of coal ownership agreements and other contractual obligations.

At the end of 2017, APU fully divested of its ownership interest in the San Juan Generating Station (San Juan), a coal-fired generating plant located in New Mexico. Once APU's exit of the Intermountain Power

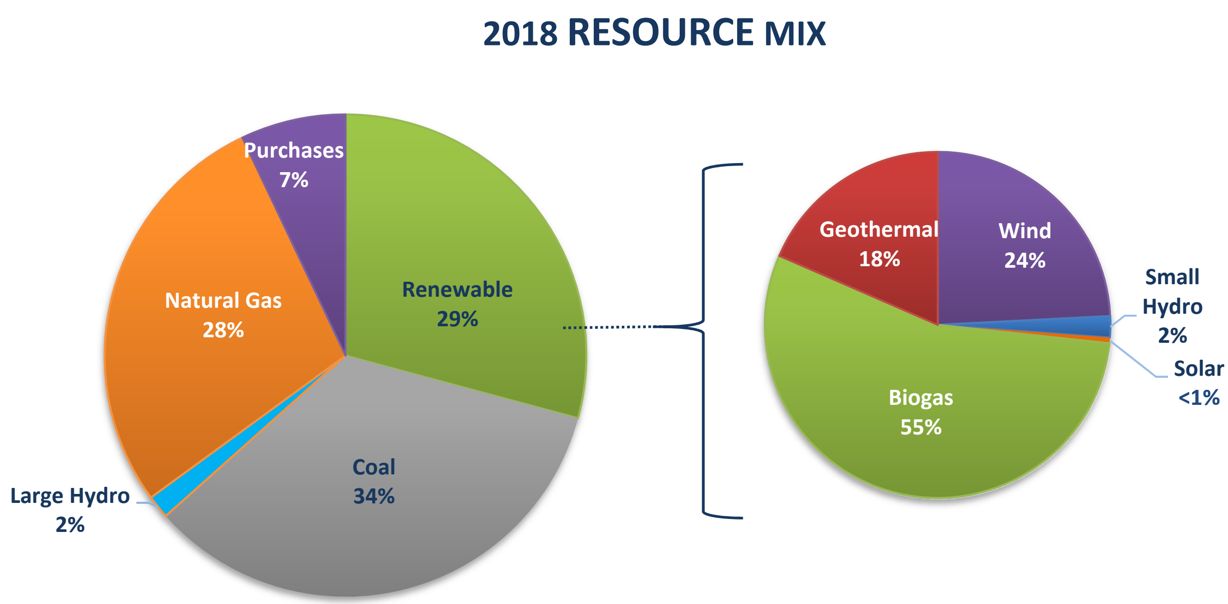
Project (IPP) contract in mid-2027 is complete, its power supply portfolio will be 100 percent free of coal resources. Transitioning away from coal resources and replacing them with clean renewable energy resources ultimately proved to be the optimum resource portfolio, as further described in Section VII of this IRP.

These renewable energy resource additions, along with APU's support for accelerating transportation electrification, will reduce APU's GHG emissions by more than 70% below 1990 emission levels by the year 2030; significantly exceeding the State's overall target of 40% below 1990 emission levels by 2030.

The divestiture from coal energy, along with the support for accelerating transportation electrification, will reduce APU's GHG emissions by more than 70% below 1990 emission levels by the year 2030.

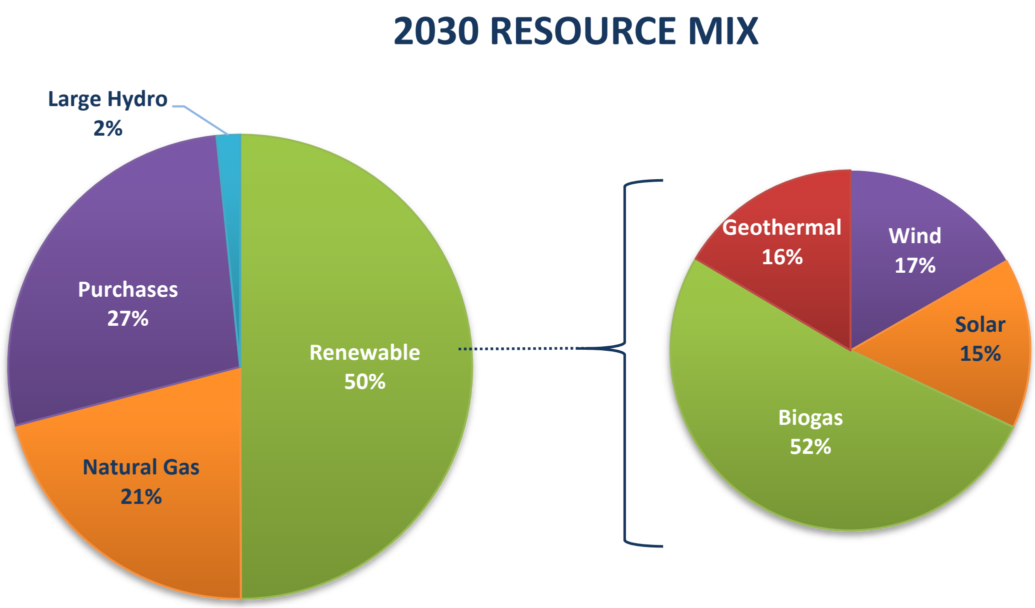
APU's Current Power Resource Mix

APU's current power resource portfolio consists of a diverse mix of generation resources, which provide high reliability, stable prices, and is comprised of roughly 30% renewable energy resources. The diversity also protects APU's customers from contingencies such as fuel unavailability, fuel price fluctuations and changes in energy policies that can drive up the cost of a particular fuel.



Renewable Energy Resource Procurement Plan

On February 28, 2017, the City Council approved APU's latest renewable energy resource procurement and enforcement plans, which expanded the procurement of renewable energy resources to serve Anaheim electric customers from 33% to 50% renewable energy by 2030, consistent with the mandates of SB 350. SB 350 also requires that utilities incorporate current renewable energy resource procurement plan into IRPs going forward. This IRP includes APU's most recent update to its renewable energy resource procurement plan, which is in accordance with the 50% renewable energy by 2030 target previously approved by City Council. The following graphic shows the optimum renewable energy resource procurement plan that will serve as a target for compliance with the RPS required by State law by 2030.

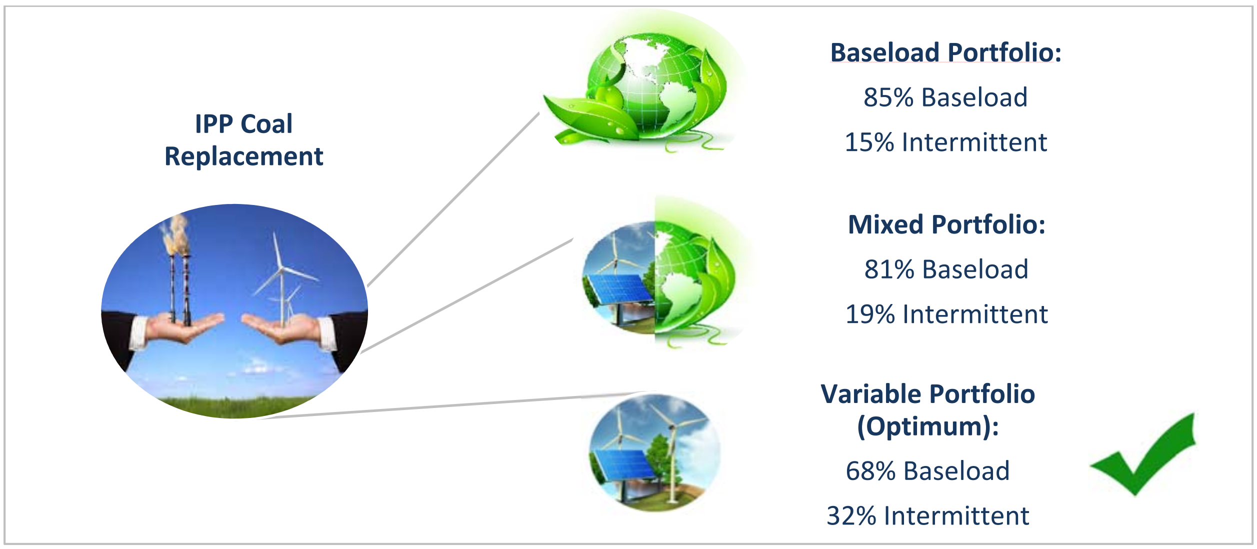


The IRP also updates the cost limitation methodology used to prevent a disproportionate impact on customer electric rates caused by a significant increase in costs associated with the procurement of renewable energy resources.

The State's RPS law permits the local governing board of each Publicly Owned Utility (POU), such as APU, to implement a cost limitation for its RPS activities. All versions of the RPS Policy previously approved by City Council included a cost limitation provision for the protection of APU customers. This cost limitation methodology is now outdated since it was based on a 2010 base year and a 33% RPS, which has been mandated by the State to increase to 50% by 2030. As part of this IRP, APU is highlighting how it will procure new renewable energy resources in a manner that does not cause an increase in overall power supply costs greater than $0.01 per kilowatt-hour in any fiscal year, which represents a 10% increase over current power supply costs or approximately four times the expected rate of general inflation in a single year, and is considered to be an undue burden on customers.

Balancing the Renewables Portfolio

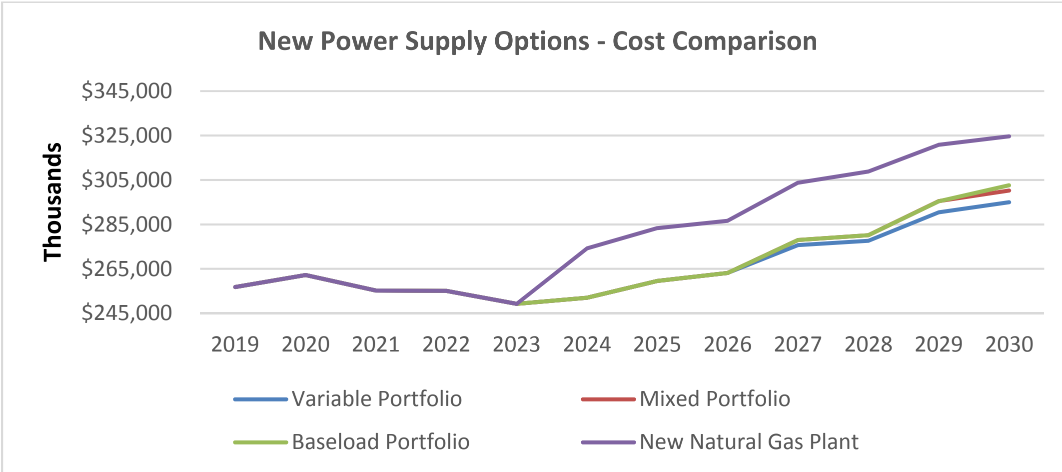
APU's renewable portion of its overall power resource mix consists mainly of baseload renewables such as geothermal, landfill gas and biofuels. These baseload resources operate continuously around-the-clock and are not dependent on favorable weather conditions unlike intermittent resources such as wind or solar power generation. The consistency and reliability that comes with baseload renewables has historically also come with a premium price. To maintain competitive rates for APU customers, Anaheim explored adding less expensive intermittent resources to balance its renewable portfolio in its plan to transition out of coal and procure from 30% to 50% renewable energy by 2050. The following graphics show the three resource portfolios analyzed prior to selecting the optimum resource portfolio and the overall resource mix planned to be reached by 2030:



A production cost modeling analysis was used to compare the overall power supply cost of APU's existing resources plus any new resources considered for each portfolio. In addition to the expected cost of each portfolio scenario, the following five factors were also considered in determining the optimum portfolio: Compliance, Regulatory Risk, Resource Adequacy, Portfolio Diversification, and Financial Exposure. The Variable Portfolio outperformed the other portfolios under both expected conditions and stress tested conditions, such as extreme heat, extreme carbon pricing, extreme fuel price volatility, and extreme high or low energy efficiency, solar penetration and electric vehicle penetration.

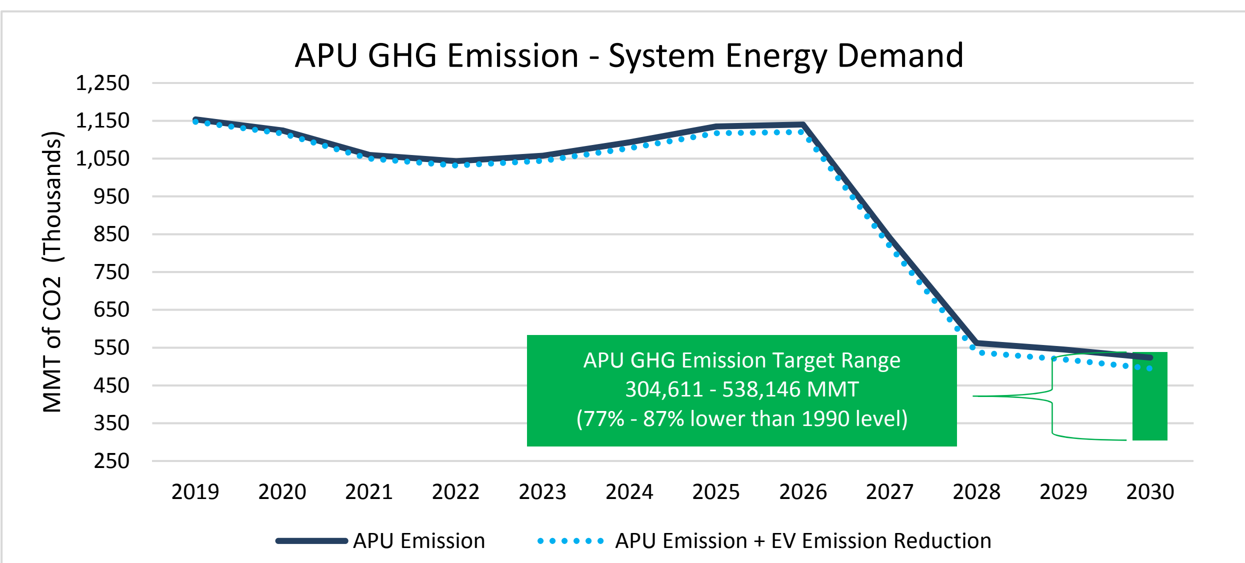
Under the Variable Portfolio, APU will achieve a diverse and low-emission resource portfolio that meets RPS and GHG reduction goals, achieves resource adequacy and local reliability, and maintains affordable electric rates.

Under the recommended Variable Portfolio, APU will achieve a diverse and low-emission resource portfolio that meets the RPS and GHG reduction goals, achieves resource adequacy and local reliability, and maintains affordable electric rates. The following graphic show that the Variable Portfolio causes the lowest overall increase in power supply costs.



**Net power supply costs excludes transmission and wholesale energy revenues*

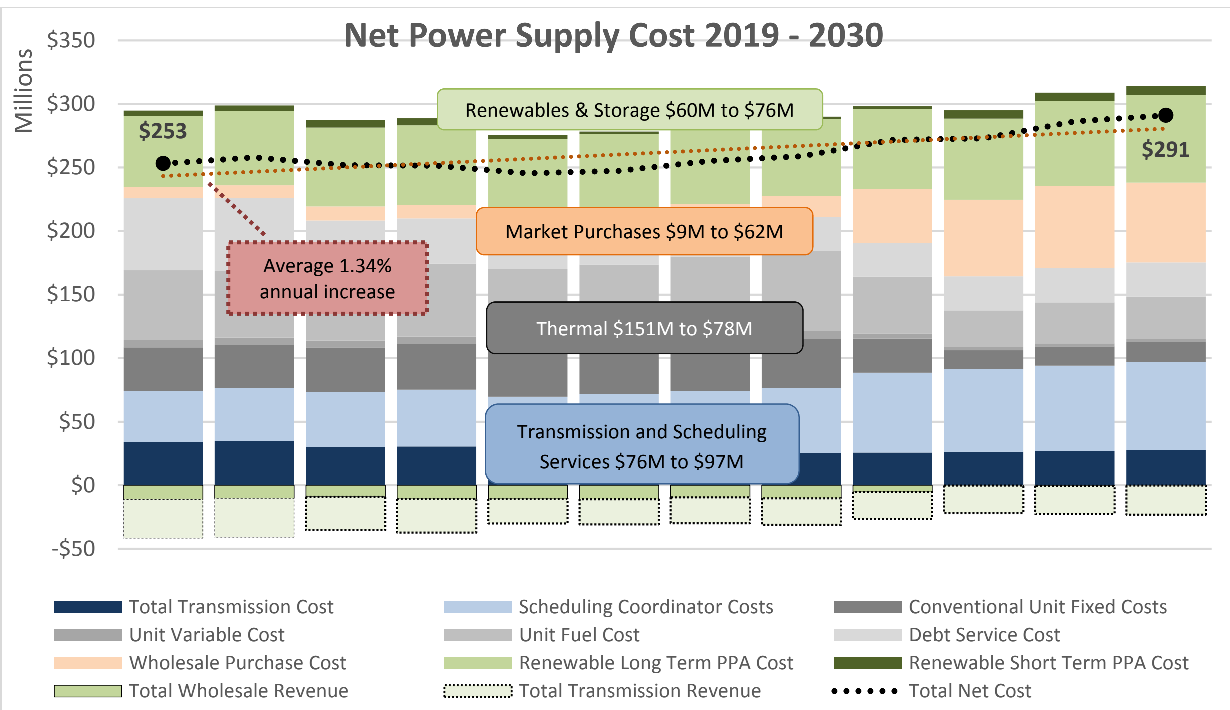
APU's resource portfolio will be coal-free by mid-2027, and at a minimum, 50% of APU's electricity deliveries will come from renewable energy resources. Based on current law and draft regulations, APU's optimum resource portfolio under this IRP will achieve the upper bound of the proposed GHG reduction target range (77% GHG reduction). However, the GHG reduction target for POUs is currently under development by the California Air Resources Board (CARB) and may ultimately be 77% to 87% below 1990 levels by 2030. If the final regulation requires that APU achieve the lower bound of the target range (87% GHG reduction), that target level could not be achieved without significant cost impacts to APU and its customers. If California Air Resources Board (CARB) were to indeed adopt the more stringent 87% GHG reduction target it would require the shutdown, or "stranding," of a reliable and efficient baseload natural gas resource Magnolia Power Plant, which has 20-years of unavoidable debt service costs that would still need to be paid by APU customers in addition to replacement renewable resources. APU is closely following relevant regulatory proceedings and will work with the CARB and CEC to recommend methodologies to further reduce APU carbon emissions, such as accounting for the effect of electric vehicle (EV) penetration on emission reduction.



Projected Effect on Customer Rates

APU strives to find resources that are cost-effective and minimize rate impacts on customer utility bills, while still meeting its compliance obligations for increased renewables and lower GHG emissions. By responsibly divesting of its coal assets and utilizing its peaking resources to integrate more renewable purchases, APU has been able to maintain affordable electric rates. The following graphic shows the expected net power supply cost forecast from 2019 through 2030 based on the recommended Variable Portfolio and the expected consumption case. Such net power supply costs are expected to increase an average of 1.34% per year from 2019 to 2030, which is less than the expected rate of inflation over the same time period.

By responsibly divesting of its coal assets and utilizing its peaking resources to integrate more renewable purchases, APU has been able to maintain affordable and competitive electric rates.



Given the large amount of reliable baseload renewable resources in APU's portfolio, as compared to the small amount of intermittent solar and wind resources, the cost to support and backup intermittent renewable resources attributed to APU by the California Independent System Operator (CAISO) has remained relatively low to date. However, to mitigate future renewable integration costs, APU currently has plans to add a 1 MW energy storage pilot project by December 31, 2021 and an additional 10 MW of energy storage by December 31, 2026, if the pilot project proves to be cost-effective. Energy storage technologies include batteries and other systems that are able to store power for later use in a controlled manner.

Local Reliability and Air Quality

Of APU's approximate 700 MWs of generation capacity, 240 MWs are located within the City. The Canyon and Kraemer Power Plants provide flexible power generation capability, known as resource adequacy capacity, near the Anaheim load center, including black-start capability, which enhances local and statewide reliability. The power plants use clean-burning natural gas fuel, include air emission controls to further reduce air pollutants that cause smog, have much lower GHG emissions than coal resources, and operate as flexible peaking units to support the morning and evening ramping needs of the power grid and backup fluctuations in solar output due to weather.

According to a recent APU customer survey, 95% of the respondents indicated that they have acceptable to excellent air quality near their home, and 89% of the respondents indicate the air quality has improved or stayed the same over the past few years. These respondents mainly attributed any air quality concerns to traffic and emissions from mobile sources, and none attributed it to APU's local power generation.

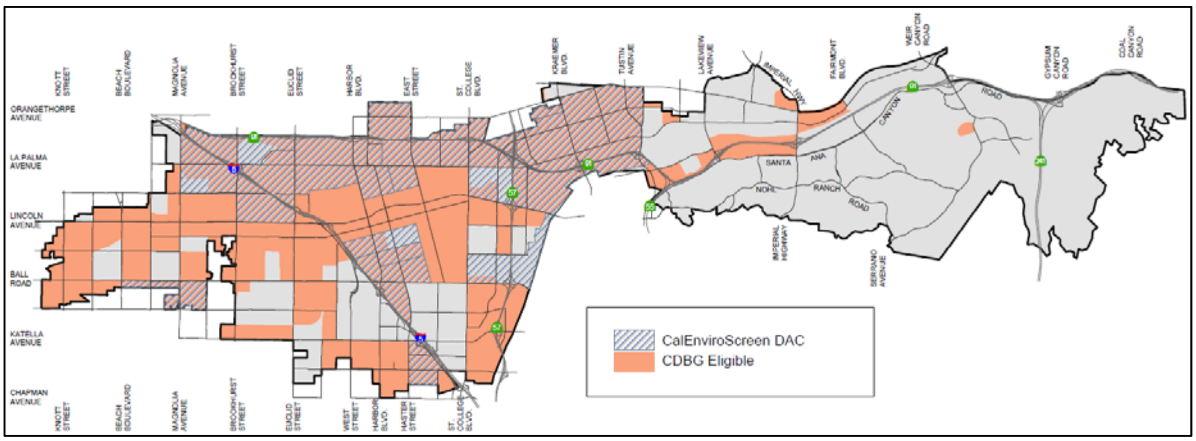
To improve local air quality and support sustainability goals, APU facilitates and promotes transportation electrification through electric vehicle time-of-use rates, rebate incentives for public access and private use charging stations, and the electrification of utilities field services vehicles. APU also supports and facilitates the installation of fast-charging infrastructure to be used by visitors and residents without home charging facilities, which helps to remove fossil fueled vehicles from the road and improves local air quality.

In addition, APU supported customer-owned solar distributed generation by fully implementing the Senate Bill (SB) 1 solar initiative rebates. To date, over 28,000 totaling 26 MW of customer-owned solar systems have been installed in Anaheim. APU continues to expand clean local distributed generation through utility-owned solar projects. As an example, APU is installing and will maintain 1.5 MW solar carports and lunch shelters at nine public schools throughout Anaheim through its Solar for Schools program, and is expected to continue adding solar school facilities in future years.

Programs for the Low Income and Disadvantaged Communities

APU has a tradition of helping low income customers use energy efficiently to reduce their electric bills, and APU has historically provided rate discounts to income-qualified seniors, military veterans and disabled customers. More recently, APU has implemented programs to address the needs of its income-qualified customers considering that the 2015 U.S. Census shows that nearly 58% of Anaheim households are under the low income designation. Additionally, APU has incorporated programs that assist "disadvantaged communities (DAC)," as defined by Senate Bill 535 (De León) and the most current version of CalEPA's California Communities Environmental Health Screening Tool ("CalEnviroScreen").

The CalEnviroScreen considers area pollution exposure levels in addition to income and unemployment levels to determine which areas are disadvantaged. However, APU programs serve expanded DAC areas, which include low income areas defined by the Department of Housing and Urban Development as Community Development Block Grant (CDBG) areas. The following map illustrates this expanded DAC area served by APU DAC programs:



To ensure energy efficiency, transportation electrification and renewable energy is accessible to the low income and disadvantaged communities (LI-DACs), APU offers program incentives and works closely with other City departments including Planning and Building, Public Works, Community Services and Community and Economic Development to service LI-DAC customers. Some examples include:

- Offering rebates for enhanced energy efficiency and publicly accessible EV charging stations located at schools and Affordable Housing Developments. The public access EV rebate program is funded by proceeds from the California Low Carbon Fuel Standard (LCFS) program.

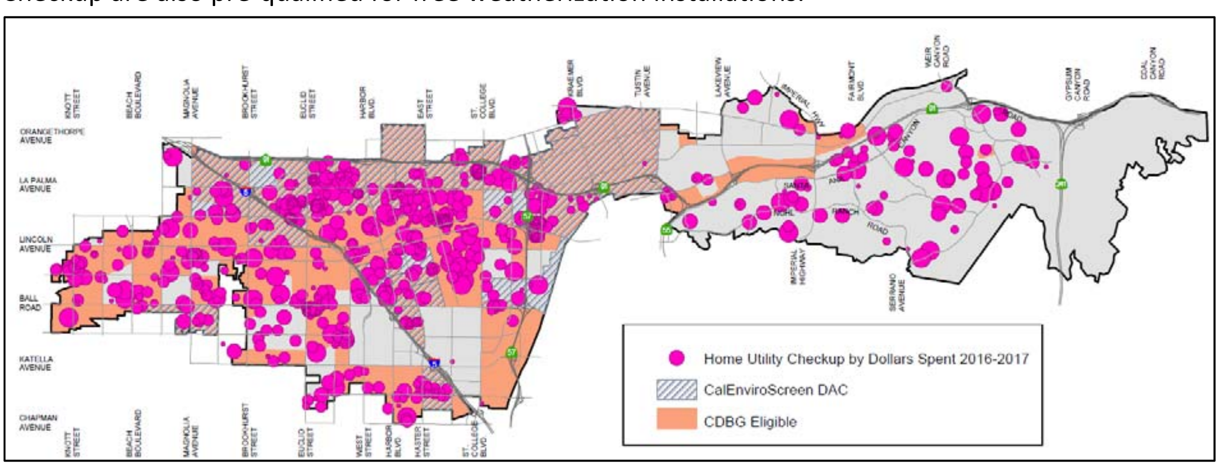
- Actively seeking grant opportunities to support EV charging stations and shade trees for qualifying commercial, industrial, and residential projects and multi-family developments near freeways and within LI-DACs.

- Transitioning to LED street lights and partnering with the Southern California Gas Company to offer no-cost weatherization services that are frequently located within LI-DACs.

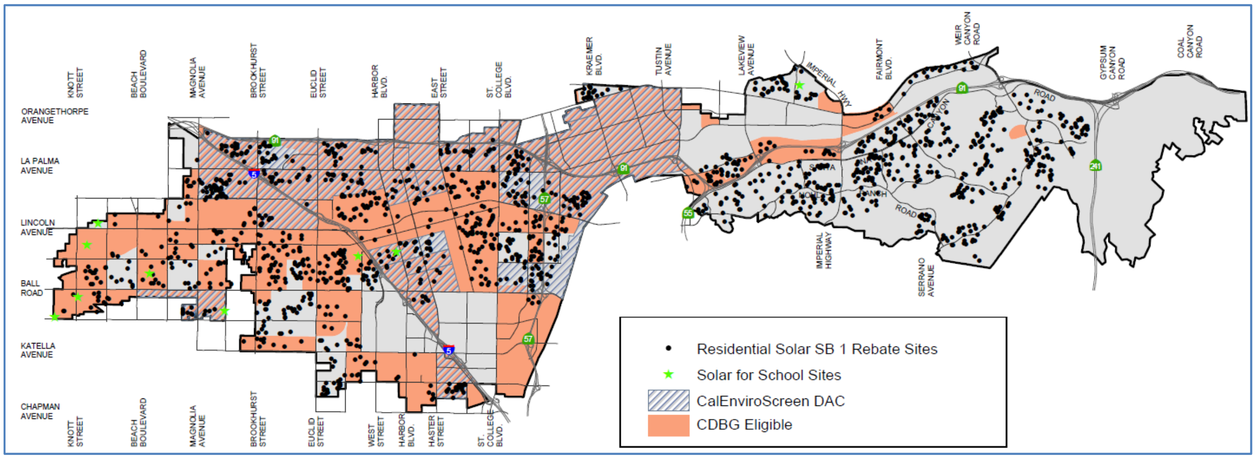
- Providing EV charging stations at park sites within LI-DACs through grant funding opportunities.
- Providing customer education and outreach on energy efficiency and income-qualified programs at community meetings.
- Hosting community outreach events within LI-DAC areas, specifically promoting sustainable resources and conservation programs.
- Developing an income-qualified solar discount program that integrates with the Solar for Schools energy production to allow households to receive bill savings, where these customers may otherwise not be able to access solar benefits because they are living in multi-family dwellings.

APU's low income energy discount is offered to seniors, military veterans, and disabled customers who meet specified income thresholds. Low Income Home Energy Assistance Program (LIHEAP) is also available for customers needing additional bill assistance.

Data analytics is utilized to maximize LI-DAC residents' participation in efficiency programs. As an example, a significant majority of the customers who participate in the Home Utility Checkup Program are within LI-DACs, as illustrated in the following map below. APU's weatherization program is therefore enhanced through the Home Utility Checkup Program. Eligible customers applying for the Home Utility Checkup are also pre-qualified for free weatherization installations.



APU's data analytics show in the map below that residential solar rebates were evenly distributed throughout APU, which is partially attributed to the income-qualified solar incentives offered at a higher rate. In addition, 8 out of the 9 Solar for School sites are located in LI-DACs.



Customer Support of IRP Approach

The Variable Portfolio, recommended by this IRP as the optimum portfolio, is also closely aligned with the preferences of APU customers, as evidenced by a customer survey conducted in late 2017.

As a customer-owned electric utility, APU actively solicited input from customers and received responses from approximately 1,200 residents and businesses through online surveys, phone interviews, and outreach events. Survey respondents overwhelmingly expressed high satisfaction with APU services. Customers indicated that they are likely to contact APU for advice on solar and other distributed generation, and feel that APU will offer fair and balanced advice.

Customer Survey Quotes

"Good for the environment and our kids' future!"

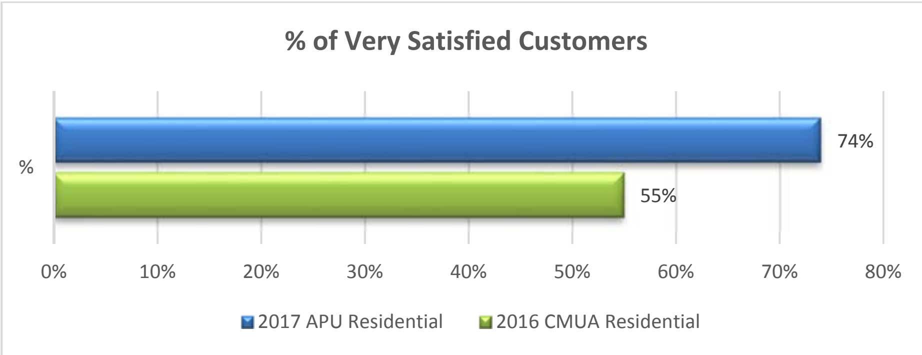
"Protect the planet."

"As a community, we need to reduce greenhouse gas emissions."

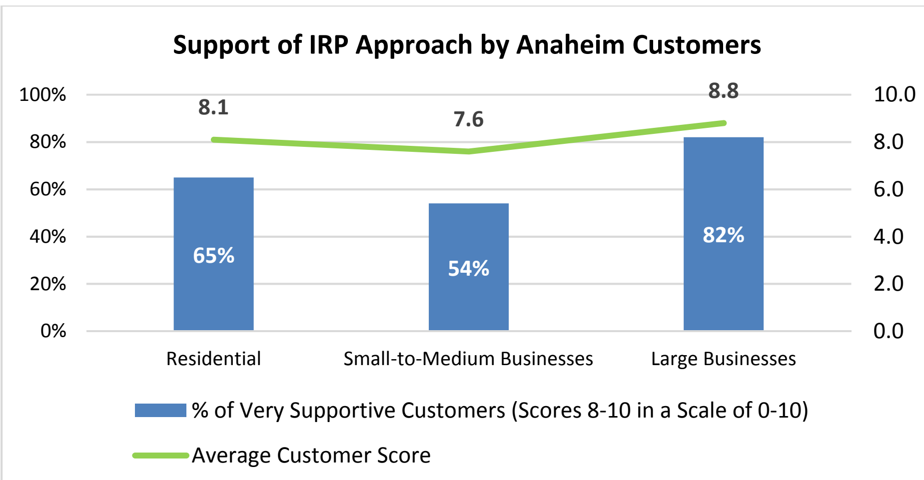
"Reducing coal usage helps keeping air pollution low."

"Renewable energy is the future."

In 2016, California Municipal Utilities Association (CMUA) conducted a statewide customer satisfaction survey that reached nearly 1,400 residential customers. In comparison to the CMUA municipal customers surveyed, APU customers expressed a significantly higher overall customer satisfaction with APU services.



Customers also expressed high support of the IRP approach to eliminate coal resources and reach a renewable energy target of 50% by 2030.



In addition to the customer survey, in March 2018 APU held community events at public locations in each of Anaheim's six council districts, at which a summary of the IRP was presented, including greenhouse gas reductions, phasing-out of coal resources, 50% renewable portfolio standard, transportation electrification, local solar projects, and energy efficiency.

Executive Oversight and Governing Board Approval

Executive Oversight

The IRP development is guided by an Executive Oversight group consisting of the following members:

- General Manager
- Assistant General Manager – Power Supply
- Assistant General Manager – Electric Services
- Assistant General Manager – Finance and Administration
- Chief Risk Officer

During IRP development, quarterly meetings were held to discuss APU policy, guiding principles and key components of the IRP. Staff receives direction and support from the Executive Oversight group on all aspects of the IRP, particularly the cross-departmental efforts such as transportation electrification and programs and resources targeted for the low income and disadvantaged communities.

Board and Council Approval

This IRP and future updates will be presented to the Public Utilities Board for their consideration and recommendation to the Anaheim City Council for approval.

The Public Utilities Board is made up of seven Anaheim residents who are appointed to staggered four-year terms by members of the Anaheim City Council. Their role is to make recommendations to the Anaheim City Council on utility matters, including:

- Annual capital and operating budgets
- Renewable energy resource options
- Sources of water and power supply
- Water and electric rates
- Water and energy conservation and efficiency incentives

Following the Board's recommendation for approval, the IRP will be presented to the Anaheim City Council for approval and adoption.

II. APU FACT SHEET

PUBLIC UTILITIES

Dukku Lee
Utilities General Manager

Brian Beelner
Assistant General Manager
Finance & Administration

Janet Lonneker
Assistant General Manager
Electric Services

Graham Bowen
Assistant General Manager
Power Supply

Michael Moore
Assistant General Manager
Water Services

Janis Lehman
Chief Risk Officer

Local Ownership & Control

Anaheim Public Utilities is a city-owned, not-for-profit electric and water utility that offers quality electric and water services to residents and businesses in Anaheim at rates among the lowest in California.

Anaheim citizens are more than utilities customers: they are owners of their utilities. They have input to the decision process both directly and through an appointed citizen advisory Public Utilities Board. With final authority vested in Anaheim's elected City Council, decisions are made in the best interest of our citizens, quality of life, and local economy. As a municipal, not-for-profit utilities, our rates are based on our costs of providing water and electricity.

Electric Services Facts

Anaheim Public Utilities operates the only municipal electric utility in Orange County, delivering more than 3.7 million megawatt-hours to Anaheim's 350,000 residents and more than 15,000 businesses, including multi-million dollar tourism, sports and manufacturing customers.

Revenues & Expenditures

APU’s total electric utility revenue is more than $458 million a year, and net investment in utility plants is $880 million.

Power Use

Residential customers make up 85% of APU’s total customer meter base; however, nearly 75% of total load is consumed by commercial and industrial customers.

Resource Adequacy

APU has over 700 megawatts (MW) of generation capacity from various types of resources. The record peak customer demand of 593 megawatts was reached on July 14, 2006.

Power Resources

3 natural gas plants (in-state[1])
1 coal plant (out-of-state)
1 large hydroelectric plant (out-of-state)
4 small hydroelectric plants (in-state)
2 solar photovoltaic plants (in-state[2])
2 geothermal plants (1 out-of-state)
3 wind plants (1 out-of-state)
2 landfill gas plants (in-state)

Distribution Infrastructure

Transmission, 220kV
- 1.2 circuit miles

Sub-Transmission, 69kV
- 32.9 circuit miles of overhead
- 57.2 circuit miles of underground

Distribution, 12kV and lower, circuit miles
- Overhead – 401 primary, 1,219 secondary
- Underground – 709 primary, 963 secondary

Transformer Capacity, KVA
- 220kV to 69kV – 1,808,000
- 69kV to 12kV – 1,157,800
- 12kV to customer – 1,633,671

13 Substations
19,902 Streetlights
13,022 Distribution Transformers

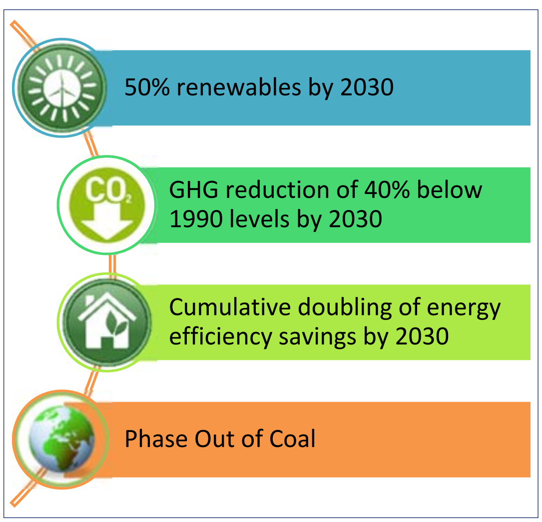
[1] Two Plants in Anaheim Service Area
[2] One Plant in Anaheim Service Area

III. PLANNING GOALS

APU's mission is to be an agile, customer-focused, water and power utility operating in an ever-changing world providing reliable, high quality, environmentally sustainable, and competitively priced water and power and delivering the maximum value to our customer-owners in order to preserve Anaheim's health and prosperity. This IRP supports this mission by establishing resource planning goals of sustainable resources, high reliability, and affordable rates, including the following sub-goals:

Sustainable Resources	High Reliability	Affordable Rates
• 50% RPS • 40% GHG Reduction • Lowest Regulatory Risk	• Resource Adequacy • Portfolio Diversification	• Lowest Expected Cost • Managed Market Risk

A. SUSTAINABLE RESOURCES



For more than two decades APU has been a leader in i) helping its customers use energy wisely and efficiently and ii) transitioning to sustainable power resources such as wind, geothermal, biogas, small hydro, and solar. APU currently serves 29% of its customer load from renewable resources and in 2017 the Anaheim City Council adopted a policy for APU to achieve a 50% renewable portfolio standard by 2030, which are both in compliance with California policy goals.

In 2006, Assembly Bill (AB) 32 established a statewide GHG emissions reduction target of 20% below 1990 levels by 2020. This goal was recently expanded by the passage of Senate Bill (SB) 32, which established a statewide GHG emissions reduction target of 40% below 1990 levels by 2030. To help achieve the State's GHG reduction goals, Governor Brown signed SB 350, which established targets for all California electric utilities, including APU, to increase the use of renewable resources to serve customer load to 50% by 2030. SB 350 also set a goal to double electricity and natural gas energy efficiency savings statewide by 2030.

This IRP lays out a plan for APU's resource portfolio to achieve Anaheim's sustainability goals and comply with all of California's legislative and regulatory requirements, including the following:

- Meet or exceed the following Renewables Portfolio Standard (RPS) targets, as a percentage of retail load:
  - 33% by December 31, 2020;
  - 40% by December 31, 2024;
  - 45% by December 31, 2027;
  - 50% by December 31, 2030, and each year thereafter.

- Meet or exceed the GHG emissions reduction targets established by the California Air Resources Board (CARB) for electric utilities, which contribute toward a statewide GHG emissions reduction goal of 20% below 1990 levels by 2020, and 40% below 1990 levels by 2030. The GHG reduction target for POUs which is currently under development by CARB may ultimately be 77% to 87% below 1990 levels by 2030.

Sustainable Resources

***50% RPS** is measured by percent of renewable energy delivered to serve retail load.*

***40% GHG Reduction** is measured by percent of GHG reduction of the total generation portfolio.*

***Regulatory Risk** measures the ability to remain compliant with current and anticipated future legislative or regulatory changes.*

- Meet or exceed the energy efficiency targets established by the Anaheim City Council for APU electricity customers, which contribute toward a statewide cumulative doubling of energy efficiency savings in the electricity and natural gas sector final end uses by 2030. The energy efficiency target established for APU by City Council is currently a 1.1% reduction in electricity sales per year.

- Phase-out of all APU coal resources by 2027.

These sustainability goals and reasonable Regulatory Risk were considered in the development of the power supply scenarios evaluated under this IRP. Regulatory Risk measures the ability to remain compliant with current and anticipated future legislative or regulatory changes. The recommended optimum portfolio is expected to achieve all of these goals and be resilient to future regulatory risk.

B. HIGH RELIABILITY

High overall electric service reliability is a key APU goal considered in the development of this IRP. Overall electric service reliability is comprised of i) high power supply reliability and ii) high electric distribution system reliability.

High power supply reliability is measured by two quantitative portfolio performance measures: Resource Adequacy and Portfolio Diversification.

1. Resource Adequacy is measured by the ability to achieve an additional 15% capacity over the forecasted system peak demand, and to meet local and flexible capacity requirements.

2. Portfolio Diversification is measured by the different types of resources, fuel and contract lengths within the portfolio, which increases flexibility, reliability, and operational performance of the overall portfolio.

High Reliability

Resource Adequacy *is measured by the ability to achieve 15 percent above system peak forecast, and to meet forecasted local and flexible capacity requirements.*

Portfolio Diversification *is measured by the different types and length of resource investment within the portfolio.*

While the power supply portfolio scenarios evaluated under this IRP primarily considered power supply reliability (versus distribution system reliability), the addition of customer-owned distributed energy resources (DER), such as rooftop solar, fuel cells, and batteries, the proliferation of electric vehicle charging infrastructure, and increased energy efficiency measures could have an effect on electric distribution system reliability; as such, they were also considered and addressed under various sections of this IRP. The recommended portfolio maintains high power supply reliability through 2030 and beyond, and the expected effect of the aforementioned demand-side factors were determined to have no adverse impact on APU's high electric distribution reliability going forward.

More specifically regarding power supply reliability, APU operates within the supply/demand balancing area of the California Independent System Operator (CAISO), and the CAISO is within the Western Interconnection of the United States, known as the electric "Grid." The electric Grid interconnects thousands of power generation plants across the 14 western states and parts of Canada and Mexico using a high voltage power transmission system, and all of these generators collectively serve customer electric demands. By participating in this interconnected Grid system, APU enjoys extremely high power supply reliability because the loss of any single generator does not affect the delivery of electricity to APU customers. There has not been a regional blackout affecting APU since August 1996, demonstrating that APU's interconnection to the Grid serves its customers very well.

To maintain high reliability the CAISO and other Grid operators require load serving entities such as APU to maintain adequate power generation capacity beyond that required to serve its own customers, which is known as a "Resource Adequacy" requirement. CAISO's current Resource Adequacy requirement is 15% of forecasted peak load. APU employs a diversified portfolio of power generation resources to comply with its Resource Adequacy obligation, and maintaining a diversified and resilient Resource Adequacy portfolio was a factor in the evaluation of the power supply scenarios considered under this IRP.

In addition to maintaining Resource Adequacy to cover any unexpected losses of power generation, the CAISO and the other balancing authorities operating the Grid also adhere to reliability and cyber security standards established and monitored by the North American Reliability Corporation (NERC) under the auspices of the Federal Energy Regulatory Commission (FERC). APU is in full compliance with NERC reliability standards, and in 2014 passed an audit of all applicable NERC standards with no violations.

APU adheres to the CAISO tariffs and Business Process Manuals pertaining to the Grid-level reliability requirements. The reliability requirements and Resource Adequacy programs provide performance and deliverability criteria for generation resources required for each load serving entity. APU's resources fully comply with the system-wide, local, and flexible Resource Adequacy requirements established by the CAISO, and the recommended portfolio is expected to maintain this reliability as APU phases out coal resources and adds renewable resources to achieve a 50% RPS. Also, to improve system resiliency, a diversified and flexible portfolio is considered to minimize risks of unplanned facility outages accompanied with acquisition of resources with complementary generation profiles.

C. AFFORDABLE RATES

As a customer-owned utility, maintaining affordable electric rates is a key APU goal considered in the development of this IRP. APU has consistently maintained electric rates that are lower than adjacent investor owned utilities, and the recommended portfolio is expected to help maintain affordable rates throughout the planning period.

Sections 205 and Section 206 of the Federal Power Act stipulate that "all rules and regulations affecting or pertaining to such [public utility] rates or charges shall be just and reasonable." State statute also requires that the integrated resource plan "enable each electrical corporation to fulfill its obligation to serve its customers at just and reasonable rates." In addition, Article XIII C of the California Constitution requires that electric rates do not exceed APU's reasonable cost to provide electricity to its customers.

The optimum (recommended) portfolio consists of a balanced mix of renewable resources and ensures high reliability, while at the same time maintaining affordable rates. APU's IRP process includes comprehensive production cost modeling to ensure the resource portfolio serving APU's customer load is met at the lowest possible cost.

The long-term resource planning process introduces many assumptions and each of them may deviate from the original assumptions. A modeling "stress test" is introduced to ensure the optimal portfolio outperforms the alternatives under all scenarios. In addition, the portfolio financial exposure is calculated to evaluate mitigating factors.

Achieving affordable rates is measured by two quantitative portfolio performance measures: **Expected Cost** and **Market Risk**. Lowest expected cost is measured by the total cost to supply power, while Market Risk is measured by percentage of energy purchased from the wholesale market, and the portfolio's ability to withstand market price volatility.

Affordable Rates

***Expected Cost** is measured by the total cost to supply power.*

***Market Risk** is measured by the percentage of energy purchased from the wholesale market, and the portfolio's ability to withstand market price volatility.*

IV. KEY POLICY DRIVERS AFFECTING THE UTILITY

California is considered a leader in its many efforts to combat the effects of climate change. The overarching goal of the State's climate change strategy is to reduce statewide GHG emissions to 40% below 1990 levels by 2030. To reach this goal, the State has put forward several key legislative actions over the past several years that have a direct effect on how APU plans for and manages its resource portfolio now and into the future. APU is committed to reducing GHG emissions by implementing not only the letter of state laws and regulations, but also their spirit, which supports Anaheim's goal of a more sustainable environment for future generations. In doing so, APU's long-term strategies focus on striking a balance amongst numerous legislative and regulatory issues and challenges while maintaining affordable rates and reliable service for its customers.

The following table is a summary of the California laws passed since 2006 requiring electric utilities to reduce GHG emissions and increase the proportion of renewable energy in their power supply portfolios:

Date	Legislation	Description
July 26, 2017	Assembly Bill 617 (Christina Garcia, Chapter 136, Statutes of 2017)	**Companion to Cap-and-Trade** Establishes a groundbreaking program to measure and reduce air pollution from mobile and stationary sources at the neighborhood level in the communities most impacted by air pollutants. Requires the Air Resources Board to work closely with local air districts and communities to establish neighborhood air quality monitoring networks and to develop and implement plans to reduce emissions. The focus on community-based air monitoring and emission reductions will provide a national model for enhanced community protection.
July 25, 2017	Assembly Bill 398 (Eduardo Garcia, Chapter 135, Statutes of 2017)	**Cap-and-Trade Extension** Extends and improves the Cap-and-Trade Program, which will enable the State to meet its 2030 emission reduction goals in the most cost-effective manner. Furthermore, extending the Cap-and-Trade Program will provide billions of dollars in auction proceeds to invest in communities across California.
September 8, 2016	Assembly Bill 197 (Eduardo Garcia, Chapter 250, Statutes of 2016)	**Greenhouse gas regulations** Prioritizes direct emission reductions from large stationary sources and mobile sources.
September 8, 2016	Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016)	**Greenhouse Gas emission reduction target for 2030** Establishes a statewide greenhouse gas (GHG) emission reduction target of 40 percent below 1990 levels by 2030.
October 7, 2015	Senate Bill 350 (De León, Chapter 547, Statutes of 2015)	**Clean Energy and Pollution Reduction Act of 2015** Establishes targets to increase retail sales of renewable electricity to 50 percent by 2030 and double the energy efficiency savings in electricity and natural gas end

		uses by 2030.
April 12, 2011	Senate Bill X1-2 (Simitian, Chapter 1, Statutes of 2011)	Governor Edmund G. Brown, Jr. signed Senate Bill X1-2 into law to codify the ambitious 33 percent by 2020 goal. SBX1-2 directs California Public Utilities Commission's Renewable Energy Resources Program to increase the amount of electricity generated from eligible renewable energy resources per year to an amount that equals at least 20% of the total electricity sold to retail customers in California per year by December 31, 2013, 25% by December 31, 2016 and 33% by December 31, 2020. The new RPS goals applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. This new RPS preempts the California Air Resources Board's 33 percent Renewable Electricity Standard.
September 27, 2006	Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006)	California Global Warming Solutions Act of 2006. This bill requires Air Resources Board (ARB) to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020. ARB shall adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program. AB 32 directs Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 to continue its role in coordinating overall climate policy. See more information on AB 32 at ARB.

Source: http://www.climatechange.ca.gov/state/legislation.html

A. REDUCING GREENHOUSE GAS (GHG) EMISSIONS

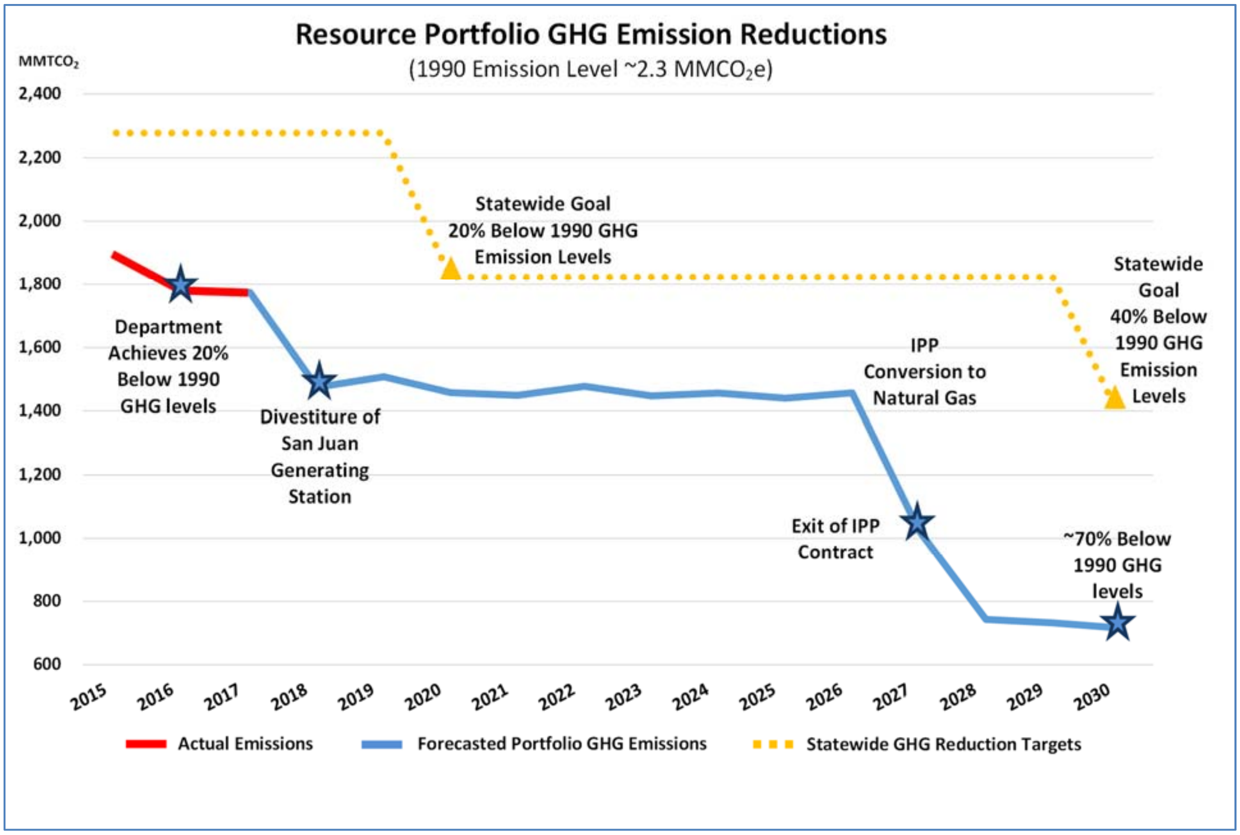
The passage of AB 32 in 2006 requires a statewide reduction in GHG emissions to 1990 levels by the year 2020; effectively a 30% decline in emissions from current statewide output. In 2016, SB 32 expanded the statewide GHG emissions reduction goal to 40% below 1990 levels by the year 2030. To meet the AB 32 and SB 32 goals, APU began reducing its reliance on generation resources that produce GHG emissions by transitioning from fossil fuel-fired generating resources to renewable resources and cleaner natural gas generation technologies. The most significant contribution that APU can make in reducing GHG is the reduction of energy resources that produce GHG emissions from its power supply. In addition to GHG emission reductions from APU's power supply, further GHG reductions will come from complementary efforts including increased energy efficiency measures, local solar, energy storage, and transportation electrification.

In July 2015, APU developed its first utility-specific Greenhouse Gas Reduction Plan with the purpose of developing a clear and comprehensive long-term strategic framework to reduce GHG emissions. The Plan identifies a goal to reduce GHG emissions by 20% below 1990 levels by 2020, and a minimum of 40% below 1990 levels by 2030. It is important to note that the 40% reduction below 1990 levels is a statewide goal; however, California utilities will likely be called upon to do more. The California Air Resources Board, in conjunction with California Energy Commission, is in the process of developing utility-specific GHG reduction targets for California utilities as prescribed through the passage of SB 350. The development of utility-specific GHG reduction targets is not expected to be completed before the adoption of this IRP; however, APU is well positioned to meet GHG reduction targets beyond the current

40% mainly as a result of increased renewables procurement and divestiture plans underway for coal resources under contract.

APU achieved its goal of 20% below 1990 levels through the increased renewable generation from 11% in 2010 to 33% of overall sales in calendar year 2015. Further GHG emissions reductions are forecasted to reach near the 40% reduction target upon the divesture of the San Juan Generating Station which occurred at the end of 2017. As shown in Graph 1, upon APU's exit from the Intermountain Power Project in 2027, APU's overall GHG emissions from its power supply portfolio is expected to reach approximately 70% below its 1990 emissions by 2028 based on projected GHG emissions from any of the portfolio scenarios analyzed and discussed further in Section VII.

Graph 1: APU GHG Reduction Targets



B. INCREASING PROCUREMENT FOR RENEWABLE RESOURCES

APU has steadily been increasing the renewable energy component of its resource portfolio since 2003. In response to Senate Bill 1078, the Anaheim City Council adopted a renewable portfolio objective in July 2003 requiring APU to provide 15% of retail energy requirements with energy from renewable resources by 2017. That objective was revised by Council Resolution No. 2006-187 in August 2006 to achieve a target of 20% by 2015 as a result of Assembly Bill 1362, which accelerated the statewide target to 20% by 2010. The passage of SB X1-2 in 2011 increased the State's renewables target to 33%

by 2020, and was further expanded in late 2015 through the passage of SB 350 which requires APU to provide 50% of its retail energy sales to customers from renewable energy resources by the year 2030.

The Renewable Portfolio Standard (RPS) is a key element of the State's strategy to reduce statewide GHG emissions. Today, APU delivers nearly one third of its retail electricity sales from renewable resources. APU is a fully resourced utility, meaning APU's resource portfolio has sufficient generation capacity to serve customer energy demand and meet Resource Adequacy requirements. The State's increasing renewable energy procurement mandates create a challenge in balancing the costs associated with the current resource portfolio with the added costs of further increasing the renewable energy component of the overall resource mix. Section VII further discusses the effect of an accelerated RPS, along with strategies to minimize costs, risk and maintain affordable rates for the customers.

C. TRANSFORMATION OF THE REGIONAL GRID

APU is a market participant within the CAISO, which manages approximately 80 percent of California's electric grid and operates a competitive wholesale market. The CAISO is also responsible for Grid reliability and efficiency. While California's RPS is one of the more effective ways of lowering emissions of GHGs, integrating a significant amount of variable renewable energy resources, such as wind and solar, into the physical electric power grid presents various challenges for Grid reliability and the stability of energy markets. As the State's share of variable renewable energy generation increases, the need for resources to respond to intermittent generation becomes critical for grid operators especially when this is occurring on a minute-by-minute basis, with changes in hourly, daily, and seasonal patterns of variable generation.

As a consequence of the State's RPS, including solar generation installed by residents and businesses, the CAISO is dealing with an over-supply of daytime electricity produced by solar generation. When there is less demand for electricity than there is supply, the result is a drop in wholesale electricity prices; which in turn forces generation to shut down (or curtail) until the demand for electricity increases later in the day. During times of extreme energy oversupply, the CAISO may need to send market signals through negative energy pricing, resulting in generators paying other entities to take the energy. This will lead to additional costs if market participants own generation that cannot be ramped down due to technology constraints such as non-dispatchable renewables or a minimum capacity requirement.

V. RENEWABLE ENERGY PROCUREMENT PLAN AND ENFORCEMENT PROGRAM

A. ELEMENTS OF THE RPS PROGRAM

A.1. PROCUREMENT TARGETS

Public Utilities Code Section 399.30(o), as amended by SB 350 (De Leon), directs the CEC to establish POU enforcement rules and procedures for the RPS. Unless otherwise provided herein, all section references will refer to the California Code of Regulations, Title 20, Division 2, Chapter 13, Sections 3200-3208 (Regulation). Section 3204 of the Regulation requires APU to adopt and implement a Procurement Plan to demonstrate that it procures a minimum quantity of electricity products from eligible renewable energy resources, including Renewable Energy Credits (RECs). The CEC, through its formal rulemaking process, adopted multi-year Compliance Periods and procurement targets for each calendar year (CY) through 2020. SB 350 continues the same multi-year Compliance Period construct and establishes a 50% RPS by 2030. The CEC is scheduled to adopt the 2021 through 2030 Compliance Period and annual procurement targets in 2018. The current and proposed (*) Compliance Periods and procurement targets are outlined below:

Compliance Period (CP)	Compliance Period Targets
CP 2 (CY 2014-CY 2016)	Total renewable procurement for CP 2 must be equal to or greater than the sum of: [(20% of 2014 retail sales)+(20% of 2015 retail sales)+(25% of 2016 retail sales)]
CP 3 (CY 2017-CY 2020)	Total renewable procurement of CP 3 must be equal to or greater than the sum of: [(27% of 2017 retail sales)+(29% of 2018 retail sales)+(31% of 2019 retail sales)+(33% of 2020 retail sales)]
*CP 4 (CY 2021-CY 2024)	Total renewable procurement of CP 4 must be equal to or greater than the sum of: [(34.8% of 2021 retail sales)+(36.5% of 2022 retail sales)+(38.3% of 2023 retail sales)+(40% of 2024 retail sales)]
*CP 5 (CY 2025-CY 2027)	Total renewable procurement of CP 5 must be equal to or greater than the sum of: [(41.7% of 2025 retail sales)+(43.3% of 2026 retail sales)+(45% of 2027 retail sales)]
*CP 6 (CY 2028-CY 2030)	Total renewable procurement of CP 6 must be equal to or greater than the sum of: [(46.7% of 2028 retail sales)+(48.3% of 2029 retail sales)+(50% of 2030 retail sales)]
*Post-2030	Compliance periods beginning on and after January 1, 2031, shall be three (3) years in length. Total renewable procurement in each three year compliance period must meet an average of 50% over each compliance period.

A.2. PORTFOLIO CONTENT CATEGORY REQUIREMENTS

Per Section 3202(a)(2), any renewable contracts executed after June 1, 2010 will be categorized into one of three portfolio content categories (PCCs). The table below describes the types of resources that are subject to the PCC limitations, and the minimums and maximums allowed for each Compliance Period. Any renewable contracts executed prior to June 1, 2010 are not subject to the following PCC limitations:

Portfolio Content Categories (PCCs)	Percentage Requirements (Post-June 1, 2010 Procurement)
PCC 1: Energy or RECs from eligible resources interconnected to a transmission network within the Western Electricity Coordinating Council (WECC) that: 1. Has its first point of interconnection within the metered boundaries of a California (CA) balancing authority area; or 2. Has its first point of interconnection to an electricity distribution system used to serve end users within the metered boundaries of a CA balancing authority area; or 3. Is scheduled into a CA balancing authority without substituting electricity from another source. If another source provides real-time ancillary services to maintain an hourly import schedule into CA, only the fraction of the schedule actually generated by the renewable resource will count; or 4. Has an agreement to dynamically transfer electricity to a CA balancing authority area.	CP 2: Minimum of 65% CP 3, and thereafter: Minimum of 75%
PCC 2: Energy or RECs from eligible resources interconnected to a transmission network within the WECC that must be matched with incremental energy that is scheduled into a CA balancing authority area.	CP 2: Maximum of 35% CP 3, and thereafter: Maximum of 25%
PCC 3: Energy or RECs from eligible resources that do not meet the requirements of PCC 1 or PCC 2, including unbundled RECs.	CP 2: Maximum of 15% CP 3, and thereafter: Maximum of 10%

B. PLANNING AND PROCUREMENT

B.1. PLANNING ACTIVITIES

APU's Integrated Resources (IR) division is responsible for managing APU's energy resource portfolio (both conventional and renewable). To effectively manage the overall resource portfolio, IR develops a Power Supply Forecast on an annual basis. When developing this forecast, IR considers several factors including, but not limited to, an assessment of the resource supply portfolio and a projection of customer energy and peak demand requirements. This annual review results in a twenty (20) year projection that includes all contracted projects, potential projects, and other viable technologies to fill resource needs that are required to meet California Independent System Operator (CAISO) reliability requirements, as well as legislative mandates. IR determines its expected renewable procurement needs by comparing its forecasted RPS procurement quantity targets to its forecasted energy deliveries from its renewable energy resource portfolio, all of which are key components of the Power Supply Forecast.

IR takes the RPS program's regulatory framework into account when planning for renewable procurement, and meets to discuss its RPS requirements and progress on a regular basis. This process includes a thorough analysis of project performance, as well as short-term and long-term RPS needs. Other factors taken into consideration while conducting this analysis include, but are not limited to: renewable integration costs, the risk of delay or failure associated with renewable resources contracted or under consideration, transmission availability, developer experience, financial considerations (including the ability of the developer to secure funding), technology (i.e., new technology versus proven technology), and any other factors that can potentially delay or indefinitely postpone a project.

IR's objective is to identify renewable projects that are viable and cost-effective, enhance APU's resource portfolio, and optimize each PCC in an effort to minimize overall costs.

State law requires APU to develop this Integrated Resources Plan (IRP) prior to January 31, 2019. This comprehensive plan outlines APU's activities in order to meet a 50% RPS by 2030 and greenhouse gas (GHG) emission reduction targets. It must also address impacts on customer rates, energy efficiency, system reliability and the integration of various distributed energy resources within the APU service area. The IRP describes APU's strategy for effectively managing its overall energy resource portfolio into the future. Going forward, the two components of the RPS Policy, (i.e., the Renewable Energy Resources Procurement and Enforcement Plans), will be incorporated into the IRP, which will be presented for review and recommendation by the Public Utilities Board, considered for approval and adoption by the Anaheim City Council, and updated at least once every five years thereafter.

B.2 PROCUREMENT (ORIGINATION)

APU intends to demonstrate its progress in reaching its RPS targets in compliance with State's established RPS goals; however, it is important to note that APU is fully resourced and additional resources will exceed the retail sales needs. Per PUC §399.15(a) "… in order to fulfill *unmet* long-term resource needs, the commission shall establish a renewable portfolio standard…" (emphasis added).

APU has sufficient long-term resources to meet anticipated needs. Future resource procurement plans will be based upon load forecasts, any new power supplies required, if any, to cover unmet needs, and divestiture of existing coal resources. Additionally, as a member of the CAISO, APU is mandated to procure resources to meet 115 percent (115%) of its forecasted peak demand for each month to ensure that more than sufficient resources are available to meet customer loads.

To date in the third Compliance Period, IR executed five (5) additional renewable energy contracts, which includes 36 MW of solar energy sourced within California. APU's procurement strategy incorporates both near and long-term renewable power purchase agreements to meet the complex requirements of the RPS Regulation.

APU routinely reviews its procurement strategy every month, not only for meeting its RPS goals, but to also ensure the reliability of its distribution system. In addition, APU evaluates the viability of energy storage, demand response, and distributed generation resources to maintain grid reliability and meet the State's overall energy policy goals.

C. STATUS OF APU'S RPS PORTFOLIO

C.1. PROGRESS TOWARD MEETING TARGETS

APU met the Compliance Period 1 target of an average 20% of its power from renewable resources, and its Compliance 2 target of providing no less than 25% of its power from renewable resources by the end of 2016. APU is on track to meet the RPS target of 33% by 2020. Planning activities undertaken in 2017 while developing the IRP incorporate a variety of renewable resources as a way to ensure continued diversification of the portfolio while progressing toward an aggressive goal of 50% renewables by 2030.

C.2. RENEWABLE RESOURCE PROCUREMENT PLAN

Appendix A – Renewable Procurement Plan provides a detailed summary of APU's Renewable Resource Energy Procurement Plan. The table includes all grandfathered and contracted resources, as well as any contracts being actively negotiated. This chart also provides expected RPS compliance percentages and expenditures. The data is based on actual data for past years and forecasted data for all future years. Appendix A may be revised, with the approval of the General Manager, without further approval by the Anaheim City Council to reflect updated Renewable Resource Procurement Plan information or data.

C.3. BANKING OF EXCESS PROCUREMENT

Due to the inconsistent nature of renewables development and energy production, there may be years when the APU exceeds its projected RPS targets. In order to preserve the investment our customers have made, and will continue to make, in the development of these resources, the legislature and State agencies recognized that the ability to use any excess procurement for future compliance is essential. Pursuant to Section 3206, the City Council may permit APU to accumulate excess procurement of eligible renewable resources in one Compliance Period to be applied to any subsequent Compliance Period. APU intends to continue banking any excess procurement, as appropriate, and will use any surplus to help satisfy its future RPS compliance targets in the most cost-effective manner.

C.4. REPORTING REQUIREMENTS

APU is required to provide the CEC with documentation and reports, pursuant to Section 3207. Compliance reports are due by July 1 after every Compliance Period; however, similar reports are required annually for the CEC to track each publicly owned utility's progress toward meeting RPS targets. APU has demonstrated full compliance for the years 2011-2013 in its July 2014 compliance filing to the CEC. The second Compliance Period filing covering the years 2014-2016 was filed ahead of the July 1 2017 deadline, and is awaiting verification from the CEC.

D. POTENTIAL COMPLIANCE DELAYS

D.1 COMPLIANCE PERIOD 2 EVENTS

As discussed in Section B.1. above, in planning its renewable procurement position and needs, APU accounts for potential issues that could delay RPS compliance. Unforeseen circumstances in the future may potentially hinder APU's ability to comply. Achieving renewable energy goals is dependent on the successful performance of renewable developers in meeting contractual obligations, completing construction milestones in a timely fashion, and achieving commercial operation. During Compliance Period (CP) 2, APU experienced delays associated with two renewable resource contracts; however, short-term renewable energy was purchased to maintain compliance. The first contract delay was caused by the developer's inability to secure site and fuel agreements in a timely manner, and the second contract delay was due to the difficulties the developer encountered with transmission interconnection and permitting. To the extent delays and resource underperformance occur, the amount of delivered energy which APU can rely upon to reach its goals is reduced.

APU's forward procurement strategy includes the probability of circumstances, such as the ones outlined above, occurring, and as such, APU considers procuring additional eligible renewable resources above and beyond planned procurement to account for potential energy delivery shortfalls. Going forward into the next Compliance Periods, APU will continue to consider all factors in the planning process that may have an effect on its renewables portfolio and delay timely compliance with the RPS.

E. COST LIMITATIONS

E.1. BACKGROUND

The State's RPS law permits the local governing board of each POU to implement, at its sole discretion, a cost limitation for its RPS activities, consistent with Section 3206(a)(3). The City Council, in the manner set forth in this and previous versions of the RPS Policy, has implemented a cost limitation in its RPS Policy for the protection of its customers and continues to review its methodology in coordination with updates to the Procurement Plan. Previous versions of the RPS Policy included a cost limitation based on a goal of 33% renewables by 2020. APU is revising the cost limitation methodology to account for costs related to the increased State goal of a 50% RPS by the year 2030.

Through the approval and adoption of this IRP, the Anaheim City Council is implementing a cost limitation that relies on:

- The most recent Procurement Plan (which is contained herein); and
- Procurement expenditures that approximate the expected cost of building, owning or operating eligible renewable resources, which does not include indirect expenses as described in Section 3206(a)(3)(B)(3); and
- The potential that some planned resource additions may be delayed or cancelled.

This cost limitation meets all of the requirements of Section 3206(a)(3). The cost limitation value which is contained herein may be updated on a periodic basis.

E.2. SUMMARY OF COST LIMITATION ELEMENTS

APU's cost limitation is intended to reflect current market conditions, address any disproportionate rate impacts to customers, and reflect the added costs of committing public funds to additional projects as some are delayed or permanently removed from a construction queue. The analysis for the cost limitation is calculated based on the most recent power supply forecast. The City Council, in ensuring that customers do not face a disproportionate burden, has the authority to implement a cost limitation, which may result in the temporary suspension of RPS compliance activities.

E.3. COST LIMITATION THRESHOLD

The City Council hereby approves and directs APU to implement the following RPS cost limitation threshold to prevent a disproportionate customer rate impact associated with the implementation of State-mandated RPS procurement targets:

In no event shall the cost of procuring any new renewable energy resources cause an increase in overall power supply costs greater than $0.01 per kilowatt-hour in any fiscal year during a 20-year planning horizon. A $0.01 per kilowatt-hour increase is considered to be an undue burden on customers as it represents a 10% increase over current power supply costs in a single year, which is approximately four times the expected rate of general inflation.

E.4. PROCESS FOR IMPLEMENTATION

APU continuously monitors its expenditure levels and will advise the City Council routinely of its RPS expenditures. Below is the process that APU will follow to advise the City Council when the threshold to implement its cost limitation is met and the direction it will take, as directed by City Council:

1) APU Staff will advise City Council, via staff report, that the threshold for the cost limitation has been reached and will recommend a course of action for City Council consideration.
2) City Council, at its sole discretion, may choose to implement the cost limitation provision and direct APU to cease its activities related to RPS compliance.
3) Through the direction provided by City Council, APU will either cease its activities related to RPS compliance or continue its RPS compliance activities.

E.5. DETAILS ON COST LIMITATION THRESHOLD

This section provides background on APU's actions, when a cost limitation threshold is reached.

1. Disproportionate Rate Impacts

APU forecasts RPS procurement costs when developing the annual power supply forecast. The forecast provides a projection of supply and demand, including costs, and provides an estimation of anticipated increases in costs. It is determined that renewable procurement costs that exceed an increase of $0.01/kWh will cause a disproportionate burden on customers. A $0.01/kWh increase is considered a disproportionate burden as it represents a 10% increase over current power supply costs in a single year, which is approximately four times the expected rate of general inflation. This cost limitation is a proactive measure which aims to prevent undue economic consequences of the RPS statute and Regulation on customers.

2. Projects Delayed or Cancelled

Per Section 3206(a)(3)(C) cost limitations can include "the potential that some planned resource additions may be delayed or canceled."

As discussed in detail in the Procurement Plan, APU staff contracts for the required amount of RPS resources, to meet compliance obligations. However, issues outside the APU's control (i.e., permitting, financing of the project, interconnection issues, cost projections, etc.) may delay or indefinitely postpone a project. As a POU, Anaheim must be selective when entering into contracts for renewable procurement as these contracts are associated with financial obligations and tie up public funds. The cost of the delay or indefinite postponement of any project should be included when determining detrimental rate impacts or calculating an increase to power supply costs.

3. Other Circumstances

The City Council may choose to implement additional cost limitations, consistent with the Regulation upon the occurrence of, but not limited to, the following examples:

- Changes in the Regulation

In the event that the RPS Regulation is modified, there is a possibility that contracted resources may not fully count toward APU's RPS, as anticipated. The cost of replacing the lost renewable energy that was expected to be delivered from these resources must be taken into consideration.

- Force Majeure

The occurrence of a Force Majeure event which adversely impacts the delivery of renewable resources and thereby increases RPS compliance costs. It is expected that such Force Majeure events will place an undue economic burden on Anaheim as well as its customers.

F. ENFORCEMENT PROGRAM

WAIVER FOR NONCOMPLIANCE

APU monitors its progress in reaching its RPS targets on a monthly basis, as well as through the APU's annual budgeting process, subject to the approval of budgeted expenditures by the City Council as recommended by the Public Utilities Board. The City Council is responsible for enforcing the RPS Policy through the Enforcement Program, and will consider any recommendation by the Public Utilities Board.

Current law authorizes the City Council to waive APU's compliance requirements, consistent with PUC §399.15(b)(5) and Section 3206(a)(2) of the Regulation, if APU can demonstrate any of the following conditions are beyond the control of the utility, and will prevent timely compliance. The conditions for waiver or delaying compliance include, but are not limited to the following (which may delay or indefinitely postpone a project):

1. Inadequate transmission capacity: [Section 3206(a)(2)(A)(1)]. There is inadequate transmission capacity to allow for sufficient electricity to be delivered from proposed eligible renewable energy resource projects using the current operational protocols of the California Independent System Operator (CAISO). City Council interprets this to mean the inability to bring eligible renewable resources into the CAISO due to transmission limitations. This includes instances where transmission outages may prevent renewable energy from entering into the CAISO market. This may cause APU to be out of compliance for a Compliance Period. The City Council has the authority to waive APU's compliance for this instance.

2. Permitting, interconnection, or other circumstances that delay procured renewable energy resource projects or insufficient supply of eligible renewable energy resources: [Section 3206(a)(2)(A)(2)]. Examples include, but are not limited to, the following:
    - Development (i.e., permitting, financing, etc.): City Council interprets this to include a renewable resource developer's inability to obtain financing, permits, interconnection, or the rights to build the project. This may cause APU to be short of compliance for a Compliance Period. The City Council has the authority to waive APU's compliance for this instance.
    - Operation (i.e., fires, accidents, outages, etc.): City Council interprets this to include any unforeseen circumstances preventing the renewable resource from being developed or delaying its output. This includes outages at the renewable energy facility. For example, if there is a wildfire, transmission outage, or facility outage that prevents resources from delivering energy into the CAISO may cause APU to be short of compliance for a Compliance Period. The City Council has the authority to waive APU's compliance for this instance.
    - Regulatory Delays: City Council interprets this to include instances where State agencies delay timely requests by APU for registering renewable resources, certifying renewable resources, and accepting renewable resources into its

renewable portfolio. In addition, these also include changes to State mandates, which may lead to a delay in compliance. The City Council has the authority to waive APU's compliance for this instance.

3. Unanticipated curtailment to address needs of a balancing authority: [Section 3206(a)(2)(A)(3)]. City Council interprets this section to include the CAISO directing a renewable resource to modify their energy obligations, due to the needs of the balancing authority. This may cause APU to be short of compliance for a Compliance Period. The City Council has the authority to waive APU's compliance for this instance.

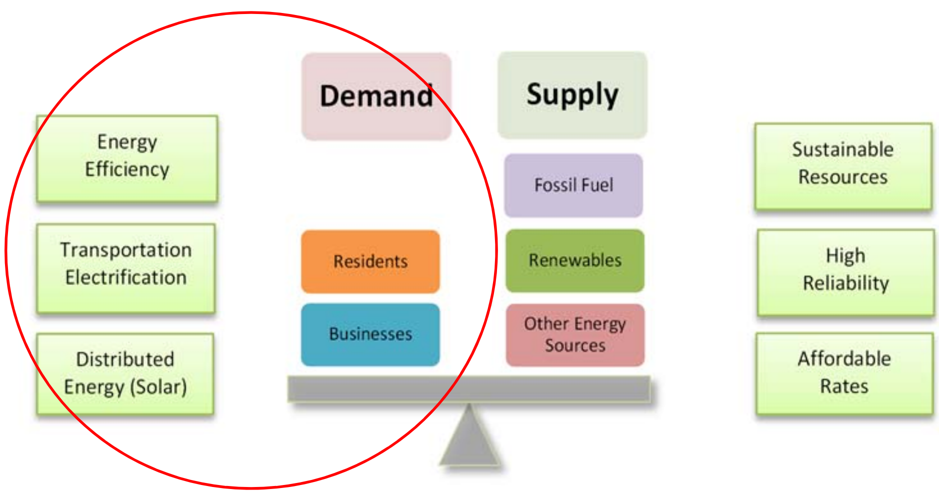
APU will monitor its progress in reaching its RPS targets; however, as listed above, there may be circumstances that prevent APU from procuring renewable resources to meet its RPS targets. In such an instance, APU will request City Council authority to approve a waiver of compliance, consistent with Section 3206(a)(2).

VI. ENERGY DEMAND AND PEAK FORECASTS

Integrated resource planning is the process in which APU evaluates a multitude of supply-side and demand-side resources to meet customer energy needs in an efficient, cost effective, and reliable manner. Traditionally this integrated resource planning activity was primarily to ensure that all cost-effective demand side resources were deployed prior to commitment to new supply-side resources such as power plants. Supply-side resources usually involved long lead times to develop and increased the use of fossil fuel causing the depletion of a limited resource and adverse effects on the environment. More recently, the passage of SB 350 now requires integrated resource planning to consider and address the following elements in addition to traditional demand-side and supply-side resources:

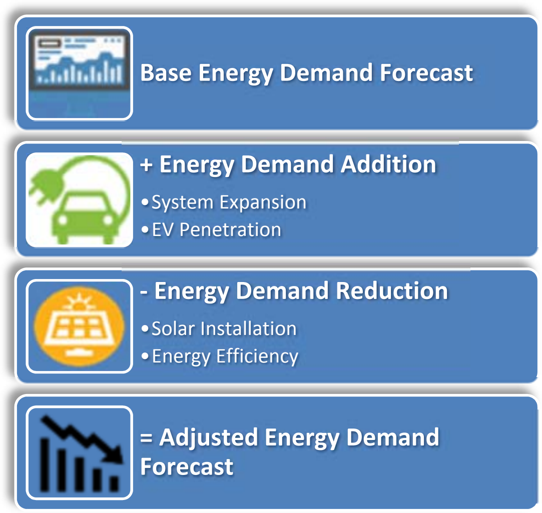
- Actively involve stakeholders. (APU proactively solicited feedback from residents, small to medium businesses, large businesses, high school students and the Latino Utilities Coalition.)
- Include energy efficiency and demand side management activities.
- Incorporate more robust analysis of more aspects of utility activities.
- Explicitly account for commodity price volatility and other risks to quantify the risk/reward tradeoff.
- Reflect a set of goals that are broader than just meeting energy demand, such as meeting RPS goals and GHG goals.
- Accommodate the load increases and decreases caused by transportation electrification and distributed energy resources such as rooftop solar.

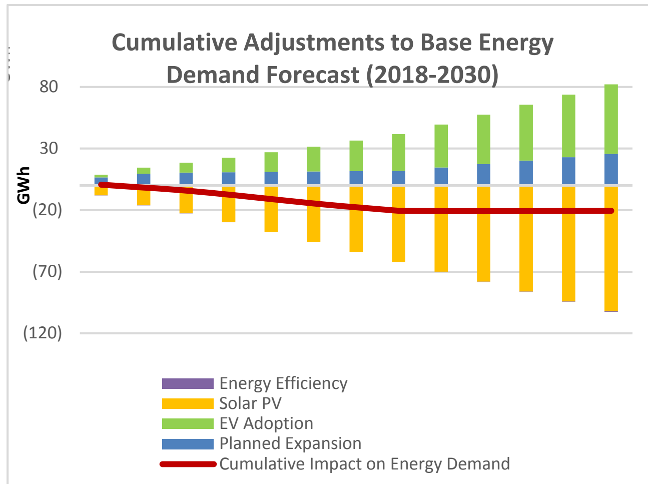
The energy demand forecast and peak forecast are both developed as a first step to evaluate APU's future energy needs. APU's forecasting methodology and different components of the forecasts are detailed below.



Pursuant to this IRP, APU performed a long-term statistical forecast of its expected load growth and then adjusted this base load forecast for the factors described above. This adjusted load forecast projects a total load reduction of 0.86% between 2018 and 2030, effectively a no growth energy demand forecast, which indicates that the expected customer expansion and EV growth is being offset by customer solar installation and energy efficiency reductions.

Graph 2: Cumulative Adjustments to Base Load Forecast





In determining APU's energy demand forecast, staff considered historical energy demand and customer growth trends as the basis for statistical modeling and econometric forecasting techniques to develop a "**base energy demand forecast.**" Once developed, the base forecast was further adjusted (referred to as the **adjusted energy demand forecast**) by planned system expansion, expected EV energy demand, estimated customer-side solar PV installation, and the effect of demand side management and energy efficiency. While system expansion and EV growth increase the energy demand, solar installation and energy efficiency programs reduce the energy demand.

The **adjusted energy demand forecast** was then used as the basis for the development of power supply expansion portfolio scenarios, which were analyzed to determine the recommended supply (resource) portfolio.

A. ENERGY DEMAND FORECAST - METHODOLOGY & ASSUMPTIONS

The energy demand forecast is determined in two steps:

The first step **establishes the base energy demand forecast**. It relies on traditional econometric forecasting techniques to develop relational equations that reflect historic consumption trends. The base forecast for energy demand is developed using a 5-year running average of historical temperature.

The second step **adjusts the base energy demand forecast** by taking into consideration residential and commercial projects within the City of Anaheim (City) that may affect energy demand. Information related to these projects is collected through collaboration with the City's Planning Department, APU Electric System Planning, and Business & Community Programs. Examples of such projects include City-wide development and expansion plans, customer-specific capacity additions and/or energy reduction plans, and the installation of commercial-scale solar photovoltaic (PV) and other behind-the-meter distributed generation resources. Project timelines are evaluated and incorporated into adjustments that either increase or decrease the "base" forecast.

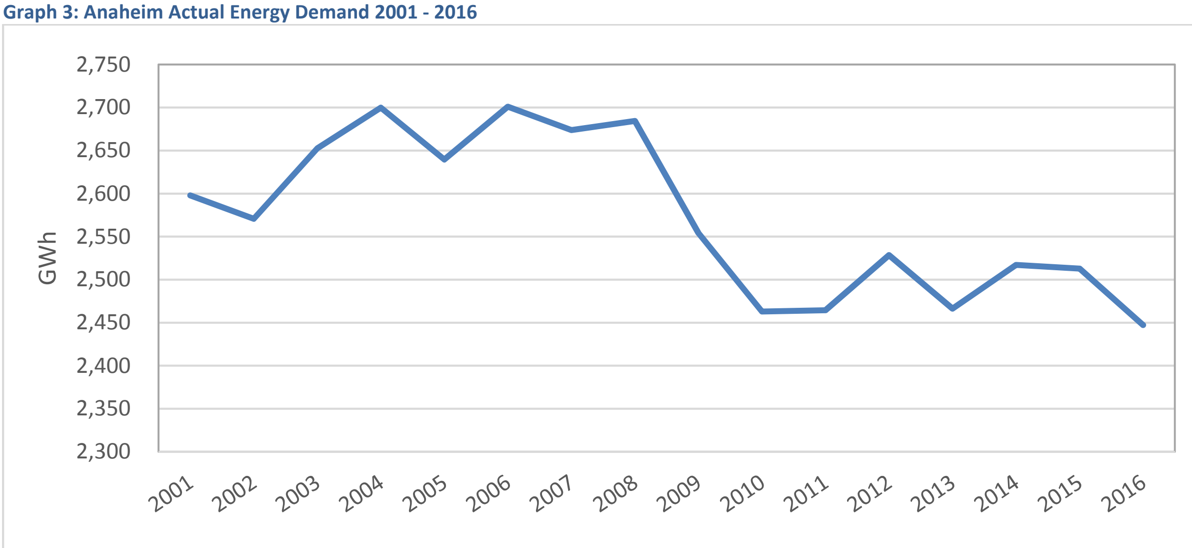
A.1. BASE ENERGY DEMAND FORECAST

Base Energy Demand Forecast

HISTORICAL ENERGY DEMAND

Prior to the economic recession in 2008, APU's average energy demand was between 2,500 and 2,700 GWh. From 2008 to 2011, a decline in energy demand growth was observed due to economic conditions impacting demand. The economy began to stabilize in 2011 and continued to improve through 2016. However, the corresponding demand growth was offset by behind-the-meter distributed generation, such as fuel cell and solar PV installation, as well as by energy efficiency in both the commercial and residential sectors.

Graph 3: Anaheim Actual Energy Demand 2001 - 2016



ECONOMETRIC MODELING

Econometric modeling is the application of mathematical and statistical methods to forecast future values and understand the relationship between variables. APU develops its forecast of total system energy consumption using econometric modeling. Hourly energy demand is estimated using least squares estimation and variables for expected temperature, calendar (weekday versus holiday), season and time effects (which capture specific hours as well as the cumulative impact of prolonged heat waves). Five years of historical hourly data are used to estimate the following econometric equation:

$$\textit{Total Energy}_t = \alpha + \beta_1 \textit{ Temperature}_t + D_1 \textit{ Holiday}_t + V_t + M_t + \varepsilon_t$$

Where:

$Temperature_t$ = Temperature at hour t

$Holiday_t$ = Dummy variable to identify weekend and NERC holidays

V_t = Vector of dummy variables for the hours

M_t = Vector of dummy variables for the months

ε_t = Error term

VARIABLES INCLUDED: TEMPERATURE FORECAST

APU owns calibrated equipment at the Linda-Vista Reservoir that records hourly temperature in the Supervisory Control and Data Acquisition (SCADA) system. The IRP energy demand forecast assumes normal weather conditions and uses average hourly temperatures from the past five years (2011 – 2016). The forecasted monthly temperatures in degrees Fahrenheit are summarized below:

Table 1: Temperature Summary

Month	Average	Minimum	Maximum
January	60	35	89
February	60	32	95
March	62	41	96
April	65	39	96
May	67	49	104
June	70	53	105
July	75	58	103
August	76	59	101
September	76	56	105
October	71	49	105
November	63	43	95
December	57	37	89

VARIABLES EXCLUDED: ECONOMIC AND DEMOGRAPHIC FORECAST

Anaheim is a fully developed Orange County city with historically consistent growth and median income level and employment rate. A series of modeling tests determined that the inclusion of economic and demographic variables leads to increased variability, and results in overly optimistic demand growth. The hourly demand estimation excluding these variables proved to be more accurate.

Although economic and demographic variables are excluded from the base model, planned expansions and energy reductions are included as adjustments after the econometric regression modeling is complete.

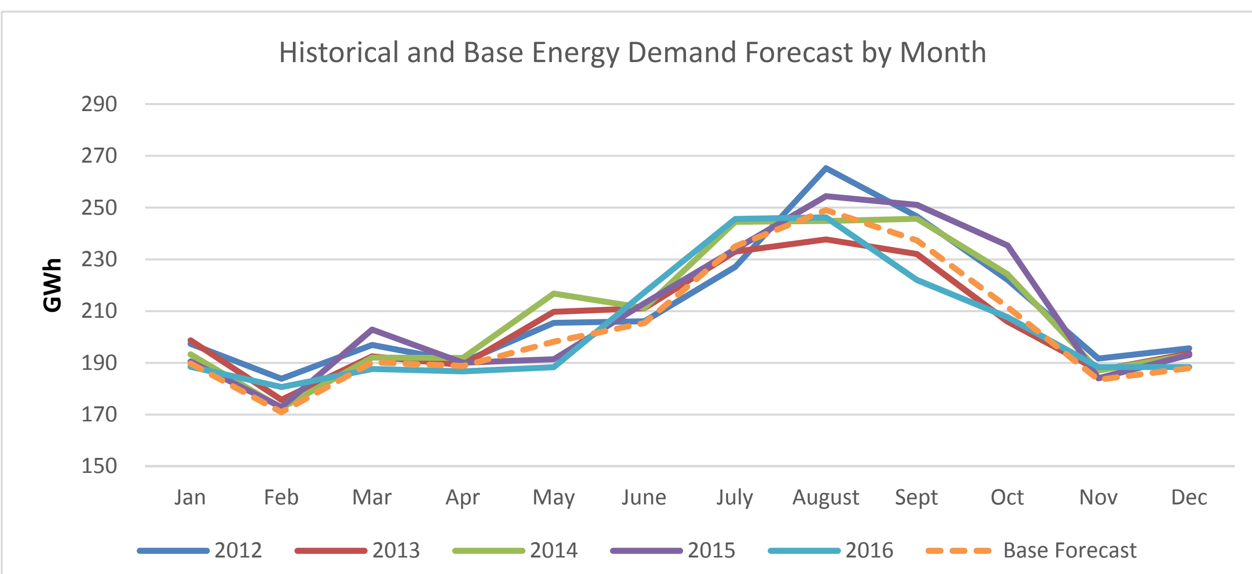
MODEL VALIDATION

The base econometric model is validated by comparing modeling results to historical energy demand data. Essentially, the model is used to develop energy demand forecasts for historical years 2013 through 2016. The forecast results are compared to historical actual values and analyzed for reasonableness. The base model was proven to produce efficient estimation results in the range of 0.4% to 2.1% variance for the testing period. Had the model been proven inefficient, alternative variables would have been introduced and a new model established to go through the validation process again.

FORECAST RESULTS

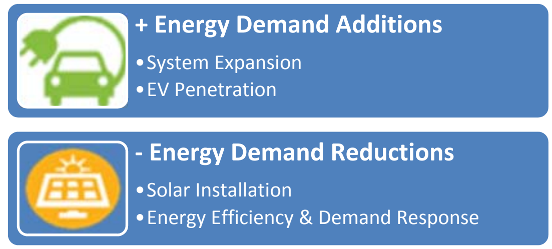
After validating the model, the base forecast for future years is generated and compared to historical energy demand. As seen in Graph 4, the energy demand forecast is comparable to historical energy demand. Overall, annual energy demand shape remains fairly constant, while peak demand appears to be lower than that of recent years. This is mostly due to the assumption of normal weather conditions rather than the incorporation of heat shocks in the base model.

Graph 4: Historical and Base Energy Demand Forecast by Month



A.2. ADJUSTMENTS

Planned energy growth and reductions are included as adjustments to the base economic model. Adjustments include planned new development, electric vehicle growth, behind-the-meter distributed generation, and energy efficiency targets.



This section focuses on the energy demand impact. The design, funding and details of these programs can be found in the following sections:

X. Transportation Electrification

XI. Solar and Other Distributed Generation

XII. Energy Efficiency and Demand Response Programs

XIII. Programs for the Low Income and Disadvantaged Communities

SYSTEM EXPANSION

Most of the open land in Anaheim is fully developed. While new building developments may contribute to energy demand increase, a corresponding decrease also incurs from the demolition of existing buildings and infrastructure. As such, it is not appropriate to apply a growth rate based on historical trends. Rather, new development data is gathered from City permits and from Electric System Planning, and these net impacts to energy demand are applied to the base model.

Anaheim's most recent development projects are expected to cumulatively contribute an additional 33 MW capacity to Anaheim's distribution infrastructure through 2030. When estimating the impact to load, staff took into consideration both the distribution system expansion and the varying levels of capacity factors for each customer sector.

EV PENETRATION & TRANSPORTATION ELECTRIFICATION

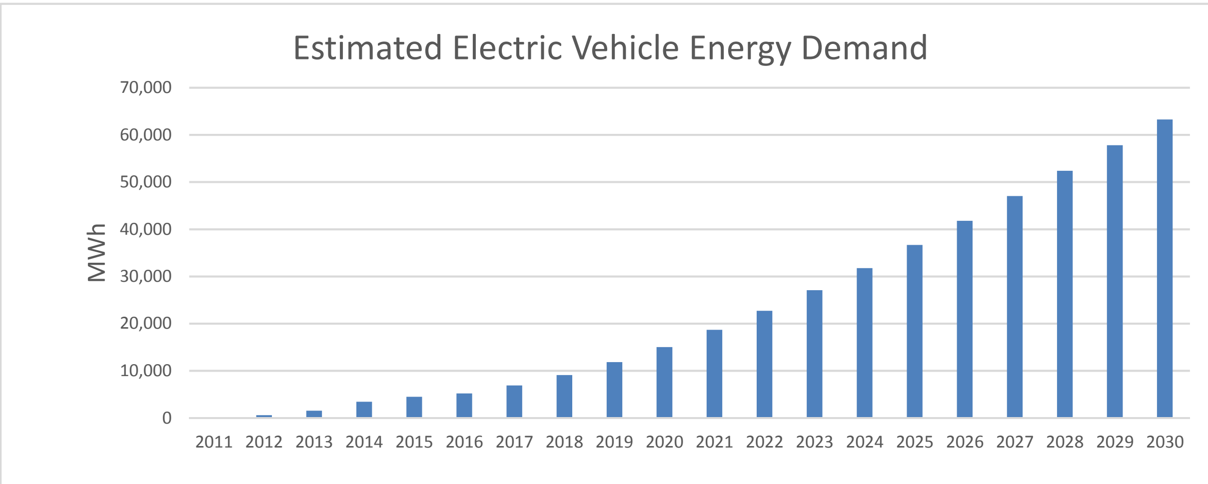
Electric vehicle growth is estimated using the CEC "Transportation Electrification Common Assumptions 3.0" workbook published in 2017[1]. Anaheim's electric vehicle energy demand forecast adopts the CEC growth assumption to meet the Governor's Order for 1.5 million electric vehicles on the road by 2025, and assumed growth to 2.6 million electric vehicles on the road by 2030.

[1] "2016 SB 350 Common Assumption Guidelines for Transportation Electrification Analysis", Version 3.0, Updated April 6, 2017. This workbook is subsequently replaced by updated versions and no longer available via the CEC website. The most updated version is available for download at http://www.energy.ca.gov/sb350/IRPs/. A comparison of Version 3.0 and the updated version may be found under Section IX. GREENHOUSE GAS EMISSION REDUCTION.

According to the model within the CEC workbook, APU's share of total California registered electric vehicles is 0.63%, or an estimated 16,280 electric vehicles by 2030.

To estimate energy demand growth, APU adopted the CEC's assumptions in the workbook in terms of energy consumption. According to the workbook, the 16,280 electric vehicles will contribute up to 63,261 MWh in energy demand growth in Anaheim in 2030.

Graph 5: Estimated Electric Vehicle Energy Demand Growth



SOLAR INSTALLATION & OTHER DISTRIBUTED GENERATION

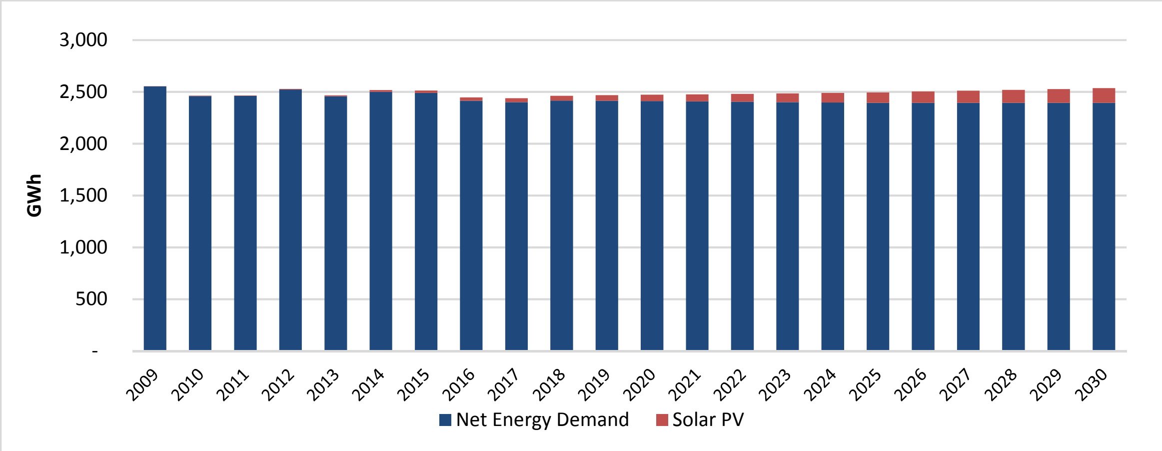
Historical behind-the-meter distributed generation information is obtained from SB 1 and City permit applications. This includes micro turbine, fuel cell, and photovoltaic (PV) installations.

Short-term PV installation growth is estimated using system size data listed on the resident's permit application. Long-term PV installation growth is estimated using a linear trend of historical installation totals. APU estimates to have 33 MW of installed PV capacity by 2019, and 87 MW by 2030. To estimate PV generation, a proxy capacity factor of 18.38% is applied to the PV capacity forecast. Detailed solar PV capacity calculation and peak impact analysis may be found in the "Peak Shift Analysis" section.

In 2019, behind-the-meter solar distributed generation is estimated to account for 2.1% of APU's total energy demand and is expected to grow by 0.3% annually reaching a total of 5.4% of total energy demand by 2030.

Graph 6 shows the estimated annual impact of behind-the-meter solar PV installation growth.

Graph 6: Estimated Behind-the-Meter Solar PV Impact to Energy Demand



Planned distributed generation projects other than solar PV are forecasted only in the short term, with system size estimates obtained from Electric System Planning.

ENERGY EFFICIENCY

In accordance with AB 2021, APU is required to establish specific annual energy saving goals as a percentage of total annual retail electric consumption. SB 350 also mandated that the CEC develop utility-specific energy efficiency saving targets to help achieve doubling statewide energy efficiency savings in electricity and natural gas end uses by 2030.

APU, in conjunction with other members within the California Municipal Utilities Association, contracted with Navigant Consulting, Inc. (Navigant) to identify all potentially achievable cost-effective electricity efficiency savings and establish annual targets for energy efficiency savings for 2018-2027. The final report "Energy Efficiency in California's Public Power Sector"[2] was published and submitted to the CEC in 2017. Anaheim City Council adopted APU's ten-year energy saving goal in March 2017, based on study results from the Navigant report.

APU's energy saving goal, along with its impact to Energy Demand, are summarized in Table 2.

Table 2: APU Energy Efficiency Targets including Codes & Standards (Navigant Study)

	Targets w/ C&S													
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028 *	2029 *	2030 *	Avg. 10 Yr.
kWh	1.15%	1.15%	1.09%	1.06%	1.04%	1.00%	0.95%	0.91%	0.86%	0.80%	0.80%	0.80%	0.80%	1.00%
kW	1.11%	1.12%	1.13%	1.15%	1.19%	1.14%	1.15%	1.13%	1.09%	1.04%	1.04%	1.04%	1.04%	1.13%

* 2028-2030 are projections based on 2027 targets. 10-Yr Average Calculated for 2018-2027.

APU's voluntary demand response program is only called upon under extreme conditions, and therefore is not included in the energy demand adjustments under normal weather conditions. In addition, the

[2] https://www.anaheim.net/DocumentCenter/View/11240

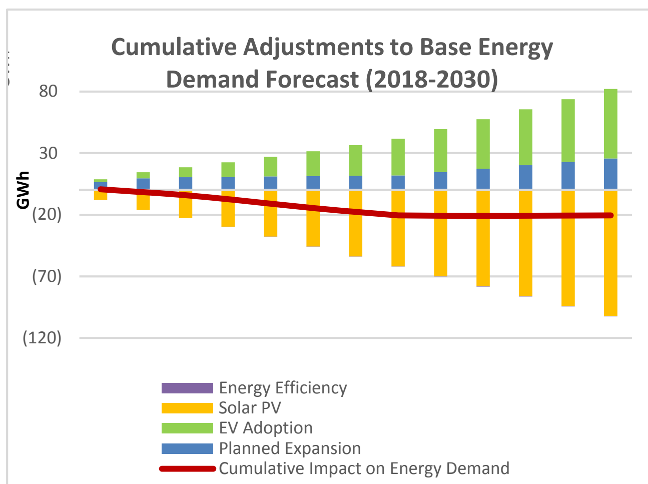
pilot residential demand response program generated 794 kWh savings in summer 2017. It is considered negligible to APU's total energy demand at this time. Estimated adjustments for demand response reductions will be calculated when future program expansion demonstrates greater impact to the total energy demand.

A.3. ADJUSTED BASE ENERGY DEMAND FORECAST

In total, APU expects a 0.86% net energy demand reduction between 2018 and 2030, which is essentially a no growth forecast. The net energy demand forecast is used in Section VII. Resource Portfolio Evaluation to determine the recommended resource portfolio to meet APU's future energy needs.

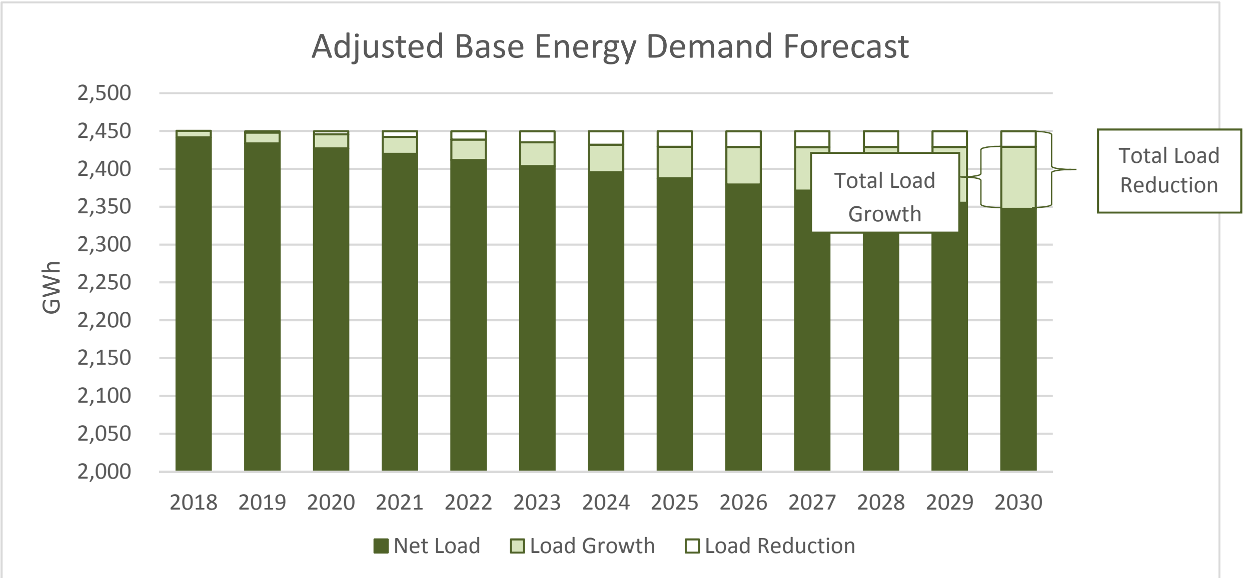
Graph 2 displays the estimated cumulative impacts to the Base Energy Demand Forecast. The energy demand additions are estimated to increase by 82 GWh cumulatively due to planned expansion projects and electric vehicle growth. During the same period, solar PV and energy efficiency are estimated to reduce the energy demand by approximately 102 GWh cumulatively. The overall cumulative net energy demand reduction is estimated to be approximately 20 GWh as indicated by the red line on Graph 2.

Graph 2: Cumulative Adjustments to Base Load Forecast



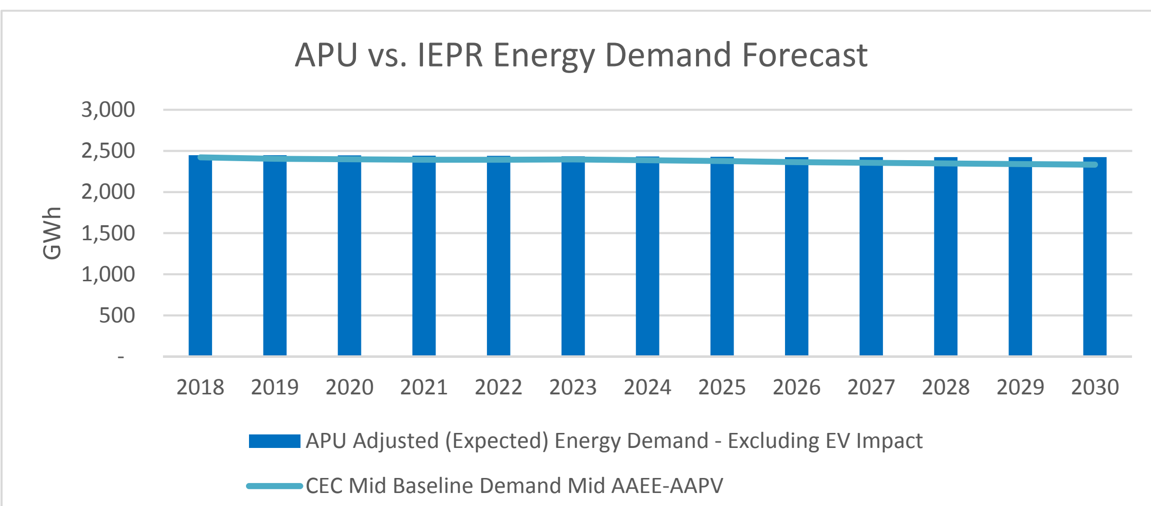
Graph 7 below depicts the Adjusted Energy Demand Forecast. The sum of all three bars is the anticipated Base Energy Demand Forecast, assuming no growth or reduction. Additions such as planned expansion projects and electric vehicles are displayed by the light green bar. The total Reductions are displayed by both the light green and white bars. The Adjusted Energy Demand is the sum of the dark green and light green bars. The remaining white bar is the estimated net energy demand reduction per year.

Graph 7: Adjusted Base Energy Demand Forecast



APU's energy demand forecast was completed in 2017. The CEC released its energy demand forecast for the 2018 Integrated Energy Policy Report (IEPR) in February 2018. Staff compared APU's adjusted (or expected) energy demand – excluding EV Impacts – against the IEPR demand forecast: Medium Baseline Demand with Medium Additional Achievable Energy Efficiency (AAEE) and Additional Achievable Photovoltaic (AAPV). APU's forecast is very close to the IEPR forecast in the early years, with a 4% variance observed by 2030. The difference is considered acceptable for planning purposes. In addition, a range of high and low energy demand will be tested under Resource Portfolio Evaluation – Stress Testing.

Graph 8: APU vs. IEPR Energy Demand Forecast

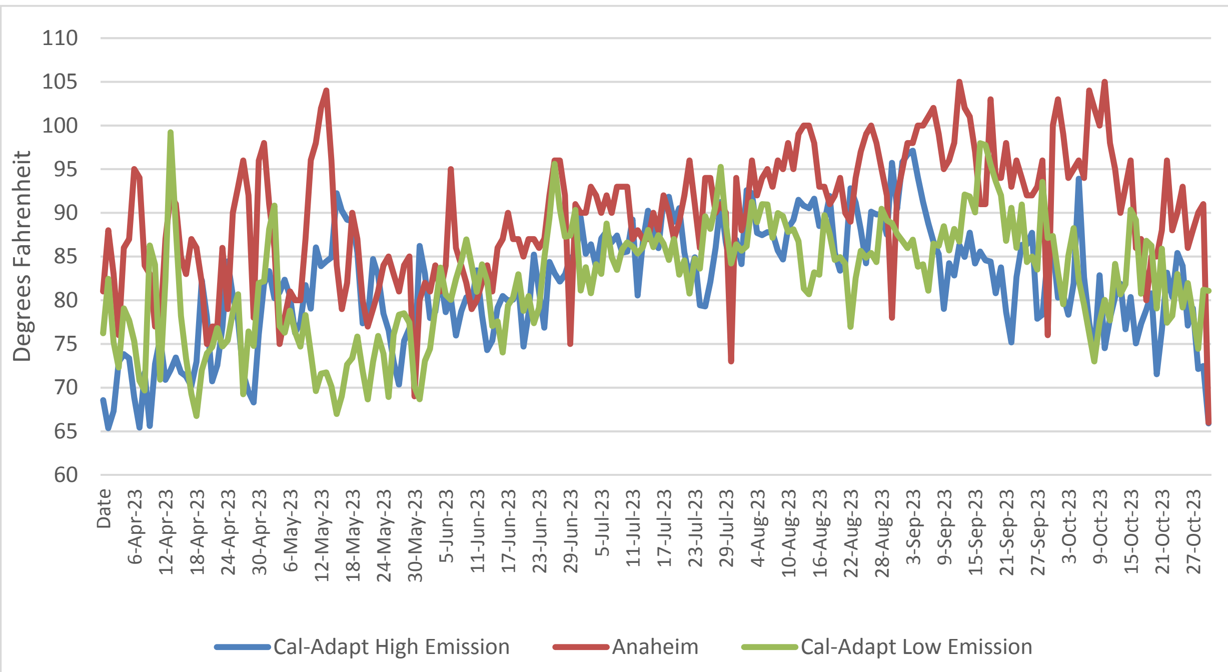


A.4. OTHER CONSIDERATIONS - EXTREME WEATHER

It is important to analyze the impact of weather extremes on energy demand due to its sensitivity related to temperature changes. Extreme temperature forecasts under high and low emission scenarios are available through Cal-Adapt, a climate change resource database developed by the Geospatial Innovation Facility at the University of California, Berkeley with funding and advisory oversight by the California Energy Commission.

The daily extreme temperature forecast data for the Anaheim area was obtained through Cal-Adapt[3] and then compared to APU's internal temperature forecast, which was developed using five-year minimum and maximum temperatures. APU's forecast consistently produces higher extremes than the Cal-Adapt forecast. The deviations between the forecasts are shown in Graph 9, which displays the high and low emissions Cal-Adapt high temperature forecast compared to APU high temperature forecast for the spring and summer of 2023. As the APU forecast produces higher extremes, it was selected to be the preferred temperature forecast to conduct the extreme weather analysis on energy demand.

Graph 9: Cal-Adapt vs APU Maximum Temperature Forecast



The econometric model described in VI.A.1. estimates a coefficient of 1.16 MWh for the temperature variable. This is interpreted as an increase in energy demand of 1.16 MWh for every degree Fahrenheit increase. For example, an increase in temperature of 20 degrees Fahrenheit results in a corresponding increase in demand for that hour of 23.2 MWh. Applying the extreme temperature forecast to the economic model produces a bandwidth of expected energy demand under high and low temperature extremes.

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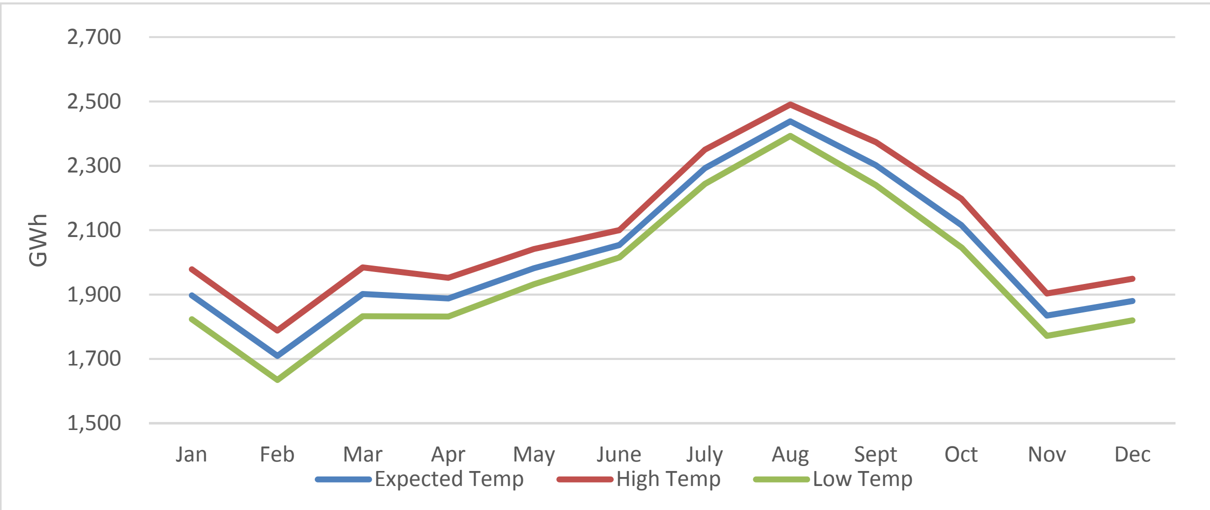
[3] http://cal-adapt.org/

Graph 10 below displays the estimated deviations from expected energy demand due to extreme weather impacts. The high weather extreme results in an increase from expected energy demand of 81 GWh annually, with the highest monthly impact in the month of October of 8.2 GWh. The low weather extreme results in a decrease from expected energy demand of 71 GWh annually, with the largest decrease being in the month of February of 7.5 GWh.

Graph 10: Forecasted Energy Demand with Extreme Temperatures



The energy demand variation due to extreme weather impacts will be used to stress test the resource portfolio in VII. F. Stress Testing.

B. PEAK FORECAST - METHODOLOGY & ASSUMPTIONS

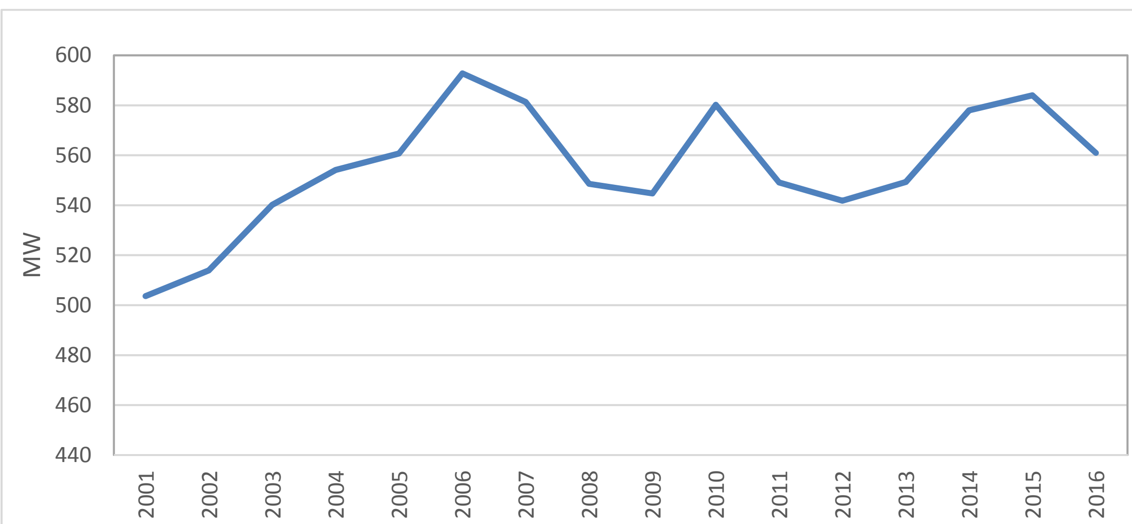
The peak forecast is also developed along with the energy demand forecast for use in consideration of the reliability aspects of power supply Resource Adequacy and electric distribution system planning:

- Peak forecast is used to determine the Resource Adequacy capacity needed to meet reliability requirements.
- Hour-by-hour peak and energy profile analysis is used to determine which resource's generation portfolio provides the best match. It also assists APU's effort to explore possibilities in using clean energy to meet the peak demand.
- Electric System Planning relies on the long-term peak forecast to plan for necessary distribution system expansion.

B.1. CONSIDERATION OF THE HISTORICAL SYSTEM PEAK

Although APU's total energy demand declined from 2008 to 2011, the total system peak has fluctuated over the past several years between 540 and 580 MWh. Anaheim's annual system peak is typically observed in the month of September, when temperatures average 76 degrees and reach up to 105 degrees.

Graph 11: APU Historical Peak Demand



B.2. DEVELOPING THE PEAK FORECAST

When developing the peak demand forecast, APU considers historical load factors.

APU's load factor is calculated by taking the total energy demand for each month and dividing it by the peak demand for the same month. Historical average load factors are calculated for each month for the most recent five years. The load factors are applied to the adjusted monthly energy demand forecast to develop the peak demand forecast.

Table 3: Historical Load Factors (as of December 2017)

Month	2013	2014	2015	2016	2017	AVERAGE
July	68%	67%	66%	69%	62%	66%
Aug	68%	60%	65%	65%	63%	64%
Sept	63%	59%	59%	60%	58%	60%
Oct	57%	72%	62%	59%	50%	60%
Nov	67%	70%	66%	79%	62%	69%
Dec	78%	77%	88%	78%		80%
Jan	80%	73%	79%	78%		77%
Feb	80%	77%	72%	69%		74%
Mar	75%	76%	68%	75%		74%
Apr	77%	66%	62%	68%		68%
May	58%	55%	61%	75%		62%
June	64%	74%	66%	54%		64%

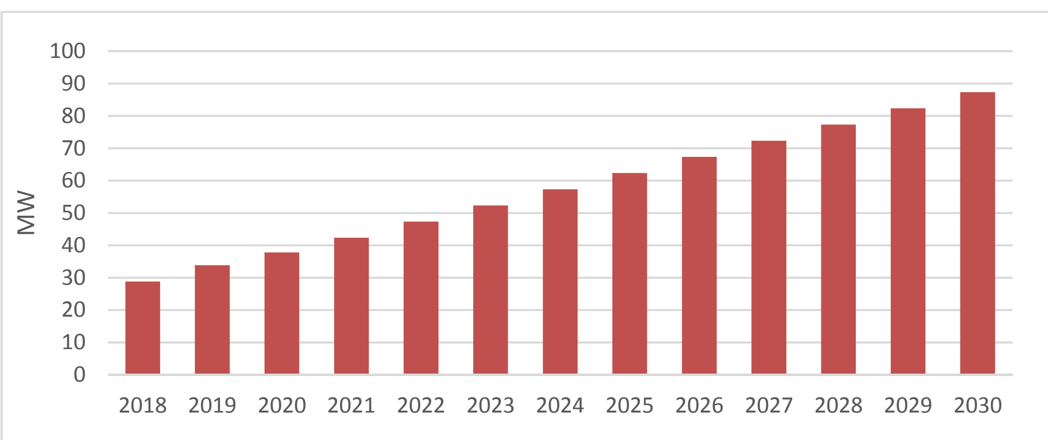
The peak demand forecast is validated by comparing the model's "backcast" output to the previous five year's actual data. The peak forecast's accuracy to predict monthly peak is between 0.3% and 3.5%. The annual peak forecast accuracy was in the range of -1% to 5% and within the acceptable confidence level.

B.3. OTHER CONSIDERATIONS

Peak Shift

APU estimates to have 33 MW of installed PV capacity by 2019 and 87 MW by 2030. Graph 12 details the estimated installed PV capacity for APU's service territory.

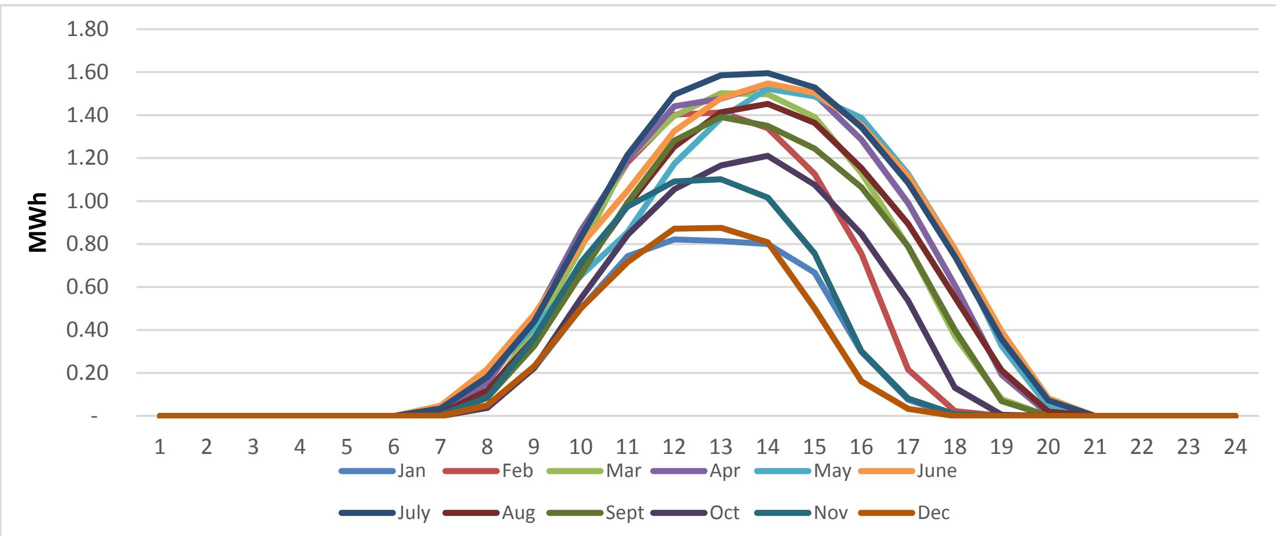
Graph 12: Estimated Distributed (Behind-the-Meter) Solar PV Capacity



To develop an estimation methodology for customer-owned, behind-the-meter solar PV generation, APU studied the solar generation from the City-owned Anaheim Convention Center solar PV system. The system generates approximately 3,400 MWh of solar energy per year (as recorded in 2015 and 2016), and has a capacity factor of 18.38%.

On average, July produces the highest generation per year, with 12.5 MWh per day. The month of December produces the least amount of generation per year, on average with 4.75 MWh per day. Graph 13 details each month's average hourly solar profile, as derived from the generation of the Anaheim Convention Center solar PV system. Peak solar generation is at noon November through March and at Hour 13 (1 PM) for the remainder of the year.

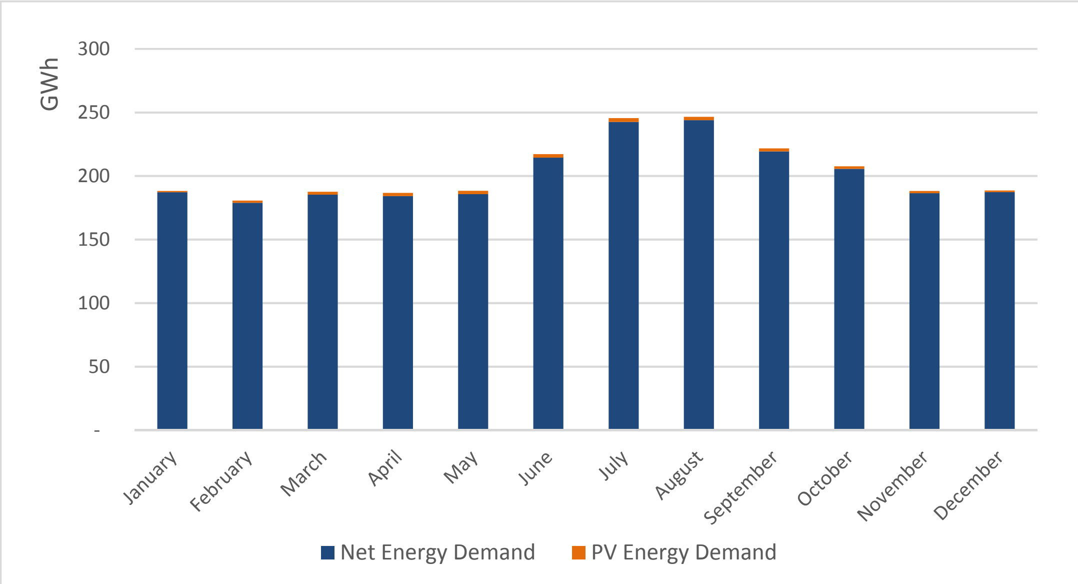
Graph 13: Average Hourly Solar Profile by Month: Anaheim Convention Center



Although production varies from system to system, the calculated capacity factor from the Anaheim Convention Center serves as a strong proxy to estimate production from installed private PV capacity within the City. This is especially true because the Convention Center is located in the center of Anaheim and is capable of capturing City specific weather effects.

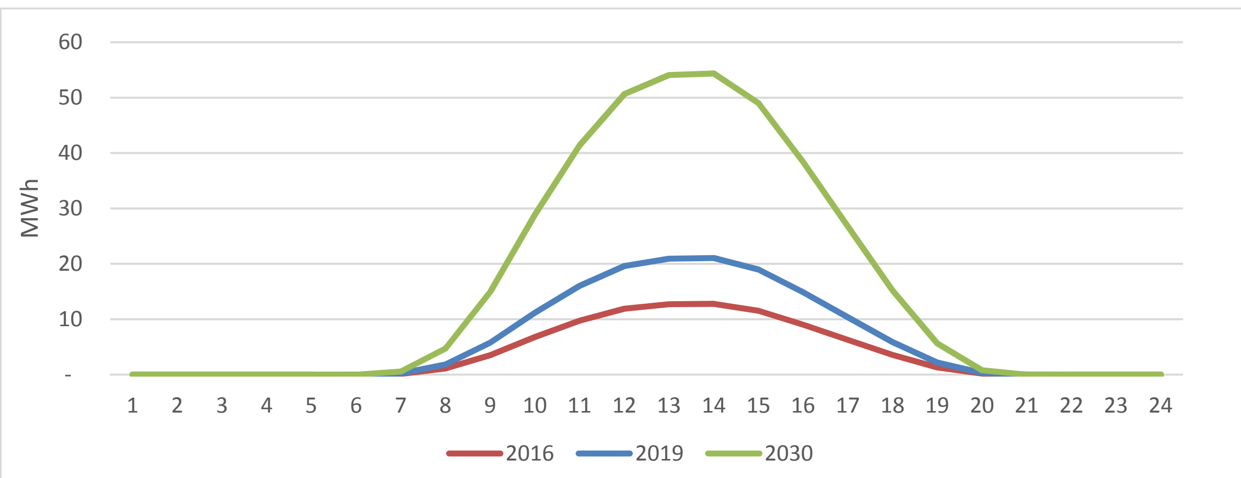
To calculate total distributed solar generation, the 18.38% capacity factor is applied to PV capacity data collected from SB 1 applications and City permits. Graph 14 details the estimated monthly distributed solar generation in 2016, and its effect on APU energy demand. The total estimated effect on energy demand using the proposed methodology for 2016 was 26,235 MWh, or a 1% reduction of Anaheim's total energy demand.

Graph 14: Estimated Distributed (Behind-the-Meter) Solar PV Impact to Energy Demand



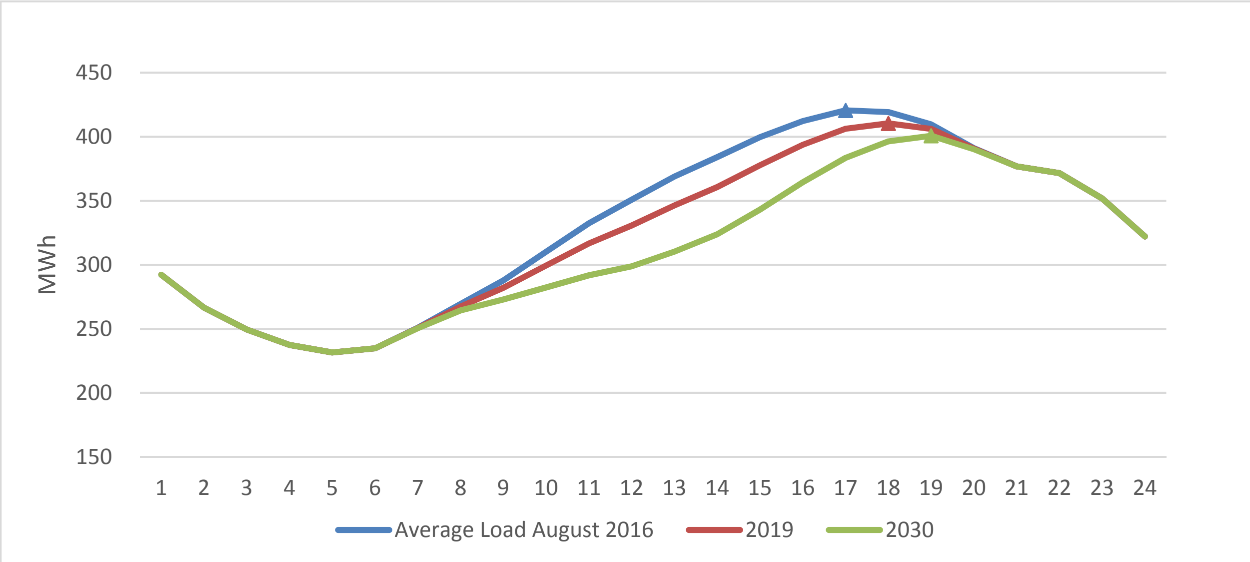
The profile for distributed solar generation can also be estimated using the convention center solar shape. Graph 15 details the estimated average hourly shape for total distributed solar generation for 2016, 2019 and 2030.

Graph 15: Estimated Average Hourly Shape for Distributed Solar Generation



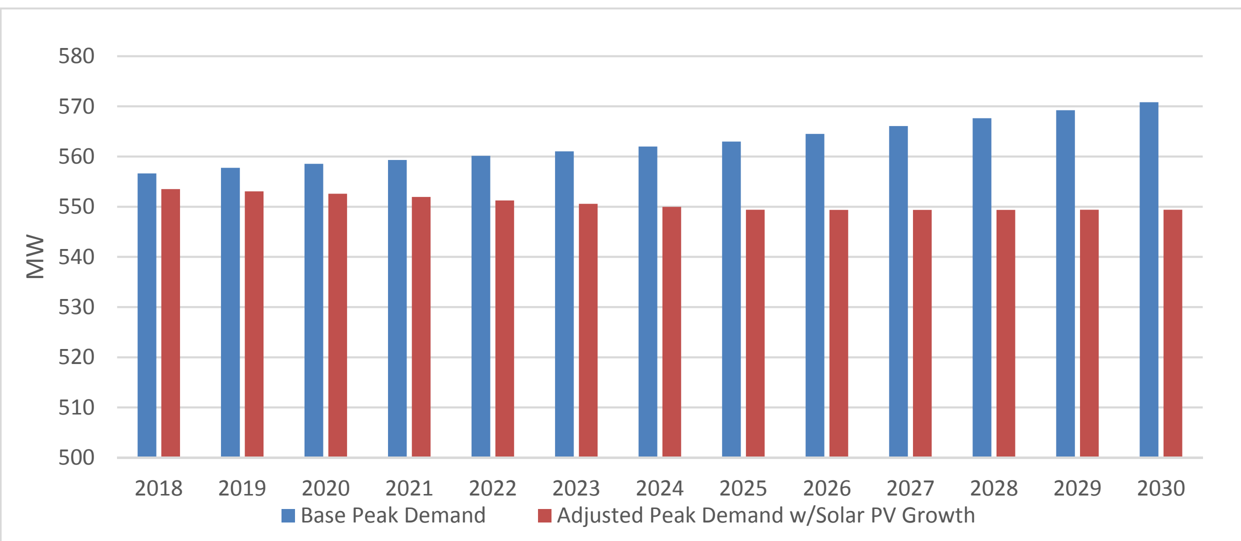
The estimated solar shape was applied to the daily energy demand forecast to estimate the future peak shift for APU energy demand. Assuming distributed solar grows as expected; there is a corresponding peak shift from hour 17 to 19 by 2030 as depicted in Graph 16 below. Peak demand is estimated to shift from hour 17 in 2016 to hour 18 in 2019, and hour 19 by 2030.

Graph 16: Peak Demand Shift



In addition to shifting the traditional peak hour, the solar PV penetration will also result in a peak reduction of approximately 2 MW every year throughout 2030. Graph 17 details the estimated cumulative impact to peak demand due to solar growth.

Graph 17: Estimated Annual Peak Demand



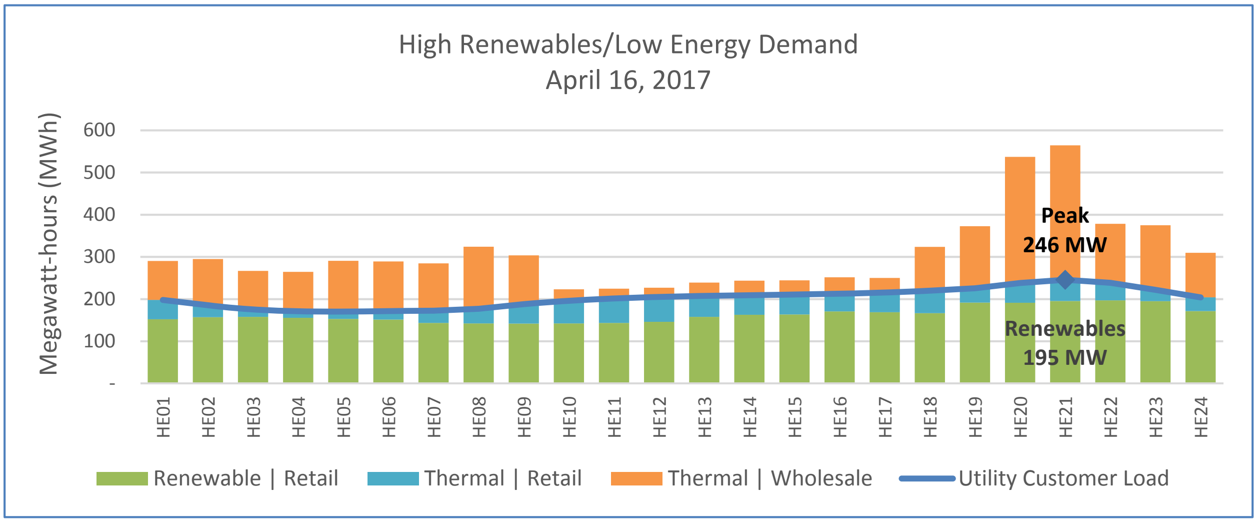
Clean Peak Analysis

Aligning renewable generation with peak demand is a current industry challenge.

In an effort to meet peak demand with renewable or other clean energy resources, APU takes into consideration its existing renewable generation portfolio, efficiency of Grid operations, energy storage options and forecasts, distributed energy resources, and energy reduction measures such as energy efficiency and demand response programs. The comprehensive consideration ensures APU meets energy and reliability needs during its peak, while reducing the need for new/additional electric generation, distribution, and transmission resources.

During certain times of the year, system peak can be served with a higher percentage of renewable energy. As an example in April 2017, the Intermountain Power Plant (IPP)[4] underwent a scheduled maintenance outage for most of the month, which caused a significant reduction in generation capacity. The energy need was replaced by two firmed and shaped renewable contracts, supplemented with ample wind and hydro energy that was available during the same month. On April 16, 2017, APU's 246 MW peak was served by 80% or 195 MW of renewables.

Graph 18: Renewables Serving Peak Demand – Day with High Renewables & Low Energy Demand



During other times of the year, serving the peak with renewable energy faces its challenges. This is generally due to a higher peak demand, renewable resource availability, and CAISO dispatch signals. APU employed its voluntary residential demand response events in summer 2017 to reduce energy demand; however, additional energy was still needed in the hot and humid summer days.

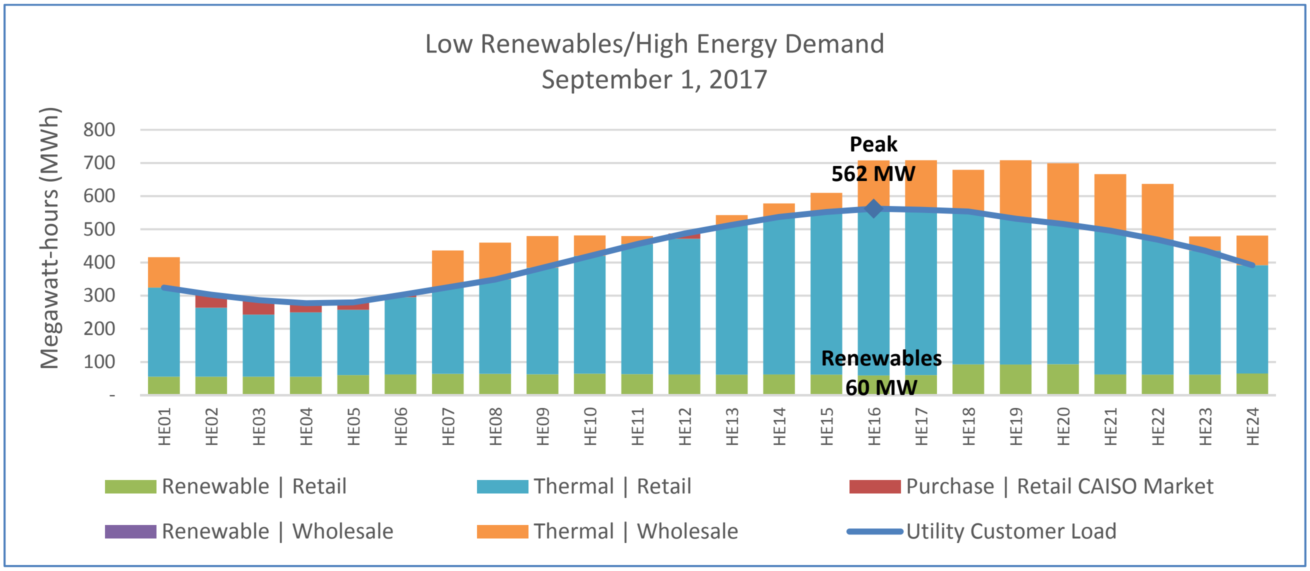
On September 1, 2017, APU reached a system peak of 562 MW; more than double the system peak in the previous example. During the peak hour, only 11% or 60 MW of renewable energy was available to meet the demand for various reasons, which included:

- De-rated landfill and geothermal generating units due to extreme heat;
- Small hydro producing less than 60% of April energy output; and
- Near zero wind output.

Also during the peak day, the CAISO dispatched APU's fossil fuel units to meet not only the APU peak, but also the system demand of other California load serving entities. The orange bars in Graph 19 indicate the thermal (non-renewable) energy APU sold into CAISO market, per market dispatch signals.

[4] Details of the power plant may be found in Section VIII.B. Generation and Transmission Resources

Graph 19: Renewables Serving Peak Demand – Day with Low Renewables & High Energy Demand

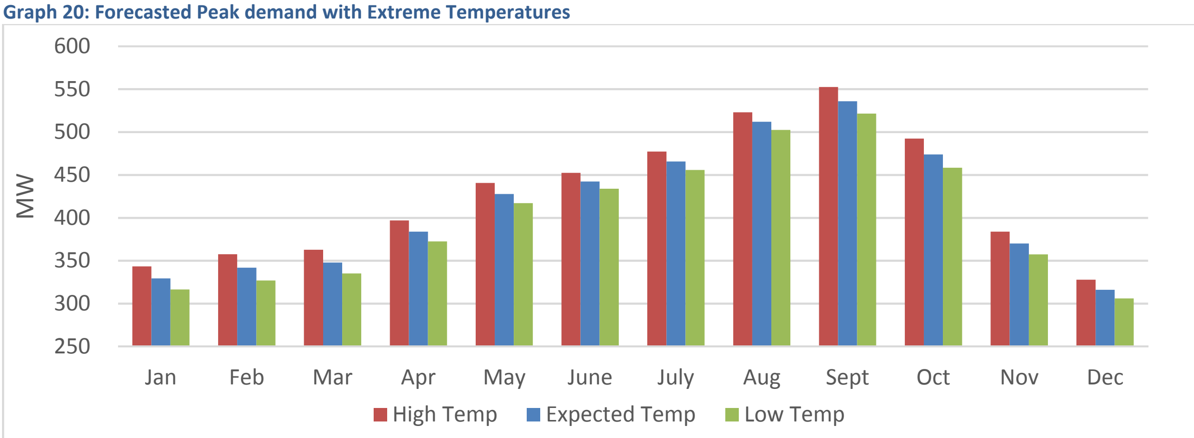


Other than reducing peak demand through efficiency measures and demand response programs, APU takes into consideration how renewables or other zero emission resources may provide more clean energy during the peak hour. Energy storage is periodically evaluated; in addition, the location and generation profile of new renewable projects are also considered. The goal is to acquire renewable projects with generation profiles most aligned with APU's energy demand profile.

Extreme Weather Impacts

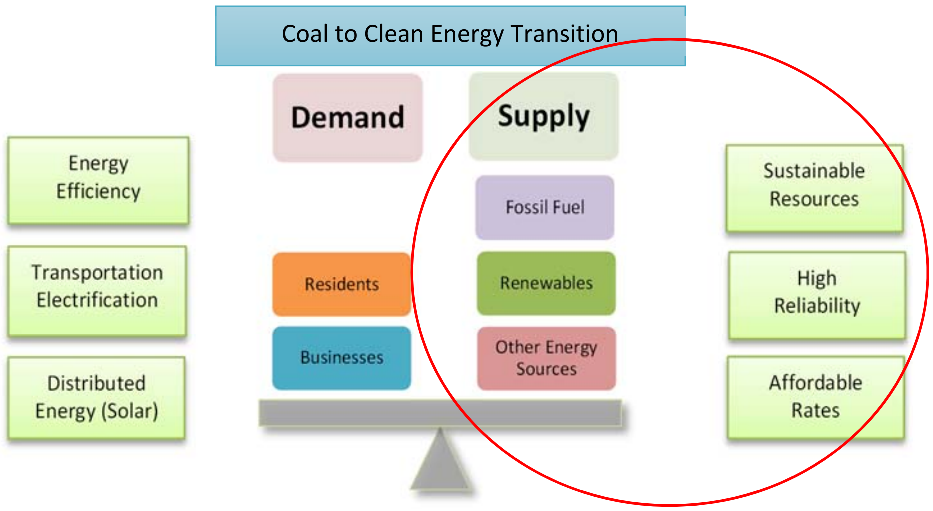
Peak demand estimates are obtained for the extreme weather analysis using the load factor methodology, as described in VI.B.2. DEVELOPING THE PEAK FORECAST. Graph 20 displays the impact of extreme temperatures on peak demand. On average, peak demand is estimated to be 14 MW higher with extremely high temperatures, with the highest impact of 18 MW in October. Similarly, peak demand is estimated to be 12 MW lower with extremely low temperatures, with the highest impact of 15 MW in October.

Graph 20: Forecasted Peak demand with Extreme Temperatures



VII. RESOURCE PORTFOLIO EVALUATION

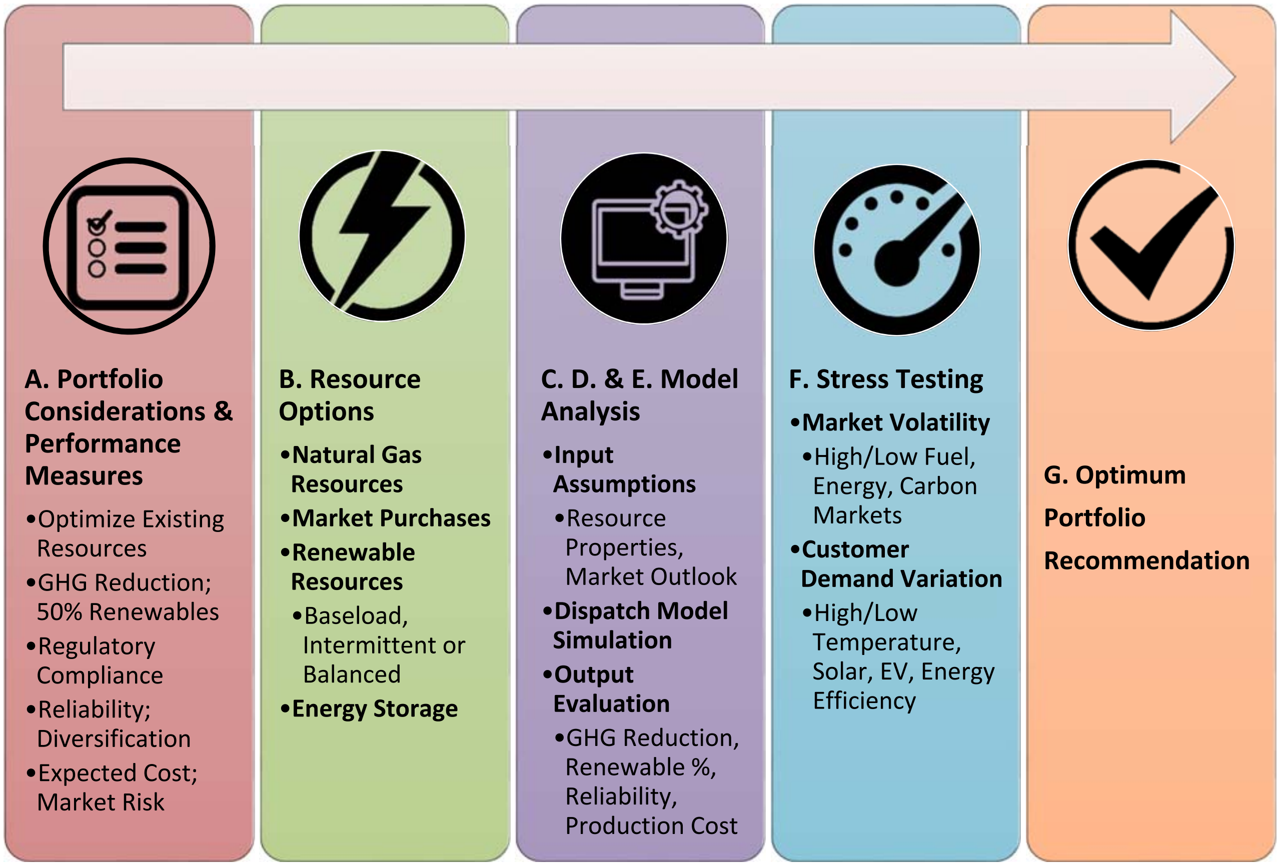
After forecasting the energy and peak demand, the supply side analysis is detailed in this section to answer one question: What is the optimal resource mix to supply the forecasted energy and peak demand given APU's planning goals of sustainable resources, high reliability and affordable rates?



This section starts with basic considerations, such as how to transition from fossil fuels to clean renewable energy and determining the performance measures to evaluate available supply-side options.

Candidate portfolio scenarios were developed based on current technology and market intelligence regarding resource availability. These supply-side options were then screened to filter out the non-viable scenarios given APU's planning goals, and the remaining scenarios were analyzed using extensive quantitative production cost modeling analysis. The model outputs were scored and stress tests performed before a final portfolio was recommended. Graph 21 below summarize the selection process used to choose the optimum resource additions needed to satisfy customer demand and reliability and sustainability goals:

Graph 21: Selection Process of the Optimum Resource Portfolio



The selection process started with Section A. Portfolio Consideration and Performance Measures followed by Section B, the consideration of Resource Options. Components of the model analysis are outlined in Sections C. Model Analysis – Production Cost Model, D. Model Analysis – Input Assumptions, and E. Model Analysis – Output Evaluation. The resource portfolios under evaluation also went through a series of Stress Testing in Section F, before the optimum portfolio is recommended in Section G.

A. Portfolio Considerations & Performance Measures

- •Optimize Existing Resources
- •GHG Reduction; 50% Renewables
- •Regulatory Compliance
- •Reliability; Diversification
- •Expected Cost; Market Risk

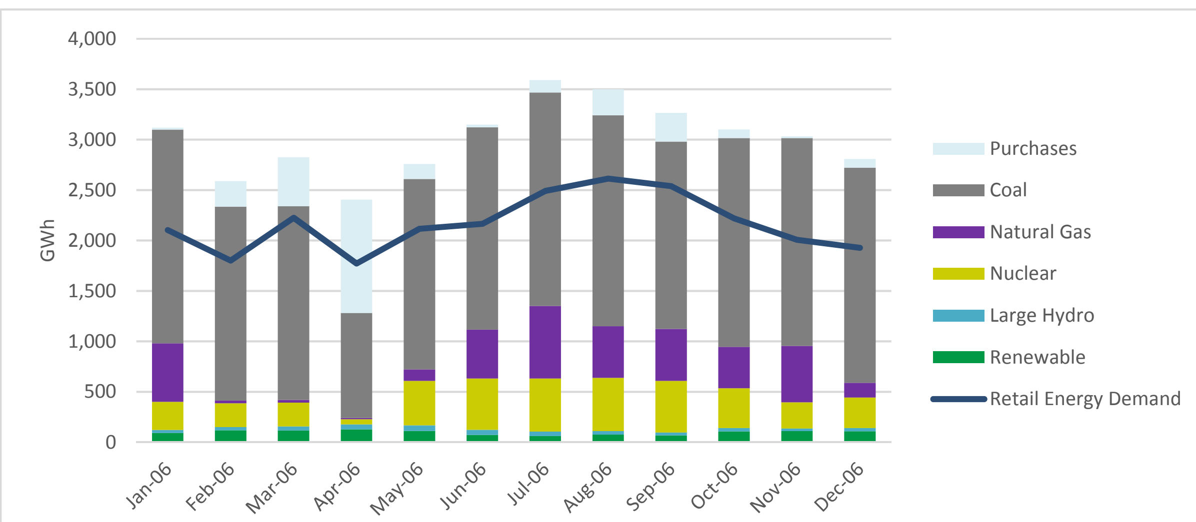
A. PORTFOLIO CONSIDERATION AND PERFORMANCE MEASURES

A.1. COAL-TO-CLEAN ENERGY TRANSITION

Prior to the heightened awareness about carbon intensive fuels on the environment as a result of GHG emissions, APU was fully resourced to meet local energy demand with long-term, low-cost, and base-loaded coal-fired power plants. Coal-fired power plants were historically a preferred resource nationally due to the abundance of coal as a fuel, its low cost, and the reliable coal generation technologies available to produce electricity. Also, in the 1980s, nuclear energy was out of favor, due to the waste issue and the associated capital risk, and it was illegal to use natural gas for power generation due to its scarcity and higher value as a space heating fuel. For these reasons, APU invested in two coal facilities that served APU customers very well for several decades, and approximately two-thirds of APU's energy needs were met by these two coal-fired power plants.

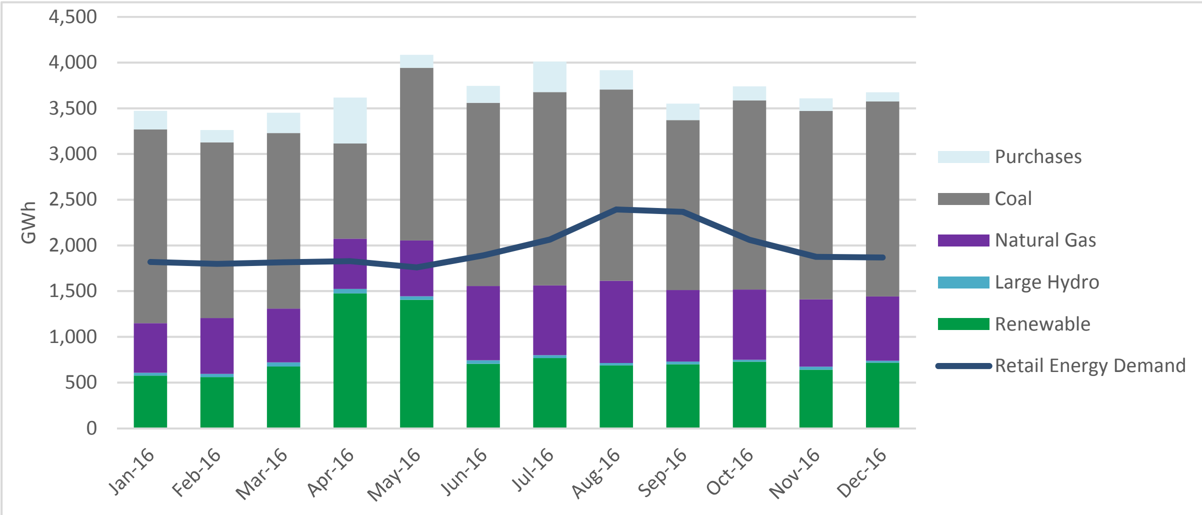
APU has actively transitioned from the carbon intensive resource mix to clean renewable energy since 2003, as it has increased renewable energy from 1% to 29% while reducing coal power from 73% to 32%. Today, APU's resource stack is very different from the historical view, with a much greater percentage of retail energy demand met by sustainable energy. The following graphs show change in APU's power supply resource stack over the past decade, from 2006 to 2016:

Graph 22: APU Resource Stack in 2006



Note: Generation above the retail energy demand was sold into the CAISO wholesale energy market.

Graph 23: APU Resource Stack in 2016



Note: Generation above the retail energy demand represents energy sold into the CAISO wholesale energy market.

Roughly one-third of APU's 2017 energy supply still came from two coal plants – San Juan Power Plant and Intermountain Power Project (IPP). APU successfully negotiated the divestiture of the San Juan coal plant at the end of 2017, which was 5 years prior to the original contract termination date. APU has also taken action to allow its IPP coal contract to expire without renewal effective 2027, at which time APU will have divested of all coal resources.

The divested coal resources will need to be replaced prior to 2027 to maintain high reliability, achieve APU's sustainability goals, comply with State mandates, and mitigate market price risk. To select the optimum resource portfolio, which includes the replacement of the divested coal resources, APU used quantitative performance measures and production cost modeling to evaluate the portfolio scenarios pursuant to its planning goals, as briefly mentioned in Section III. Planning Goals

B.2. PORTFOLIO PERFORMANCE MEASURES

APU's mission is to be an agile, customer-focused, water and power utility operating in an ever-changing world providing reliable, high quality, environmentally sustainable, and competitively priced water and power and delivering the maximum value to our customer-owners in order to preserve Anaheim's health and prosperity.

The integrated resource planning process maintains three main planning goals to achieve the organizational mission: Sustainable Resources, High Reliability, and Affordable Rates.

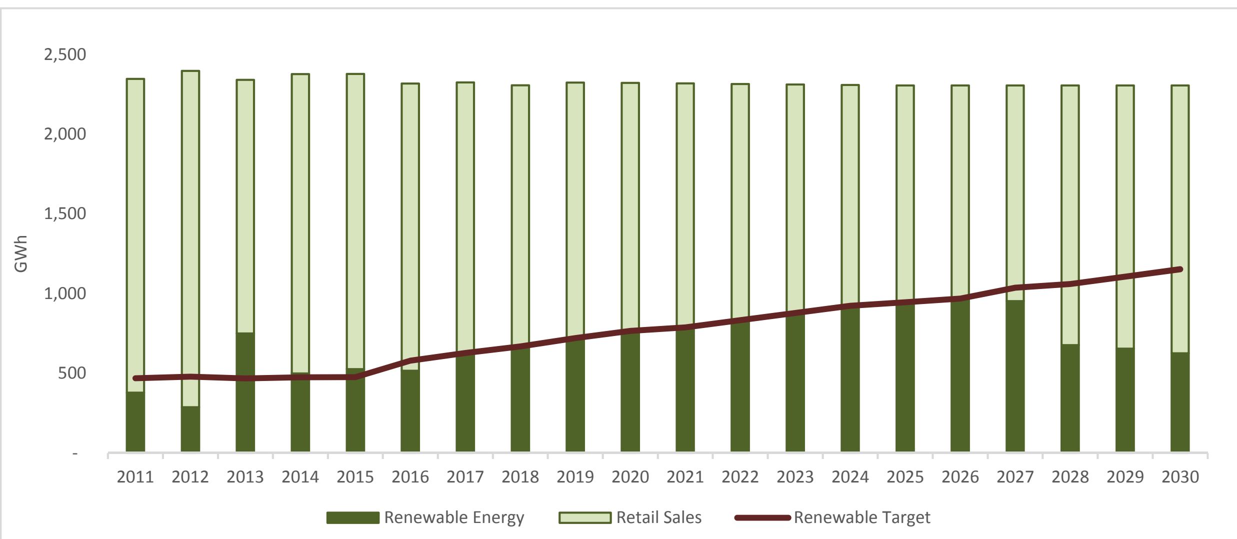
Sustainable Resources	High Reliability	Affordable Rates
• 50% RPS • 40% GHG Reduction • Regulatory Risk	• Resource Adequacy • Portfolio Diversification	• Expected Cost • Market Risk

Achieve at Least a 50% RPS

The RPS is measured by the percentage of renewable energy delivered to serve retail load. Portfolios considered must contain at least 40% eligible renewable energy by 2024, 45% by 2027 and 50% by 2030. In addition, per the RPS statute, 65% of APU's RPS obligation in any given year must come from long-term contracts (i.e., greater than 10 years in length).

APU has procured a sufficient amount of renewable energy contracts to meet RPS compliance up to year 2025. However, in order to meet renewable compliance obligations post-2025, APU will need to either extend the terms of its current renewable contracts, or procure new contracts. Graph 24 details the historical and planned renewable compliance targets.

Graph 24: Historical and Planned Renewable Energy

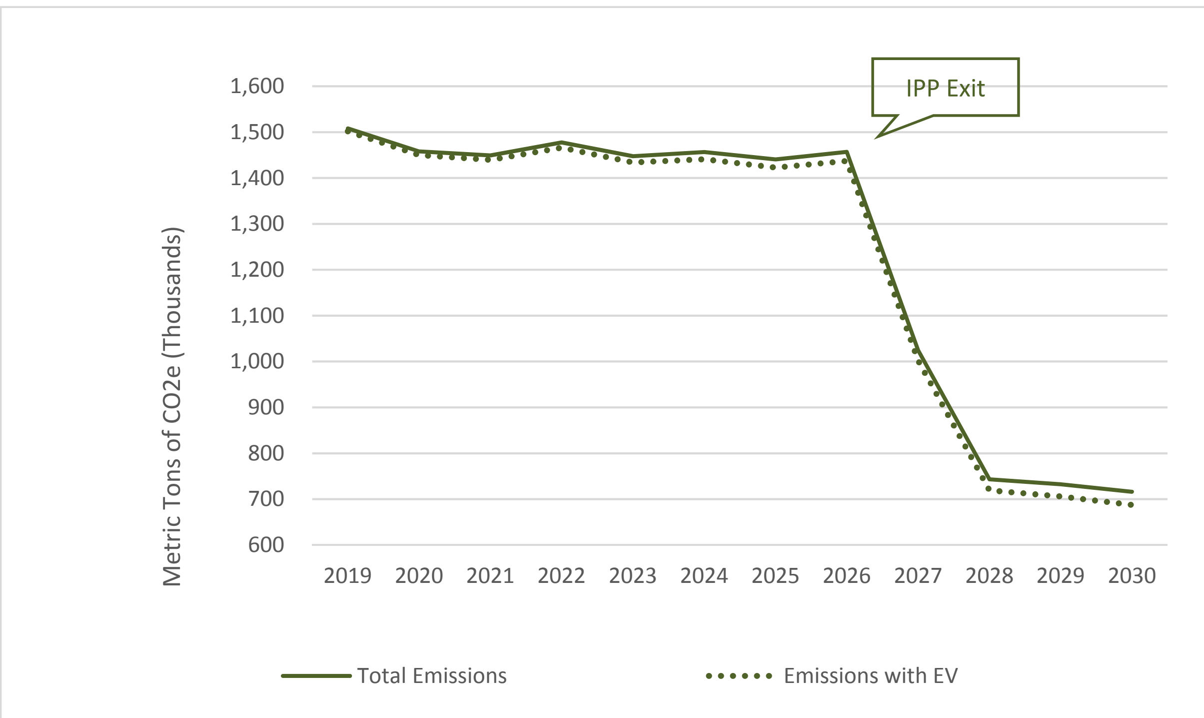


Greenhouse Gas Emission Reductions

Greenhouse gas emission reductions are measured by the percent of GHG reduction for the overall resource portfolio. Portfolios considered must meet the GHG emissions reduction targets ultimately established by the California Air Resources Board (CARB) that achieves the economy-wide greenhouse gas emissions reductions of 20% below 1990 levels by 2020, and 40% below 1990 levels by 2030.

With the planned exit of IPP, APU is on track to meet its internal GHG reduction planning goals of 480,000 $MTCO_2e$ by 2020 and 920,000 $MTCO_2e$ by 2030, a 20% and 40% reduction, respectively. Graph 25 details the planned GHG reductions with and without the GHG emissions reductions expected from vehicle electrification. Due to the divestiture of coal units, APU is on track to meet internal GHG reduction planning goals without any changes to its remaining power resouces. Since the replacement energy is needed due to APU's exit from IPP, it will be replaced with non-emitting resouces, the estimated GHG reduction as displayed in Graph 25 will remain consistent for any renewable replacement options.

Graph 25: Planned GHG Reduction



Regulatory Risk

Regulatory Risk measures the ability to remain compliant with current and anticipated future legislative or regulatory changes. The State's RPS targets have steadily increased over the past several years; therefore, this IRP considers the likelihood of higher renewable energy requirements in the future.

For example, Senate Bill 100 was introduced in the 2017 legislative session requiring electric utilities to achieve a 60% RPS by 2030. It also contains language seeking to require that eligible renewable energy resources and other zero GHG-emitting resources supply 100% of retail energy sales no later than December 31, 2045. As of the writing of this IRP, the bill remains active in the legislature.

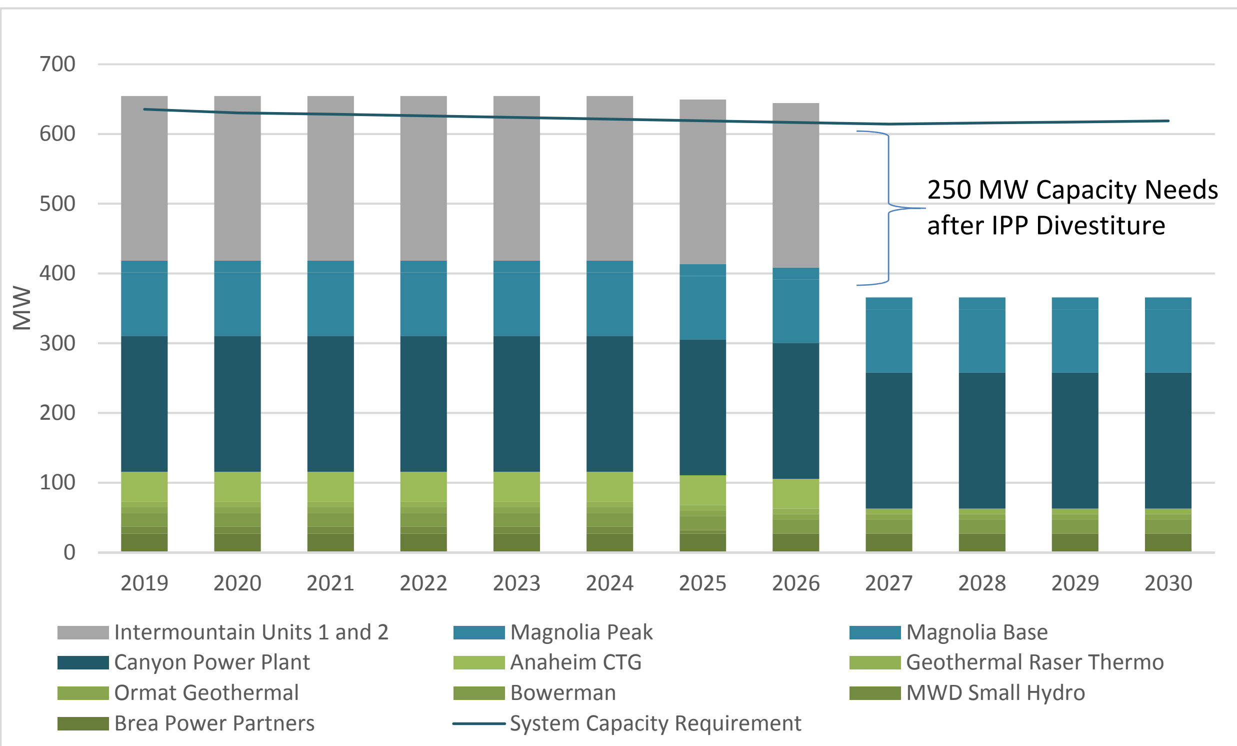
The optimum portfolio should have enough flexibility to absorb additional renewable purchases beyond the current 50% RPS requirement. Also, the optimum portfolio should be sufficiently diversified so that APU minimizes technological risk where one technology becomes obsolete or less cost-effective.

Resource Adequacy (Reliability)

Resource Adequacy is measured by the ability to achieve a 15% reserve margin above the system peak forecast while meeting forecasted local and flexible capacity requirements.

Resource portfolios not achieving this measure are still included for consideration by identifying future capacity shortages and planned capacity purchases. Costs for capacity purchases are added to the portfolio.

Graph 26: Available Resource Adequacy (RA) System Capacity



Graph 26 illustrates the resources APU may use to meet Resource Adequacy requirements. Although APU exited San Juan in 2017, ample capacity from renewable resources is available to replace the 50

MW previously provided by San Juan. When APU exits IPP in 2027, 250 MW of capacity will need to be procured to ensure resource adequacy and system reliability. The new capacity can be in the form of new energy resources with capacity, capacity-only purchases, or both.

Canyon Power Plant and the Bowerman and Brea landfill gas-to-energy plants are long-term and reliable resources located in and near Anaheim, and they provide more than 100% of the local and flexible generation capacity required by the CAISO.

The Resource Adequacy generation capacity needed after 2027, upon the expiration of the IPP coal contract, is system-wide capacity that may be produced anywhere in the 14 western states as long as it is deliverable to California. Current system-wide capacity markets indicate that this product is abundantly available at a much lower cost than building new peaking power plants or utility scale energy storage facilities. This is due to the great number of new renewable energy facilities being added system-wide.

APU plans to procure the requisite Resource Adequacy at least two years prior to the expiration of the IPP contract through competitive solicitations; however, APU will continue to monitor the capacity markets as compared to the cost of constructing new capacity facilities locally. Given the relatively small amount of Resource Adequacy capacity needed by APU, the abundance of capacity available for purchase, the Regulatory Risk of constructing new natural gas peaking power plants that may become obsolete if State law requires 100% emission-free resources, and the potential for a technological breakthrough that would significantly reduce the cost of energy storage, APU does not recommend committing to new Resource Adequacy facilities at this time. Also, should the cost of Resource Adequacy capacity increase significantly prior to 2027, APU has the option of investing to extend the life of the Kraemer Power Plant or build new generation facilities at the Canyon Power Plant site.

Portfolio Diversification

Portfolio diversification is measured by the different types and length of resource investment within the portfolio. A diversified resource portfolio increases flexibility, reliability, and overall performance.

APU's 2018 renewable portfolio consists of 15% intermittent resources and 85% baseload resources. The baseload resources are very reliable and do provide local Resource Adequacy capacity, but the cost of these resources is now significantly greater than intermittent resources such as solar and wind and APU's local capacity requirements are satisfied with existing resources. Due to APU's substantial investment in baseload renewable resources in the early years of the RPS Program, diversity is now an important consideration in the development of the optimum resource portfolio.

Expected Cost

Expected Cost is measured by the total cost to supply power. Each resource portfolio is evaluated with a goal to minimize impacts on customer bills and to serve customers at just and reasonable rates.

As previously discussed, APU has been and continues to be fully resourced to meet local demand with long-term baseload power plants. Any costs associated with additional resource procurement necessary to meet environmental goals must be carefully considered and prudently managed. A key consideration in selecting the optimum resource portfolio is leveraging existing resources and minimizing customer impact.

Market Risk

Market Risk is measured by percentage of energy APU must purchase from the wholesale market, and the portfolio's ability to withstand market price volatility. The financial exposure of the overall resource portfolio increases when a larger percentage of energy is procured from the wholesale market.

With 236 MW of capacity, IPP meets the largest portion of APU baseload energy needs, with the remainder baseload energy demand supplied by the natural gas and renewable generation facilities. The predictable cost structure of a baseload unit protects the resource portfolio from price swings in the wholesale market. The replacement energy needs resulting from APU's exit from IPP will come from renewable energy resources. Because of the intermittent nature of variable renewables (i.e., wind and solar), financial exposure must be evaluated when considering replacement energy from these types of resources.

Intermittent renewable energy resources such as wind and solar have seasonal and hourly generation profiles that are not always aligned with energy demand, and can be unpredictable at times due to changing weather patterns. Due to this variability in production, there are times when generation levels exceed energy demand, resulting in decreases in market prices and revenue from the sales of energy. Conversely, at times when energy demand exceeds the amount of generation available, market prices and the purchase of energy to meet energy demand will increase.

Modeling "stress tests" are introduced in Section F. Stress Testing to ensure the optimum portfolio outperforms the alternatives under all market cost and load growth/reduction scenarios.

B. RESOURCE OPTIONS

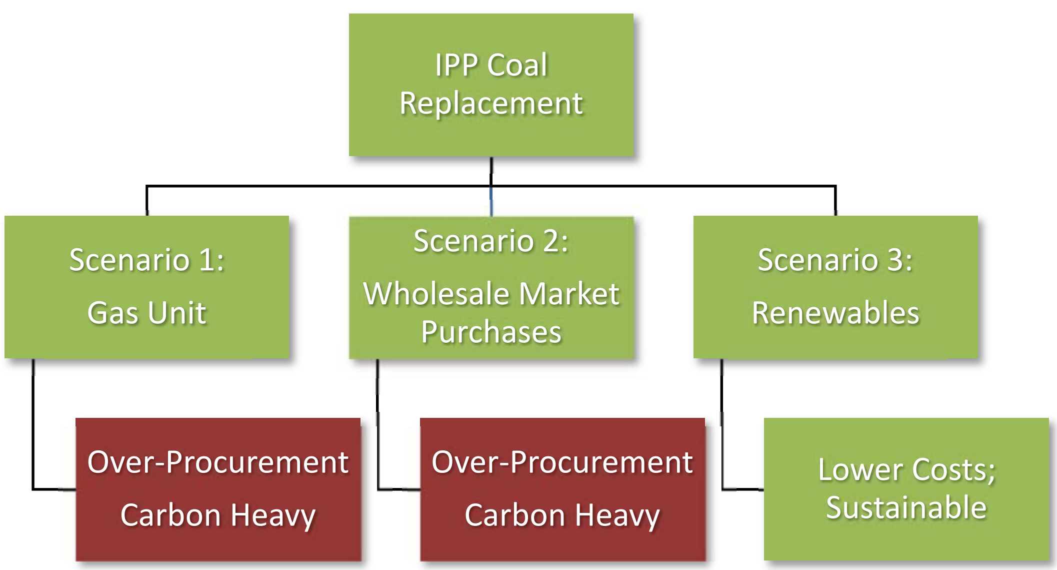
B. Resource Options
- **Natural Gas Resources**
- **Market Purchases**
- **Renewable Resources**
  - Baseload, Intermittent or Balanced
- **Energy Storage**

B.1. IPP REPLACEMENT OPTIONS

With extensive quantitative analysis, this IRP examines several scenarios for replacing the energy resulting from the exit of coal resources. Replacing the coal power plants with a new natural gas power plant or wholesale market purchases would be carbon heavy and costly. APU will still have a need to purchase renewable energy to meet the State's environmental goals; therefore, replacing energy needs resulting from APU's exit from coal power plants with renewable energy is the most optimal solution.

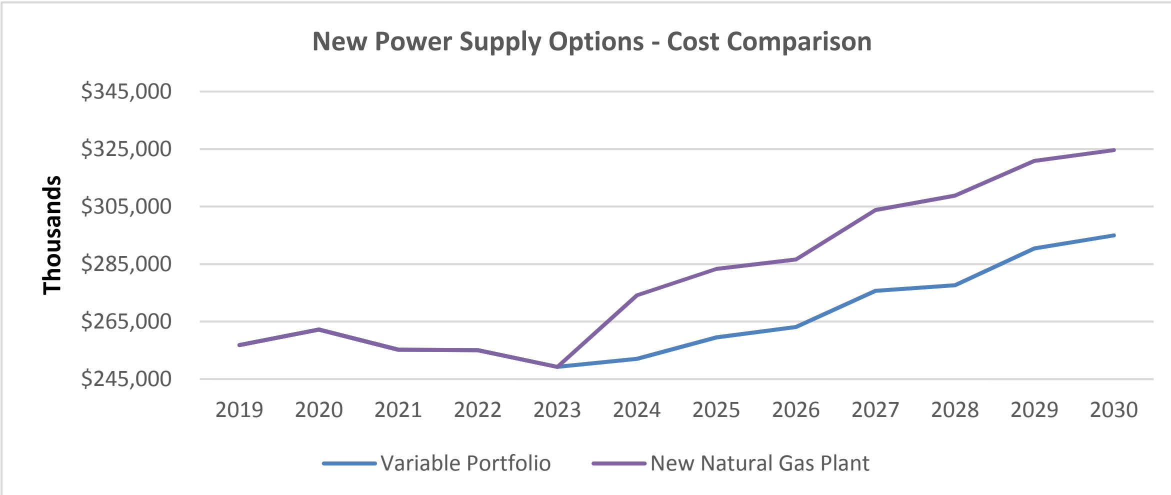
Graph 27 shows the screening process used to evaluate the options for replacing the IPP coal plant. Replacing IPP with a natural gas power plant (Scenario 1) or wholesale market purchases (Scenario 2) would still be carbon heavy as compared to renewables and would be costly because APU would still need to purchase renewable energy to meet the State's 50% mandate, resulting in "over-procurement."

Graph 27: IPP Replacement Options



Graph 28 shows that a new natural gas plant is not viable given APU's sustainability goals and State regulatory requirements. As an example, the Variable Portfolio is one of the renewable portfolios being evaluated to replace IPP. It is more costly to maintain a natural gas power plant while also acquiring renewable energy to meet the sustainability goal.

Graph 28: New Power Supply Options – Cost Comparison



**Net power supply costs excludes transmission and wholesale energy revenues*

B.2. RENEWABLE OPTIONS

Determine Renewable Generation and Capacity Needs

Staff went through the following steps to determine the renewable generation and capacity needs to meet RPS targets.

1. Determine Annual RPS Targets

In developing the candidate portfolios, the first step was to calculate the amount of renewable energy needed to meet the RPS targets. RPS targets are statutorily established and in the case of publicly owned utilities like APU, are enforced by the CEC. These targets are calculated as a percentage of customer retail energy demand.

Retail Energy Demand Forecast * RPS % = Renewable Energy Required

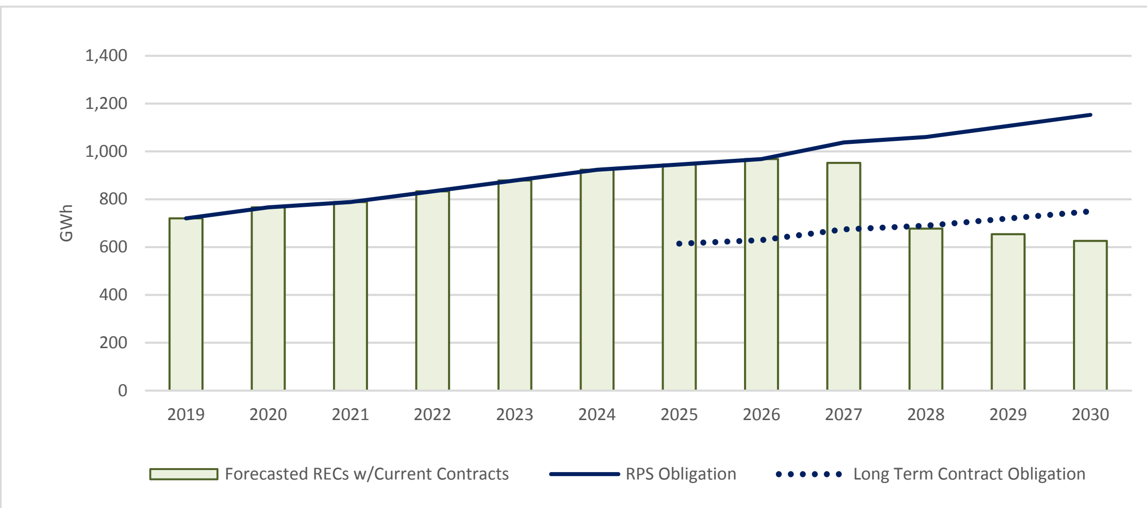
Due to the inconsistent nature of renewables development and energy production, there may be years when APU exceeds its projected RPS targets. To preserve the value of the renewable energy resources, the Legislature and State agencies recognize the ability to use any excess renewable procurement for future compliance through the "banking" of excess renewable energy credits ("REC") as they are produced. APU has banked RECs produced in excess of RPS compliance requirements to date, intends to continue banking surplus RECs for future use, and will use such surplus to help satisfy its future RPS compliance targets in the most cost-effective manner possible.

As detailed in the green bar on Graph 29, the renewable generation forecast indicates that APU will have procured a sufficient amount of renewable energy to meet its RPS obligations through 2026. In order to meet compliance obligations after 2026, APU will need to negotiate extensions of existing contracts or procure new renewable resources.

2. Determine Long-Term Contract Obligation

Pursuant to SB 350, the RPS Program also requires that starting in the year 2021, 65% of APU's RPS obligations must be met by renewable resources under contract for more than 10 years in length, shown by the blue dotted line on Graph 29. Currently, most of APU's renewable energy comes from resources under long-term contracts. However, post-2026, APU will need to secure additional long-term renewable contracts in combination with short-term renewable purchases in order to meet this compliance obligation.

Graph 29: Simulated RPS Compliance Requirement



3. Determine New Contract Size and Implementation Dates

The next step in the development of candidate portfolios for consideration was to identify a timeline for new contract implementation and capacity purchases to replace the capacity lost with the divestiture of IPP. It is less expensive to purchase capacity than to over-procure renewable generation. As such, future renewable contracts were incrementally layered into APU's portfolio to meet renewable targets, and the capacity shortfall is planned to be covered with capacity purchases as discussed under the Resource Adequacy performance measure section.

APU identified replacement energy from the responses to the SCPPA Request for Proposals[5] for renewable generation. This list was developed based on the knowledge of expected costs and availability of a larger list of possible clean power supplies. The likely resources are:

- Wind (intermittent)
- Solar (intermittent)
- Geothermal (baseload)
- Biomass (baseload)
- Landfill Gas (baseload)

Capacity calculations vary by the operating characteristics of the renewable technology. Baseload renewables have a much higher capacity factor than intermittent resources such as wind and solar (95%, 27%, and 25%, respectively). Table 4 below is an example of the estimated capacity required from all baseload, solar, or wind contracts. As expected, there is a much higher amount of megawatt capacity that must be procured if selecting intermittent resources. If APU procured only baseload renewables, it would need to procure a 15 MW contract, as opposed to 45 MW of solar or 55 MW of wind to generate the same amount of energy as a 15 MW baseload generation resource. Table 4 summarizes the amount of renewable capacity required for each resource type to meet RPS energy requirements:

Table 4: Renewable Capacity Required to Meet RPS Target

Baseload Contracts Only (MW)	2027	2028	2029	2030
Baseload 1	5	5	5	5
Baseload 2			5	5
Baseload 3				5
Total Baseload	5	5	10	15
Solar Contracts Only (MW)	2027	2028	2029	2030
Solar 1	10	10	10	10
Solar 2			25	25
Solar 3				10
Total Solar	10	10	35	45
Wind Contracts Only (MW)	2027	2028	2029	2030
Wind 1	15	15	15	15
Wind 2			25	25
Wind 3				15
Total Wind	15	15	40	55

[5] http://www.scppa.org/page/RFP-Request-for-Proposals-Archives

Renewable Portfolios Evaluated

- **Baseload Portfolio (Baseload Renewables)**

The first candidate portfolio replaces coal generation with baseload renewable resources such as geothermal, biomass or biogas. Baseload resources are reliable and stable, which translates to less capacity needed to generate the same amount of energy as intermittent resources. However, these resources are expensive compared to intermittent resources like wind or solar. APU's most recent biogas resource price is $91/MWh, compared to recent offers of $37/MWh for solar and $45/MWh for wind resources in 2017.

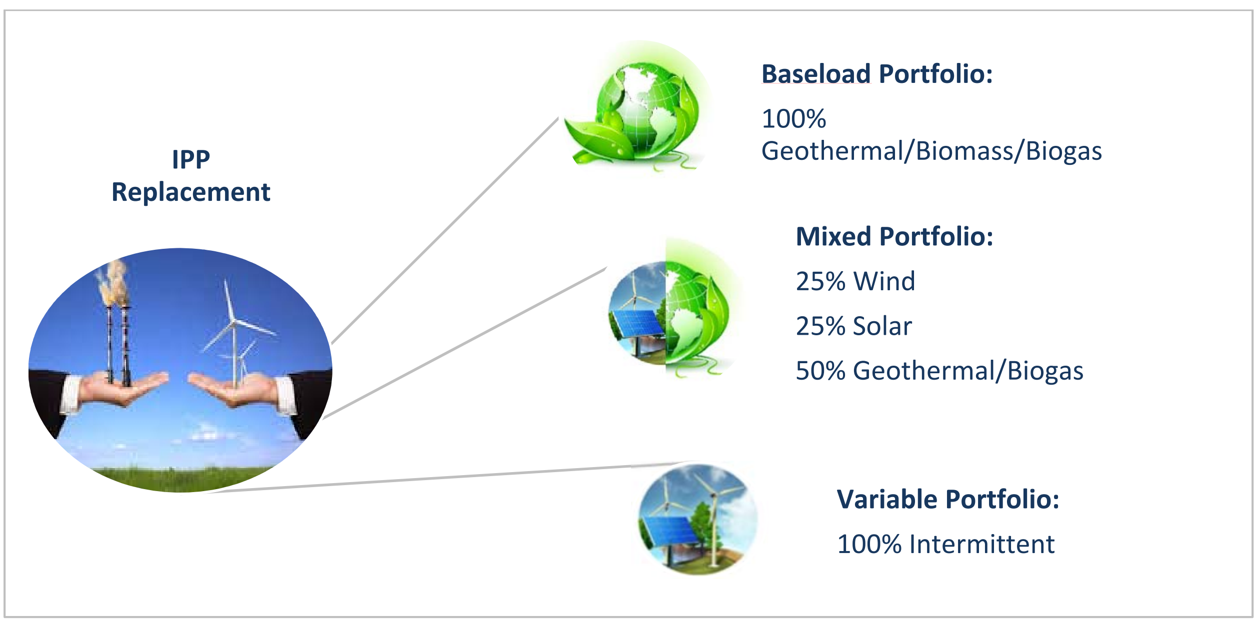
- **Mixed Portfolio (50% Intermittent/50% Baseload Renewables)**

The second candidate portfolio replaces coal generation with 50% intermittent renewable resources and the other 50% with baseload renewable resources. This option provides the benefit of stable generation and lower cost resources.

- **Variable Portfolio (100% Intermittent Renewables)**

The third candidate portfolio replaces coal generation with fully intermittent renewable resources and provides the advantage of procuring the lowest cost renewable resources currently available. It is called the "Variable" Portfolio due to the fact that the existing APU renewable mix is mostly composed of baseload resources. Adding more intermittent resources would inherently make the portfolio more balanced.

The candidate portfolios described are referred to from here on forward as the Baseload Portfolio, Mixed Portfolio and Variable Portfolio, respectfully.



B.3. ENERGY STORAGE

Energy storage may be used to facilitate the integration of unpredictable intermittent resources such as wind and solar energy; however, energy storage itself is not a renewable resource. APU is a distribution utility operating under the CAISO supply/demand balancing authority, and, as such, the CAISO requires APU to provide certain levels and types of Resource Adequacy capacity given its profile of resources used to serve APU's load. The baseload renewable resources procured by APU provide adequate Resource Adequacy capacity, and energy storage has not been required to integrate APU's renewable resource portfolio. Nevertheless, energy storage may play a more significant role in the future should technological breakthroughs make energy storage a viable replacement for the lost Resource Adequacy capacity upon the expiration of the IPP coal contract in 2027.

Pursuant to the requirements of Assembly Bill 2514 (Skinner, Chapter 469, Statues of 2010), APU submitted to the CEC on September 30, 2017 its latest re-evaluation of energy storage (ES) system procurement targets. Please see the City of Anaheim's Energy Storage Resolution No. 2017-142, Staff Report, and Updated Energy Storage System Plan for the detailed evaluation on the CEC website at AB2514 - Anaheim[6] or AB2514 - CEC -Energy Storage[7].

Currently APU has a procurement target of up to 11 MW of energy storage (ES) by December 31, 2026, subject to Anaheim City Council authorization for future capital expenditures. The 11 MW target consists of a 1 MW ES pilot project at Harbor Substation, to be completed by December 31, 2021, and depending on the results of the pilot project and future ES technologies, up to 10 MW of additional ES installation at Canyon Power Plant by December 31, 2026.

Based on APU's analyses, ES currently has a limited effect in its ability to shift energy from one time period to another in the CAISO wholesale electricity market. However, APU studied the potential for ES to provide ancillary services. The costs of regulation and spinning reserves in the CAISO market for APU have increased significantly from 2014 to 2016. Since ancillary services are much smaller in megawatt volume compared to energy products, current battery ES technologies, particularly the Lithium-Ion technology, may be a potentially viable and cost-effective means to self-provide ancillary services. The 1 MW ES pilot project and continued monitoring of ancillary service costs will help determine the feasibility of these benefits for future ES projects, and whether or not market conditions dictate potential acceleration of upcoming projects.

APU considers taking incremental steps towards integrating ES within its local grid to be prudent as solar and wind generation is projected to increase over time resulting in excess generation during certain times of the day. The 1 MW ES pilot project will allow APU to gain first-hand experience and validate the conceptual assumptions for future ES deployments. With the pilot project being completed, APU expects to have more data and experience on how to optimize the operation of ES and demonstrate value to APU customers prior to seeking City Council approval on future ES procurement.

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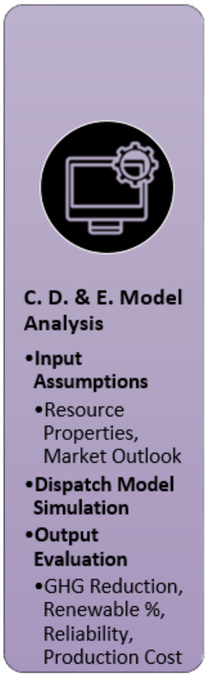
[6] http://www.energy.ca.gov/assessments/ab2514_reports/City_of_Anaheim/
[7] http://www.energy.ca.gov/assessments/ab2514_energy_storage.html



C. MODEL ANALYSIS – PRODUCTION COST MODEL

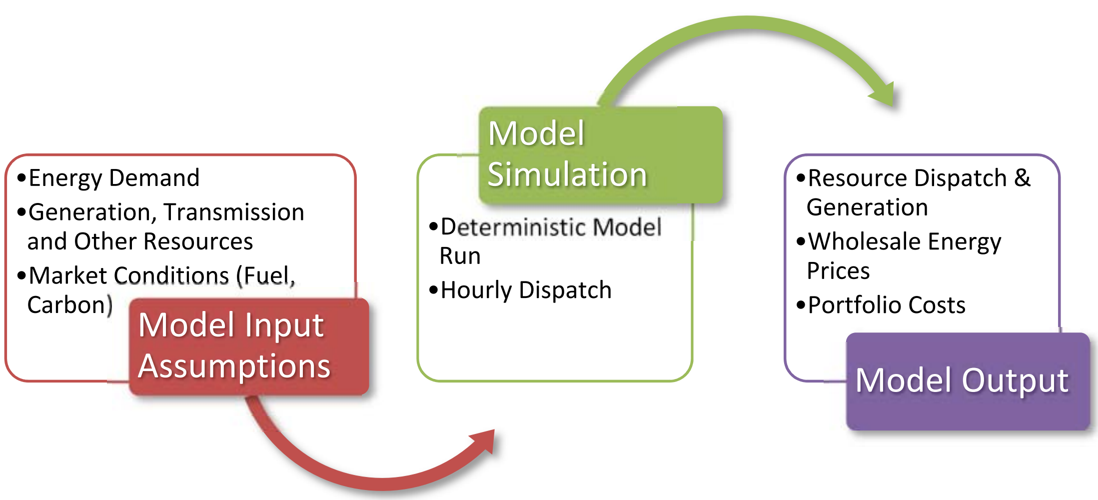
The Public Utilities Code Section 9621(c)(1) requires the IRP to address procurement for energy efficiency and demand response resources, energy storage, transportation electrification, short-term and long-term electricity, electricity-related, and resource adequacy products.

Energy efficiency, demand response and transportation electrification are considered in the demand forecast and model stress tests.

As previously discussed, APU has established a procurement target of up to 11 MW of energy storage by December 2026, should the 1 MW pilot energy storage project be deemed feasible, suitable and cost-effective. This pilot project will be used to identify potential uses such as the ability to self-provide ancillary services. In this IRP, energy storage is incorporated as a component to reduce Ancillary Service charges.

PRODUCTION COST MODEL

Considerable quantitative analysis was performed to evaluate the candidate portfolios. Staff used a production cost model to perform hourly chronological unit commitment and evaluated dispatch model runs of how APU would meet its energy demand from the present through 2030. The following graphic shows the elements of the production cost modeling process:



INPUT ASSUMPTIONS

The main input assumptions include energy demand, resource constraints and costs, and fuel and carbon prices.

APU's energy demand was developed under Section VI. Energy Demand and Peak Forecasts. APU has a licensing agreement for a production cost model that contains information of other utility areas' energy demand forecast, and the generation, transmission, and other resources such as energy storage and demand response.

The production cost model has an extensive database of the Western Interconnect that includes extensive grid-wide data such as hydro conditions, fuel prices, heat rates, maintenance schedules, area demand, emissions, transmission constraints, and variable and fixed unit costs. The model obtains grid-wide data via publically available sources from the North American Electric Reliability Corporation (NERC), the Energy Information Administration (EIA), the Environmental Protection Agency (EPA), and various balancing authorities. Input assumptions are periodically updated, and the model run results are validated against historical actuals.

These base assumptions can be modified to allow utility-specific and detailed analysis. APU updates market conditions including fuel prices and carbon allowance costs to reflect the most updated information. Key input assumptions are detailed in D. Model Analysis – Input Assumptions.

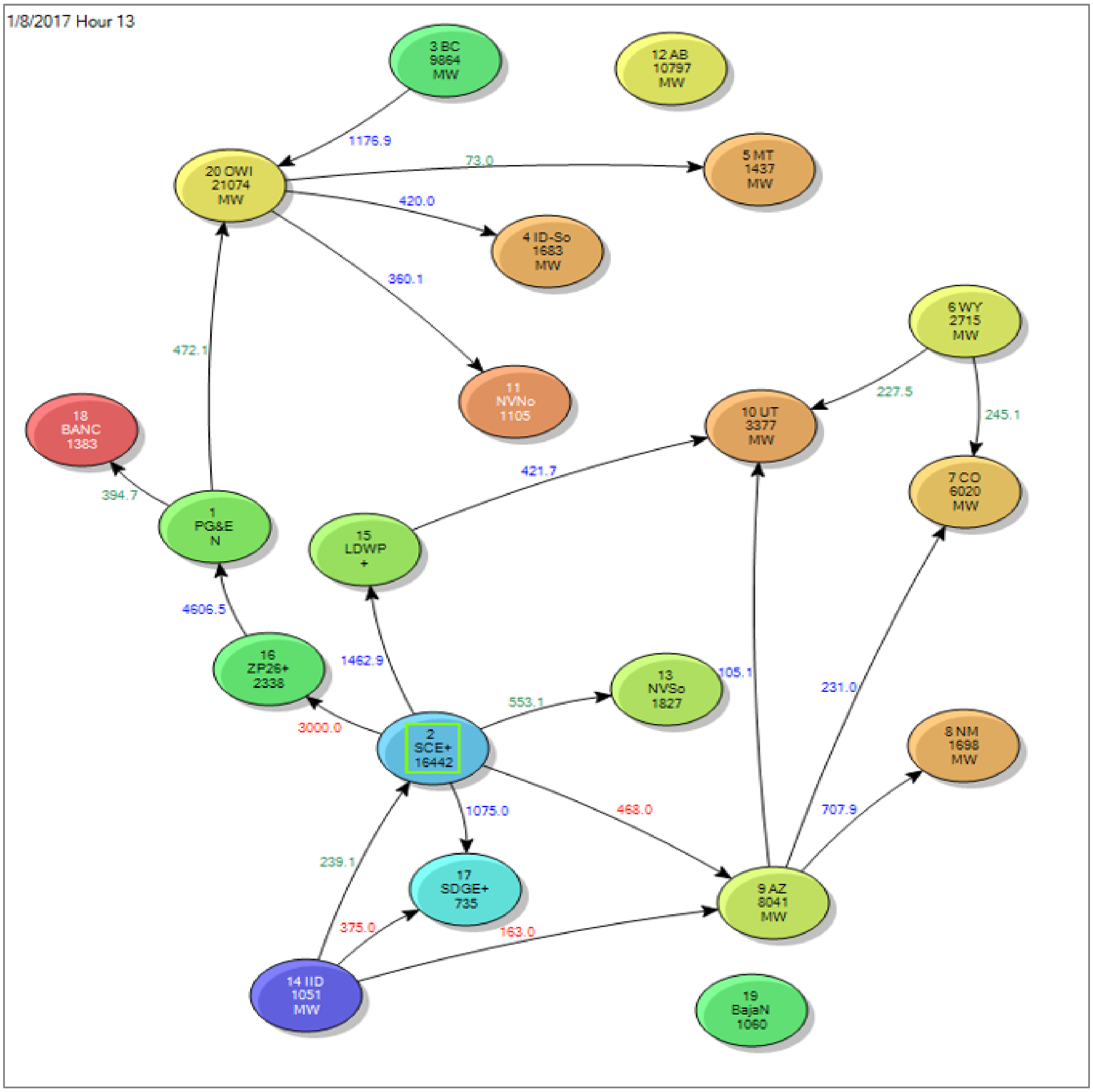
MODEL SIMULATION

APU uses the deterministic model which calculates an hourly dispatch to simulate how the energy market will dispatch the available resources to meet the region's estimated energy demand on an hourly basis. A model simulation was performed for each of the candidate portfolios.

Once the input assumptions are incorporated into the database, portfolio simulations or model runs are conducted. As an example, Graph 30 illustrates the system diagram for hour 13 on January 8, 2017, including the energy flow from between balancing areas containing loads and resources. The energy demand is displayed within the utility bubble (APU is within the Southern California Edison Company – SCE – territory); the energy flows between utilities areas are displayed on the arrows that depict transmission lines. The colors of the bubbles are indicators of energy prices, with red representing the highest and green the lowest energy prices. This process is conducted in hourly intervals for the time span specified by the user. The results of the market simulation are retrieved in the output tables of the associated model run.

Deterministic model runs reflect expected or normal conditions for each hour of the year. For example under deterministic analysis, weather, unit forced outages, gas prices, and intermittent resource generation are all assumed to be normal on every day of the year. The abnormal or extreme conditions are introduced after the initial model runs, in F. Stress Testing.

Graph 30: System Diagram



MODEL OUTPUT

With the input assumptions and model simulation, the production cost modeling software will produce the model output including the following:

- Hourly resource generation (MWh): The resources that are dispatched to meet the energy demand during the specific hour and their respective dispatch costs.
- Wholesale energy prices: The wholesale energy price for the hour.
- Portfolio costs: The fixed, variable, fuel, and carbon costs

The output for each candidate portfolio was evaluated and compared against each other in E. Model Analysis – Output Evaluation.

C. D. & E. Model Analysis

- **Input Assumptions**
  - Resource Properties, Market Outlook
- **Dispatch Model Simulation**
- **Output Evaluation**
  - GHG Reduction, Renewable %, Reliability, Production Cost

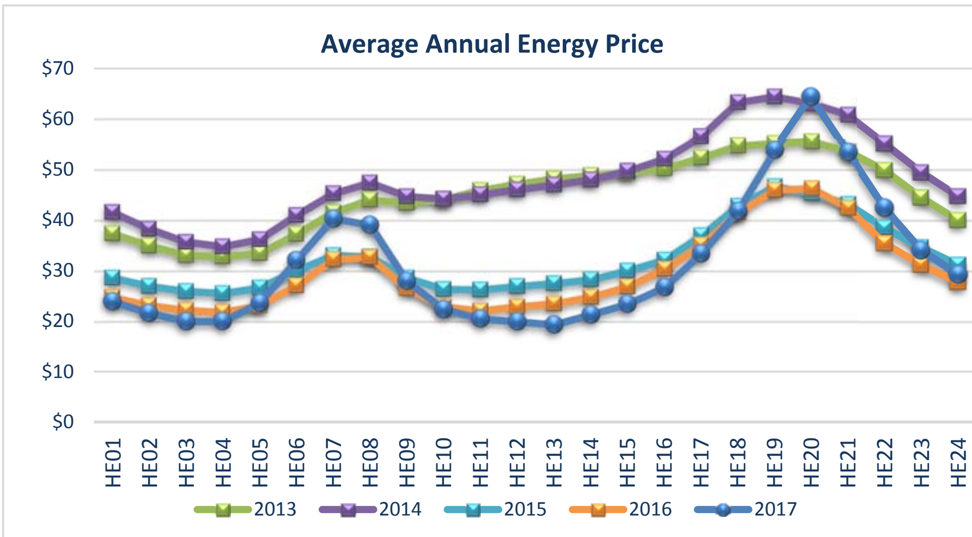
D. MODEL ANALYSIS – INPUT ASSUMPTIONS

Key input assumptions utilized in the production cost model are shown below.

CAISO UTILITY SCALE RENEWABLES

Without a corresponding increase in demand, the surge of utility scale renewables on the Grid has caused wholesale energy prices to decline. Graph 31 illustrates the average hourly energy price at SP-15[8] for 2013 through 2017. Between 2013 and 2017, the average SP-15 price dropped from $44.9/MWh to $31.5/MWh.

Graph 31: Average Annual SP-15 Energy Price

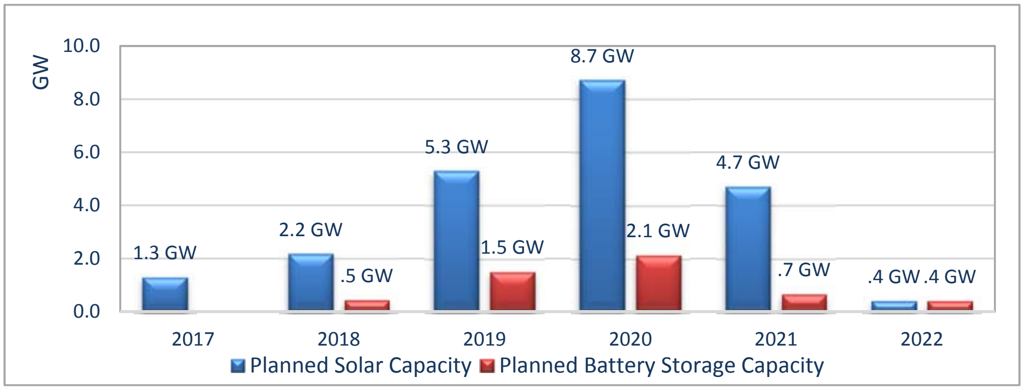


While the model has a detailed database of newer renewable resources that are currently in operation, it does not include all planned resources that are expected to come online in the future. By incorporating the planned CAISO interconnection projects for solar capacity and energy storage into the production cost model, the impact of new utility-scale solar on market prices is captured.

Graph 32 below details the total solar and energy storage capacity that is anticipated to come online for 2017 through 2022. This data was obtained from the CAISO's published Grid Generation Queue as of June 2017.

[8] South of California transmission Path 15, a CAISO pricing zone covering Southern California.

Graph 32: CAISO Interconnection Projects



EXISTING RESOURCES

For each APU resource or contract, staff examined the generic data in the model, and updated model input where necessary. The information updated may include heat rate, minimum run time, start-up time, fuel type, variable costs, fixed costs, emission factor, capacity, capacity shape, planned outages, area, resource beginning and end date, and any other information that impacts the unit dispatch.

NEW RENEWABLE RESOURCES

1. Renewable Percentage and Contract Terms

Renewable energy was assumed to meet current regulatory requirements of 50% renewable energy by 2030. Post 2021, 65% of renewable generation was assumed to come from resources with long-term contracts, defined as 10-years or longer contract terms.

New resources were layered into the portfolio over several years, which strategically meet all compliance goals while keeping costs and potential over-generation minimized. Table 5 details the new resources layered into the production cost model for each scenario. Contract terms were assumed to be 20 years.

Table 5: New Resource Capacity by Candidate Portfolio

Baseload Portfolio	2027	2028	2029	2030
Baseload Contract 1	5	5	5	5
Baseload Contract 2			5	5
Baseload Contract 3				5
Mixed Portfolio	2027	2028	2029	2030
Baseload Contract 1	5	5	5	5
Intermittent Contract 1			10	10
Baseload Contract 2			5	5
Variable Portfolio	2027	2028	2029	2030
Intermittent* Contract 1	15	15	15	15
Intermittent Contract 2			25	25
Intermittent Contract 3				15

* Intermittent resources were modeled as wind energy to offset the larger proportion of solar energy in Anaheim's portfolio post 2027.

2. **Renewable Resource Price**

   Price estimates for baseload resources were mapped to APU's most recent baseload resource signed in 2017. Price estimates for intermittent resources were mapped to the responses obtained from a 2017 Request for Proposal administered by Southern California Public Power Authority (SCPPA). Resources assume a 2% price escalation rate, following industry common practice.

3. **Resource Generation Profile**

   Resource shapes were mapped to existing contracts. Baseload, solar and wind resources were mapped to the most recent geothermal, solar and wind contracts in APU's portfolio, respectively.

NATURAL GAS PRICE

Natural gas prices were derived from the Intercontinental Exchange (ICE) Henry Hub gas forward prices and adjusted for basis differential between Henry Hub and the SoCal City Gate. An escalation rate of 1.65% is applied to develop the expected gas forward curve.

CAP AND TRADE ALLOWANCE PRICES

This IRP assumed the continuation of freely allocated carbon allowances for retail sales compliance and APU's practice of purchasing carbon allowances for compliance obligations associated with any wholesale electricity purchases assuming an escalation rate of 5% + the Bureau of Labor Statistics Consumer Price Index (CPI).

C. D. & E. Model Analysis

- **Input Assumptions**
  - Resource Properties, Market Outlook
- **Dispatch Model Simulation**
- **Output Evaluation**
  - GHG Reduction, Renewable %, Reliability, Production Cost

E. MODEL ANALYSIS – OUTPUT EVALUATION

Market simulations were conducted for each candidate portfolio. All input assumptions were consistent, with the exception of the new renewable contracts layered into each portfolio. This allows the most accurate comparison between portfolios. The candidate portfolio's model simulation results were analyzed and scored based on the six performance measures.

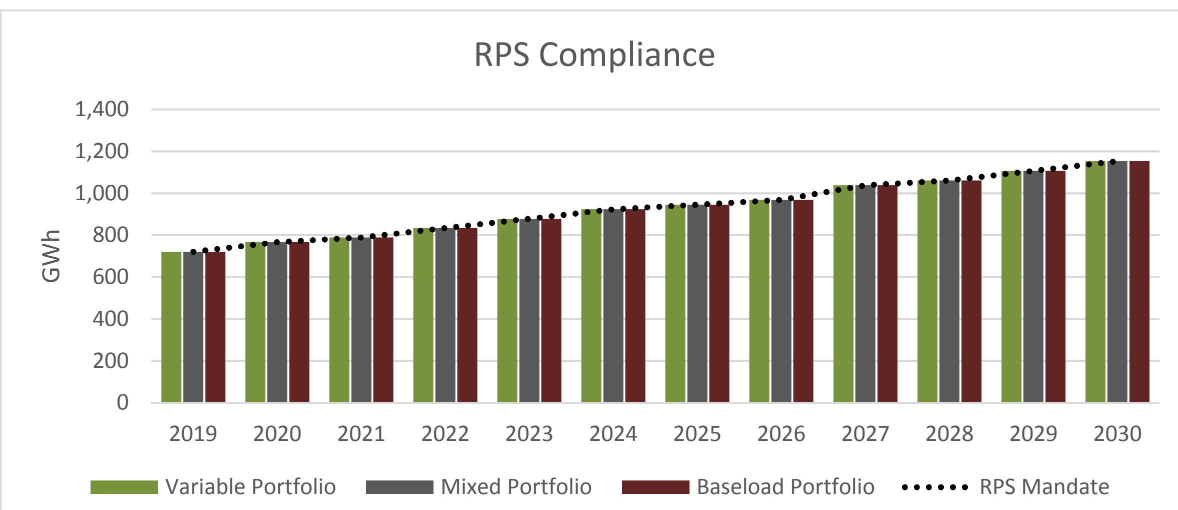
The analysis results are summarized in this section, with supporting information in Appendix C – Portfolio Evaluation Details.

50% RPS & 40% GHG REDUCTION

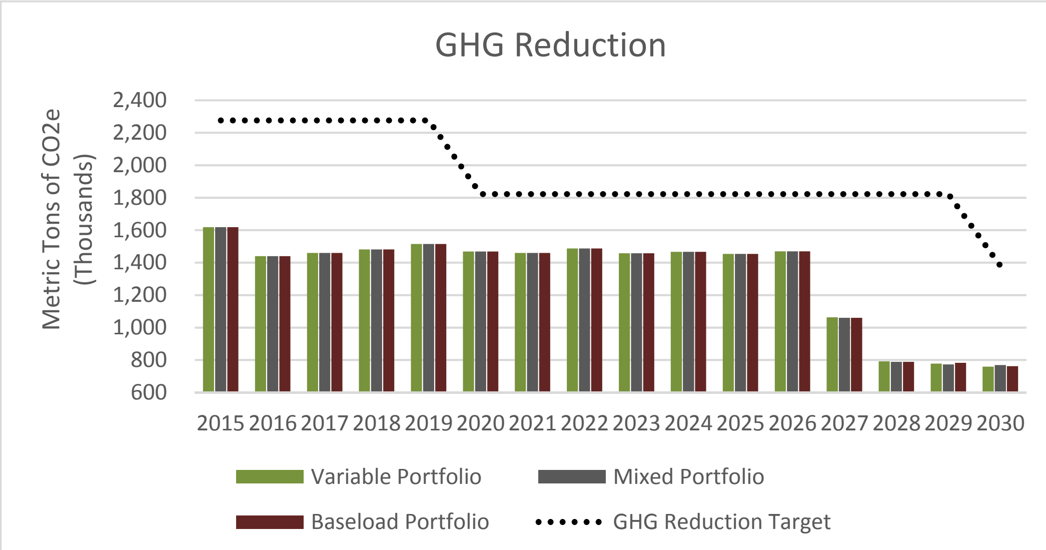
PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
RPS and GHG Compliance	**3**	**1**	**2**
Legend: 3=Best, 2=Middle, 1=Worst			

Each portfolio meets RPS and GHG targets, as shown in Graph 33 and Graph 34. While each portfolio performed equally in meeting renewable portfolio standards, the Baseload Portfolio and Mixed Portfolio produce slightly more GHG than the Variable Portfolio. By 2030, the Mixed Portfolio is estimated to produce 10,150 MTco2 more than the Variable Portfolio. The Baseload Portfolio is estimated to produce 2,551 MTco2 more than the Variable Portfolio. Because all three portfolios equally meet RPS compliance targets, they are ranked in order of the best portfolio having the least amount of GHG emissions. Using this raking strategy, the Variable Portfolio performed the best, followed by the Baseload Portfolio and then the Mixed Portfolio

Graph 33: Candidate Portfolio Results: RPS Compliance



Graph 34: Candidate Portfolio Results: Forecasted GHG Reduction



REGULATORY RISK

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Regulatory Risk	**3**	**2**	**1**
Legend: 3=Best, 2=Middle, 1=Worst			

As discussed in Section A. Portfolio Consideration and Performance Measures, to achieve the least amount of Regulatory Risk, the preferred resource portfolio should have enough flexibility to absorb additional renewable purchases beyond the current 50% RPS requirement. The preferred portfolio should also be sufficiently diversified so that APU minimizes the technological risk where one technology becomes obsolete or less cost-effective.

To address the potential for higher RPS targets, APU recommends the portfolio with the lowest power supply cost and the highest degree of diversification, which is the Variable Portfolio. Please refer to the Expected Cost and Diversification sections below for details.

RESOURCE ADEQUACY

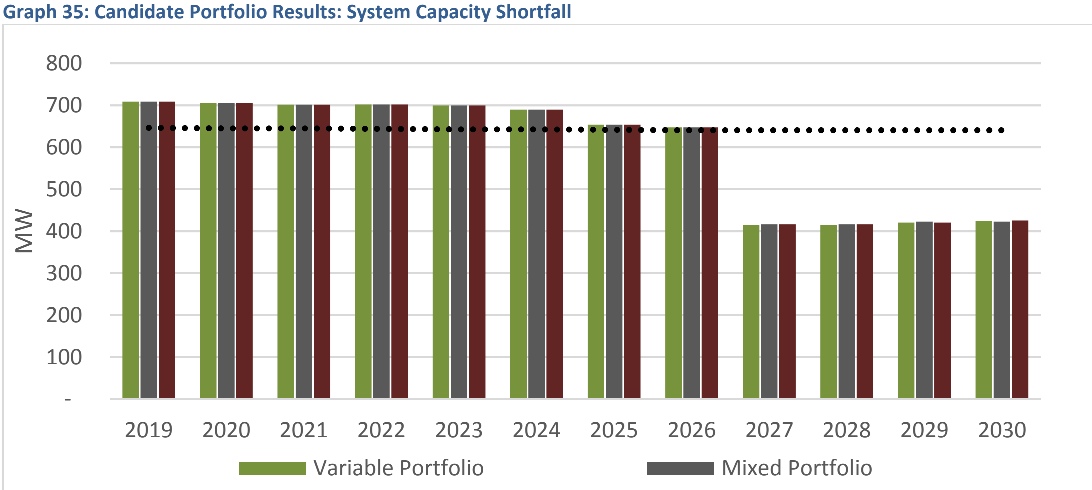
PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Resource Adequacy	**1**	**2**	**3**
Legend: 3=Best, 2=Middle, 1=Worst			

System Capacity

Although the new resources in each candidate portfolio will contribute to system capacity, these purchases will not likely be sufficient to meet all resource adequacy requirements. The baseload, solar, and wind contracts are estimated to have a capacity factor of 95%, 27%, and 21%, respectively. The system capacity values for each portfolio are summarized in Table 5: New Resource Capacity by Candidate Portfolio.

Graph 35 details the monthly capacity shortfall for each candidate portfolio. In the short run for years 2027-2030, the capacity shortfall is very similar between all three portfolios. Post 2030, the differences become larger and the Variable Portfolio has the largest shortfall of capacity, followed by the Mixed and Baseload Portfolios, respectively.

Graph 35: Candidate Portfolio Results: System Capacity Shortfall



* Minor differences in capacity shortfall are due to when contracts are layered in.

The capacity shortfalls will be supplemented with capacity contract purchases. Cost of replacement capacity has been estimated at the average 2017 market rate of $2/kW-month with a 2.5% escalation rate. The Mixed Portfolio is estimated to save $146,730 in capacity purchases through 2030 compared to the Variable Portfolio. The Baseload Portfolio is estimated to save $147,133 in capacity purchases through 2030 compared to the Variable Portfolio.

Table 6: System Capacity Purchases Cost

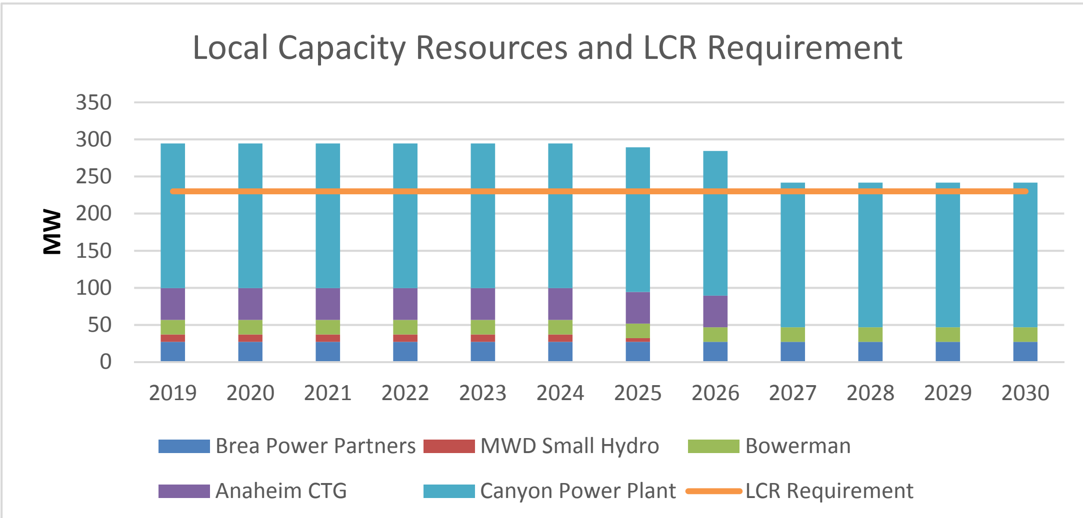
	CY 2027	CY 2028	CY 2029	CY 2030	Total
Mixed Portfolio	-$50,442	-$51,703	-$105,991	$61,406	-$146,730
Baseload Portfolio	-$50,442	-$51,703	$4,608	-$49,597	-$147,133

Local Capacity

The CAISO local capacity requirement is determined by local energy demand and transmission availability, and would not vary based on resource portfolio mix. The CAISO local capacity requirement for APU has been below 230 MW in the past few years and remains stable. APU has over 290 MW of natural gas and baseload renewable power plants located within the LA Basin.

During the planning horizon of this IRP, APU has sufficient local resources that exceed CAISO's local capacity requirements. In the next IRP, APU will consider the local capacity impact of plant retirements and baseload contract expirations.

Graph 36: Local Capacity Resources and LCR Requirement

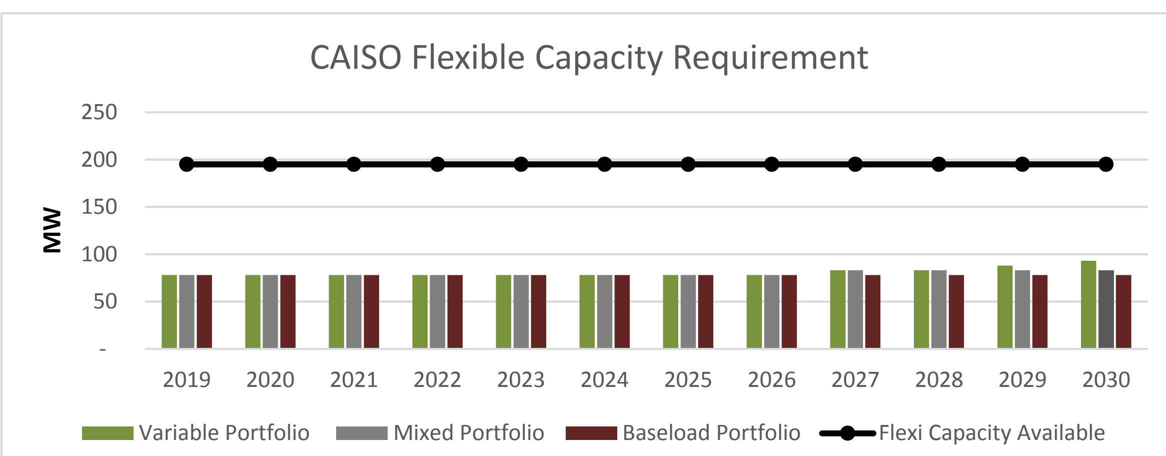


Flexible Capacity

On average, APU has a monthly flexible capacity requirement of 40 MW, which peaks in December with a capacity requirement of 80 MW. The introduction of additional intermittent resources is estimated to increase the flexible capacity requirements by 3 MW for a 20 MW solar contract and 5 MW for 20 MW wind contract.

As Canyon Power Plant has 194 MW of eligible flexible capacity, APU has sufficient flexible capacity available through Canyon to meet the additional requirements for flexible capacity. The Baseload Portfolio requires the least amount of flexible capacity, while the Variable Portfolio requires the highest amount. Graph 37 shows that under all scenarios APU has ample Flexible Capacity resources throughout the planning period:

Graph 37: CAISO Flexible Capacity Requirement



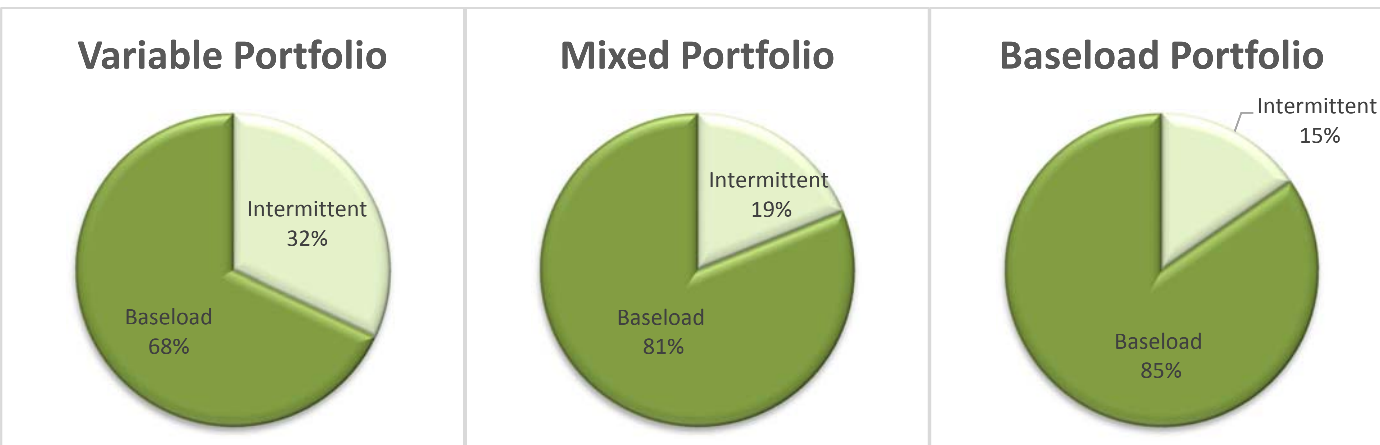
The portfolio that requires the least amount of capacity purchases is given the highest ranking. The Baseload Portfolio requires the least amount of system capacity purchases, followed by the Mixed Portfolio and then Variable Portfolio. These costs are included in the net power supply cost detailed below in the Expected Cost paragraphs.

PORTFOLIO DIVERSIFICATION

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Portfolio Diversification	3	2	1
Legend: 3=Best, 2=Middle, 1=Worst			

Graph 38 shows the estimated portfolio diversification for each of the candidate portfolios in 2030. The Variable Portfolio offers the most diversification, with 31% of the renewable generation coming from intermittent resources. This is significantly more diverse than the Mixed and Baseload Portfolios, which only have 8% and 1% intermittent resources in their portfolios, respectfully. As diversity increases flexibility, reliability, and performance, a higher grading is awarded for higher diversity. The highest diversified portfolio is the Variable Portfolio, therefore it is the preferred portfolio under this category.

Graph 38: Candidate Portfolio Results: Portfolio Diversity in 2030



EXPECTED COST

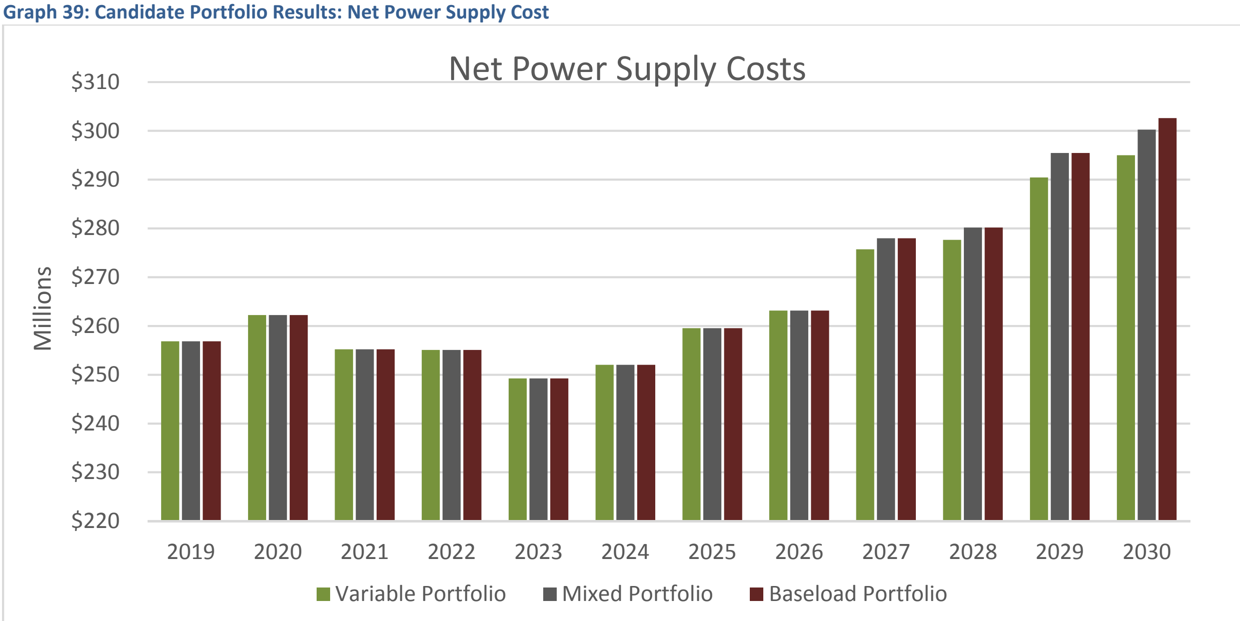
PERFORMANCE MEASURE	VARIABLE	MIX	BASELOAD
Expected Cost	3	2	1
Legend: 3=Best, 2=Middle, 1=Worst			

One of APU's goals is to minimize impacts on customer bills and to serve customers at just and reasonable rates. As such, the total power supply cost for each portfolio is estimated, with lower cost portfolios being awarded a higher rating.

The Variable Portfolio is estimated to be the least cost portfolio, costing $3.2 billion from 2019 through 2030. The Mixed Portfolio is estimated to cost an additional $15.1 million compared to the Variable Portfolio, and the Baseload Portfolio is estimated to cost an additional $17.4 million compared to the Variable Portfolio. Grading is awarded in order of the least cost being the best portfolio. The Variable Portfolio scored the highest under this performance measure.

Graph 39 displays the total annual power supply costs for each portfolio. Each portfolio performs similarly in the first several years until 2027, when new contracts come online. In the subsequent years, the cost difference grows exponentially with the Variable Portfolio remaining significantly less expensive than the other two portfolios.

Graph 39: Candidate Portfolio Results: Net Power Supply Cost



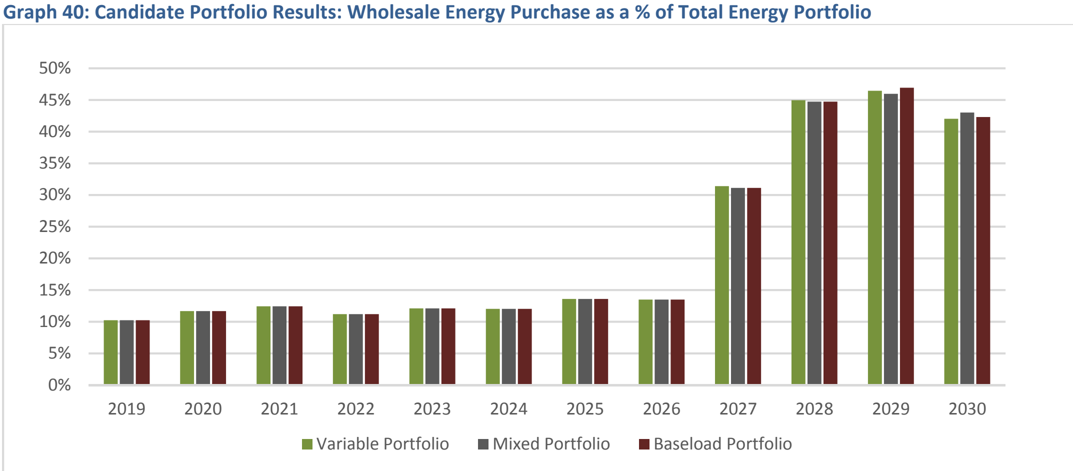
*Net Power Supply Cost = Total power supply costs net of transmission revenues and wholesale energy revenues

MARKET RISK

PERFORMANCE MEASURE	VARIABLE	MIX	BASELOAD
Market Risk	3	1	2
Legend: 3=Best, 2=Middle, 1=Worst			

Graph 40 displays the estimated financial exposure from the candidate portfolios. Financial exposure is determined by the percentage of wholesale energy purchases compared to system load as well as the cost impact of wholesale market purchases. The market purchase percentages for the Variable, Mixed, and Baseload Portfolios were very close, averaging 41.21%, 41.20% and 41.27%, respectively, from 2019 to 2030; therefore, the portfolios were awarded similar scores for this criteria. However, by 2030, the Baseload Portfolio requires an additional $139,000 annually in energy purchases compared to the Variable Portfolio, and the Mixed Portfolio is estimated to require an additional $1.2 million in energy wholesale energy purchases. A higher grade is awarded to the portfolios with the least amount of energy purchases required.

Graph 40: Candidate Portfolio Results: Wholesale Energy Purchase as a % of Total Energy Portfolio



*Slight differences in 2029 and 2030 are due to when contracts are layered in.

It is important to note that market exposure is limited by the generation capacity available from APU resources. When the wholesale market price rises above predetermined prices, all APU units will be dispatched to serve the retail customers. The percentage of market energy purchases will therefore be lower under higher wholesale market price conditions.

SUMMARY

Overall the Variable Portfolio, which replaces lost IPP generation with intermittent renewable resources, performed the best. This portfolio was estimated to have a lower overall power supply cost. It also has the least amount of Regulatory Risk and resulted in the most diverse portfolio. Due to the unpredictability of intermittent generation, this portfolio posed the highest exposure to market price spikes and required additional capacity purchases to meet Resource Adequacy capacity requirements. However, this market exposure is mitigated by the large amount of existing baseload resources under fixed price contracts. Additionally, an analysis of the system-wide capacity market indicates that these resources will be readily available at a much lower cost than building new peaking power plants or utility scale energy storage facilities.

The Mixed Portfolio, which replaces lost IPP generation with half intermittent and half baseload renewable resources, was ranked second best and performed averagely over most of the criteria.

The Baseload Portfolio had the least financial exposure to market dynamics due to the stable nature of baseload generation. This portfolio was also ranked the highest for Resource Adequacy as baseload resources have a high capacity value. However, this portfolio was also the most expensive, provided the least amount of portfolio diversification and posed the highest Regulatory Risk.

The following table displays a summary of the performance measure results for each portfolio scenario considered:

PERFORMANCE MEASURE	**VARIABLE** 	**MIXED** 	**BASELOAD** 
Compliance	3	1	2
Regulatory Risk	3	2	1
Resource Adequacy	1	2	3
Portfolio Diversification	3	2	1
Expected Cost	3	2	1
Managed Market Risks	3	1	2
Total	**16**	**10**	**10**
Legend: 3=Best, 2=Middle, 1=Worst			

F. Stress Testing

- **Market Volatility**
  - High/Low Fuel, Energy, Carbon Markets
- **Customer Demand Variation**
  - High/Low Temperature, Solar, EV, Energy Efficiency

F. STRESS TESTING

Additional analysis of the candidate portfolios was conducted using stress tests to determine whether or not the portfolio performance would change under extreme market and load changes. Portfolio simulations were performed for each candidate portfolio to address the following situations.

G.1. COMPONENTS OF THE STRESS TESTS

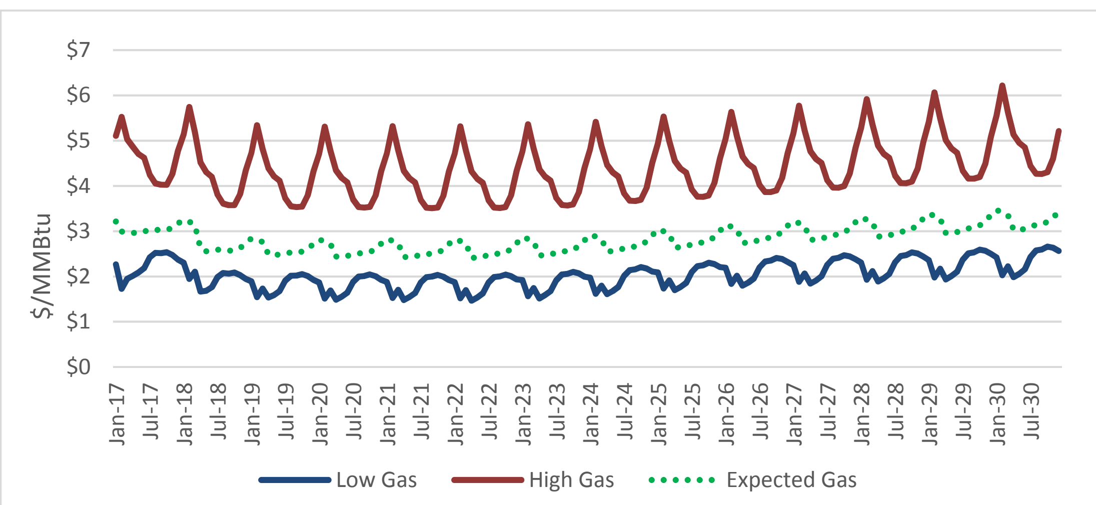
TEST 1: EXTREME HIGH COSTS VS. EXTREME LOW COSTS

A market simulation stress test was conducted by simulating portfolio performance under extreme cost situations. Each case uses the extreme high and low estimates of: resource costs, wholesale energy prices, carbon prices, and utility solar growth into the production cost model.

GAS PRICE

APU owns and contracts power resources that use natural gas as a fuel. In addition, resource dispatch and market prices are heavily influenced by gas prices. Two standard deviations were added to the expected gas price to develop the high gas price scenario. One standard deviation was deducted from the expected gas price to develop the low gas price scenario. Standard deviations were calculated using five-year historical data of the SoCal Citygate price. Graph 41 shows the gas prices used to stress test the three portfolio scenarios:

Graph 41: Stressed Gas Prices

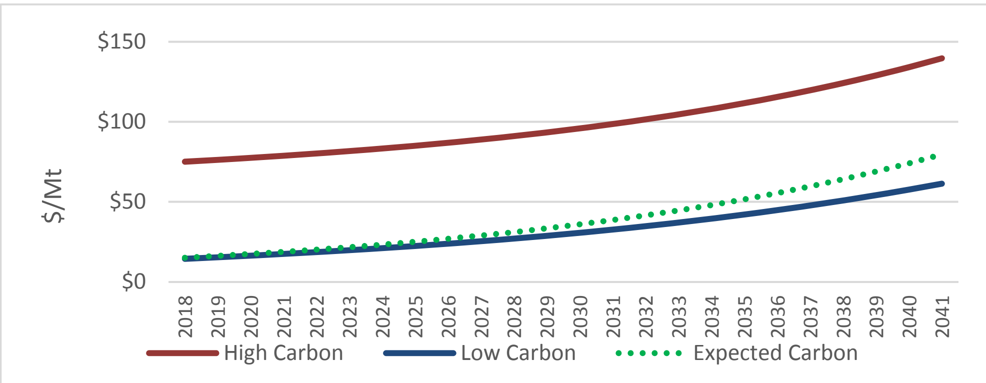


CARBON PRICE

A high carbon price forecast was developed using a $60 increase from the floor price, as discussed in the rulemaking for Post-2020 allowance allocation approved by the CARB on July 27, 2017[9]. A low carbon price scenario was developed using the floor price.

Compared to the Preliminary GHG Price Projections[10] used in the 2017 Integrated Energy Policy Report (IEPR) Demand Forecast, APU's low carbon price forecast is lower than the IEPR's low price forecast; APU's high price forecast is higher than the IEPR's high price forecast with the only exception in year 2030. APU chose to use its own extreme carbon price forecast as it stresses the model more. Graph 41 shows the carbon prices used to stress test the three portfolio scenarios:

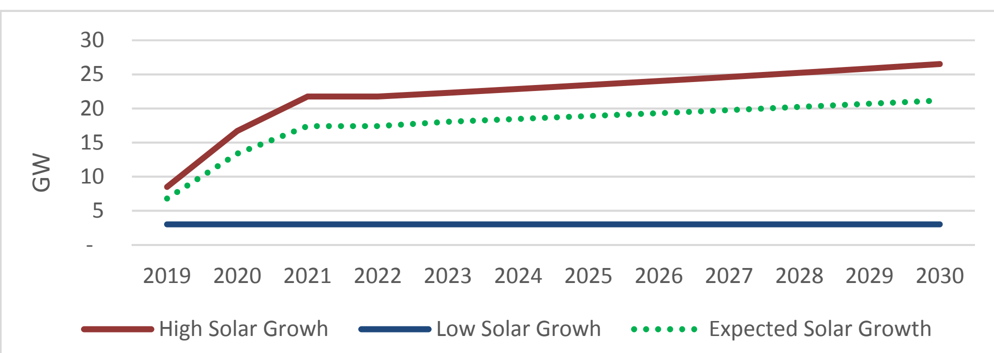
Graph 42: Stressed Carbon Prices



UTILITY SCALE SOLAR GROWTH

The high utility-scale solar growth scenario was developed assuming a 25% increase of all current planned CAISO interconnection projects and growth of 2.5% annually post 2022. The low utility scale solar growth assumed no future CAISO interconnection projects would be built. Graph 43 shows the solar growth rates used to stress test the three portfolio scenarios:

Graph 43: Stressed Utility Scale Solar Capacity Growth



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[9] See Table 13 Estimated Range of Cap-and-Trade Allowance Price 2021–2030 of the CARB California's 2017 Climate Change Scoping Plan, https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf. The Estimated Cap-and-Trade Reserve Price was $56.7 above the Floor Price. For planning purposes, this IRP uses $60 above the floor price for stress testing.
[10] TN216271_20170227T161611_Preliminary_GHG_Price_Projections__Energy_Assessment_Division

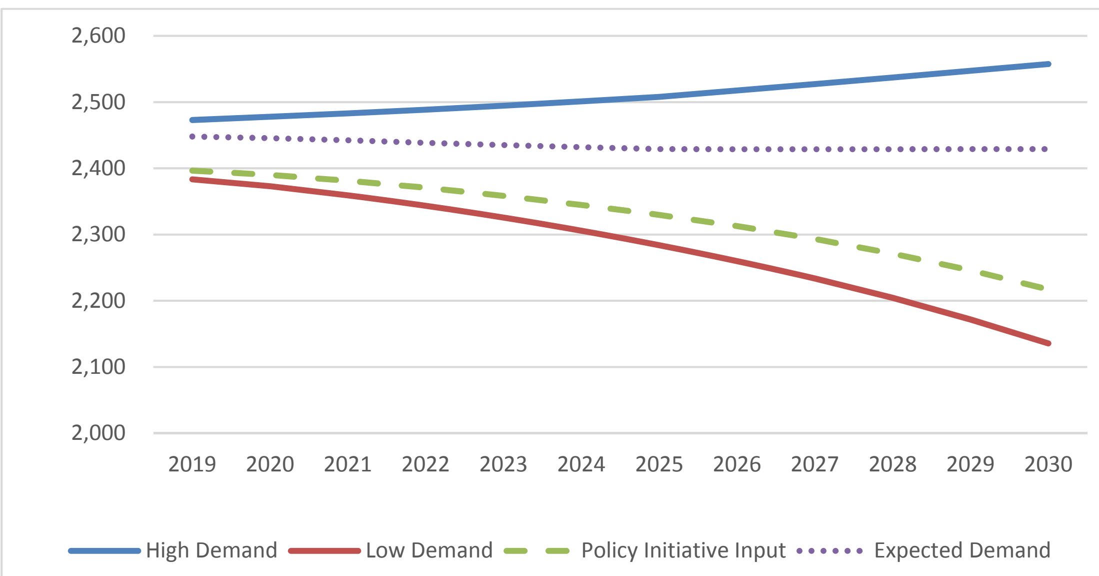
TEST 2: EXTREME HIGH DEMAND VS. EXTREME LOW DEMAND

A high demand scenario was developed by applying extremes to the base demand forecast described in Section V.A. Energy Demand Forecast - Methodology & Assumptions. Energy efficiency and solar growth effects were removed from the base demand forecast, and accelerated growth in transportation electrification was applied. The accelerated EV growth was assumed to be 25% above Governor Brown's Executive Order B-16-12, resulting in 45,000 registered electric vehicles in APU by 2038.

Similarly, a low demand scenario was also developed by applying extremes to the base demand forecast described in Section V.A. Energy Demand Forecast - Methodology & Assumptions. Electric vehicle growth was removed from the base demand forecast, and double energy efficiency goals were applied in addition to accelerated behind-the-meter solar capacity installation. The accelerated PV growth was estimated to be 25% above the capacity forecast, and energy efficiency was estimated to be 3% of retail load.

Graph 44 below also displays Policy Initiative Input as a comparison with the demand stress test values. The Policy Initiative Inputs incorporates high energy efficiency, high consumer solar installation, and high electric transportation growth assumptions to reflect the impact of the State's policy initiatives on APU load.

Graph 44: Stressed System Load Growth or Reduction (GWh)



G.2. MODEL RESULTS UNDER STRESS TESTS

The following table displays a summary of the performance measure results after stress testing each portfolio scenario.

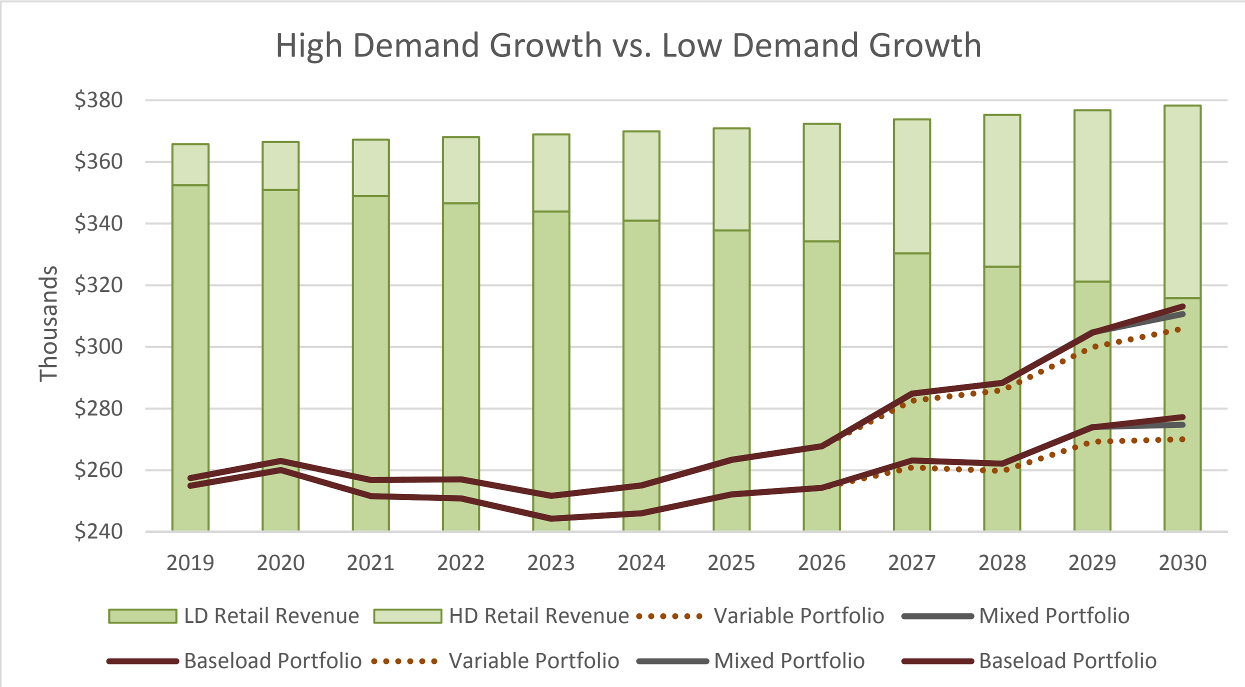
PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Compliance	3	1	2
Regulatory Risk	3	2	1
Resource Adequacy	1	2	3
Portfolio Diversification	3	2	1
Expected Cost	3	2	1
Managed Market Risks	3	1	2
Total	**16**	**10**	**10**
Legend: 3=Best, 2=Middle, 1=Worst			

The model simulation results held constant for all three portfolios under the stress tests, with the Variable Portfolio performing the best. Below are details of the tests:

Under either stress test of High versus Low Costs or High versus Low Demand, the portfolio scores of the following performance measures stayed the same: Compliance, Regulatory Risk, Resource Adequacy, Portfolio Diversification, and Financial Exposure. The only components that could change are Expected Cost, or the power supply costs, as detailed below.

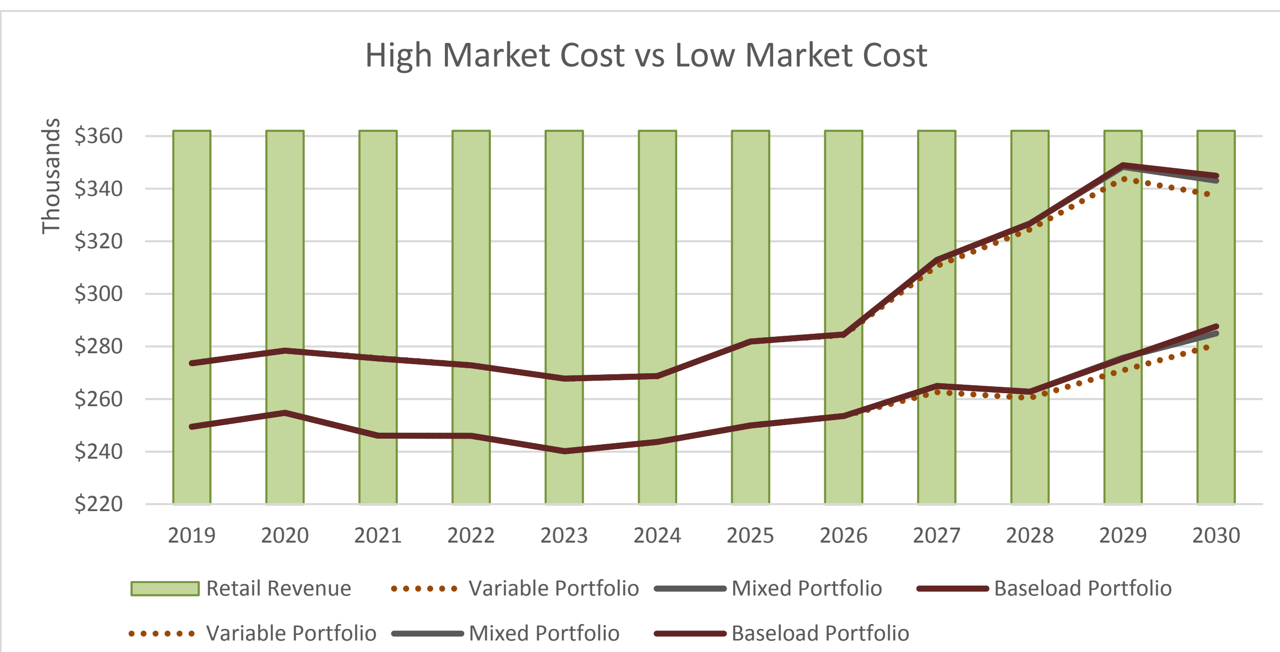
Graph 45 displays the simulation results for each candidate portfolio under these cost extremes. The total portfolio cost for each candidate portfolio with high and low cost scenarios are displayed as lines, and total retail revenue is displayed in columns. The Variable Portfolio, shown as the green dotted line, performs the best under both high and low cost market situations. The Baseload Portfolio performs the worst, with expenses being notably higher than the Variable Portfolio, but very close to the Mixed Portfolio costs. The scaling to retail revenue is intended as a reference to potential rate increases needed to supplement the changing portfolio.

Graph 45: Stress Test Results: Extreme High Costs vs. Extreme Low Costs



Similarly, a load simulation stress test was conducted by simulating portfolio performance under extreme load situations. A high load growth extreme incorporates assumptions of high electric vehicle growth, low privately owned solar PV, and low energy efficiency. A low load growth extreme incorporates assumptions of low electric vehicle growth, high consumer installed solar PV, and high energy efficiency. Graph 46 displays the simulation results for each candidate portfolio under these load growth extremes.

Graph 46: Stress Test Results: Extreme High Demand vs. Extreme Low Demand



The total portfolio cost for each candidate portfolio under high and low load growth scenarios are displayed as lines and total retail revenue is displayed in columns. Estimated retail revenue for the low load growth scenario is displayed as only the dark green column, while estimated retail revenue for the high load growth scenario is displayed as the total of the light green columns. The Variable Portfolio, shown as the brown dotted line, performs the best under both load situations. The Baseload Portfolio performs the worst, with expenses being notably higher than the Variable Portfolio, but very close to the Mixed Portfolio costs. The scaling to retail revenue is intended as a reference to potential rate increases needed to supplement the changing load scenarios.

G. Optimum Portfolio Recommendation

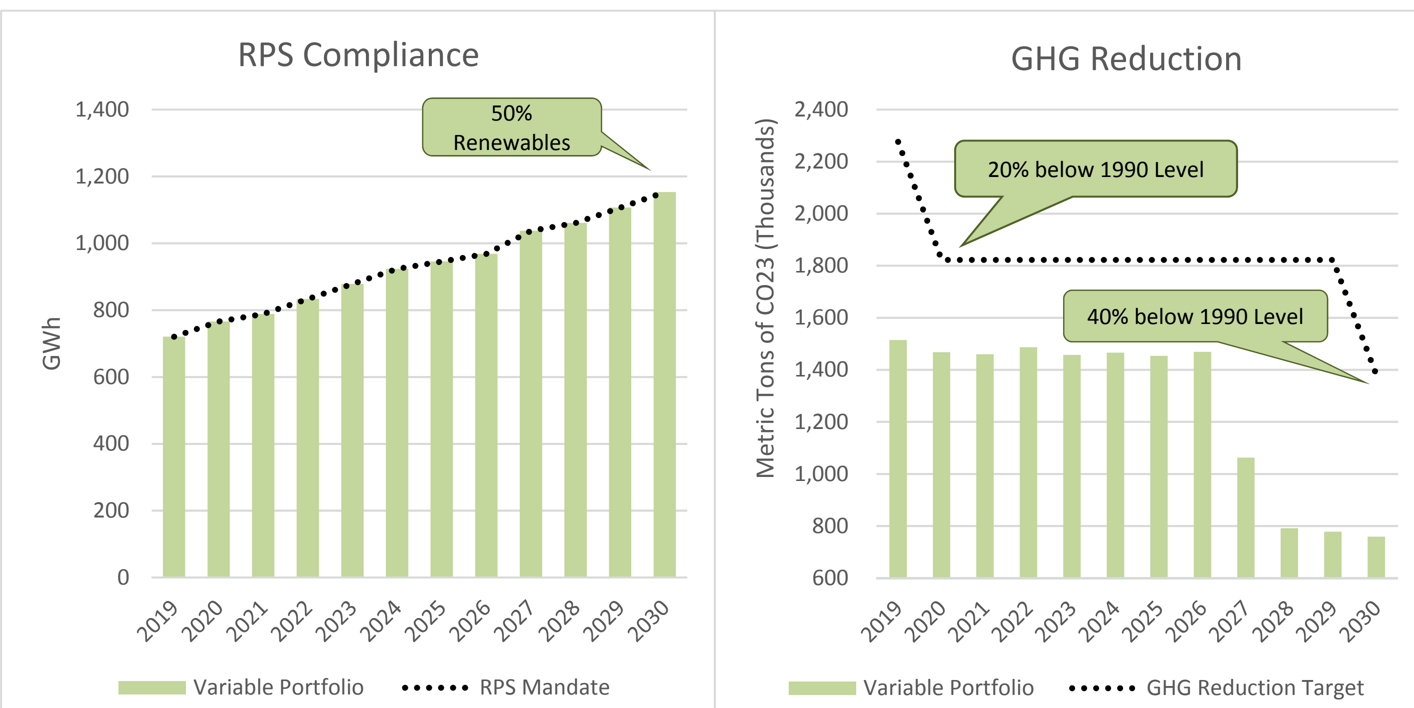
G. OPTIMUM PORTFOLIO RECOMMENDATION

The optimum portfolio recommendation is the **Variable Portfolio**, which would replace lost IPP generation with intermittent renewable resources. The Variable Portfolio performed the best under normal as well as stress conditions. It is estimated to have the least power supply cost, the least Regulatory Risk, and most diverse portfolio. As intermittent generation is unpredictable, this portfolio may pose a higher exposure to market price spikes; however, this risk is forecasted to be very small, as under extreme market conditions which simulated high market prices, this portfolio performed the best, including capacity purchases included in the power supply cost.

50% RPS & 40% GHG REDUCTION

As shown in Graph 47, the Variable Portfolio is in compliance with current legislative and regulatory requirements, and meets or exceeds renewable and GHG emission reduction targets. It is also provides the most flexibility for adjusting to potential future regulatory or legislative changes, as opposed to the other portfolio options.

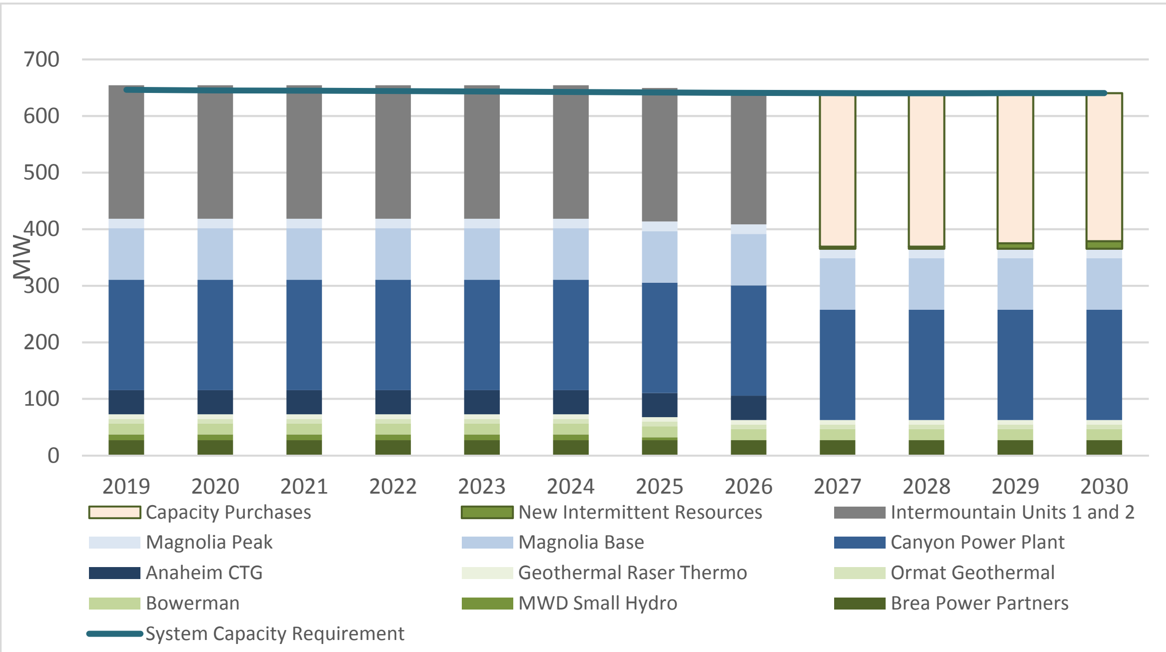
Graph 47: Variable Portfolio Meets or Exceeds Compliance Targets



RESOURCE ADEQUACY & RELIABILITY

The Variable Portfolio requires capacity purchases to meet resource capacity requirements. Graph 48 displays the change in capacity from 2019 to 2030. Capacity purchases will be acquired in 2027 to replace the system capacity lost with the divestiture of IPP. Any increase in flexible capacity requirements will be met with the Canyon Power Plant.

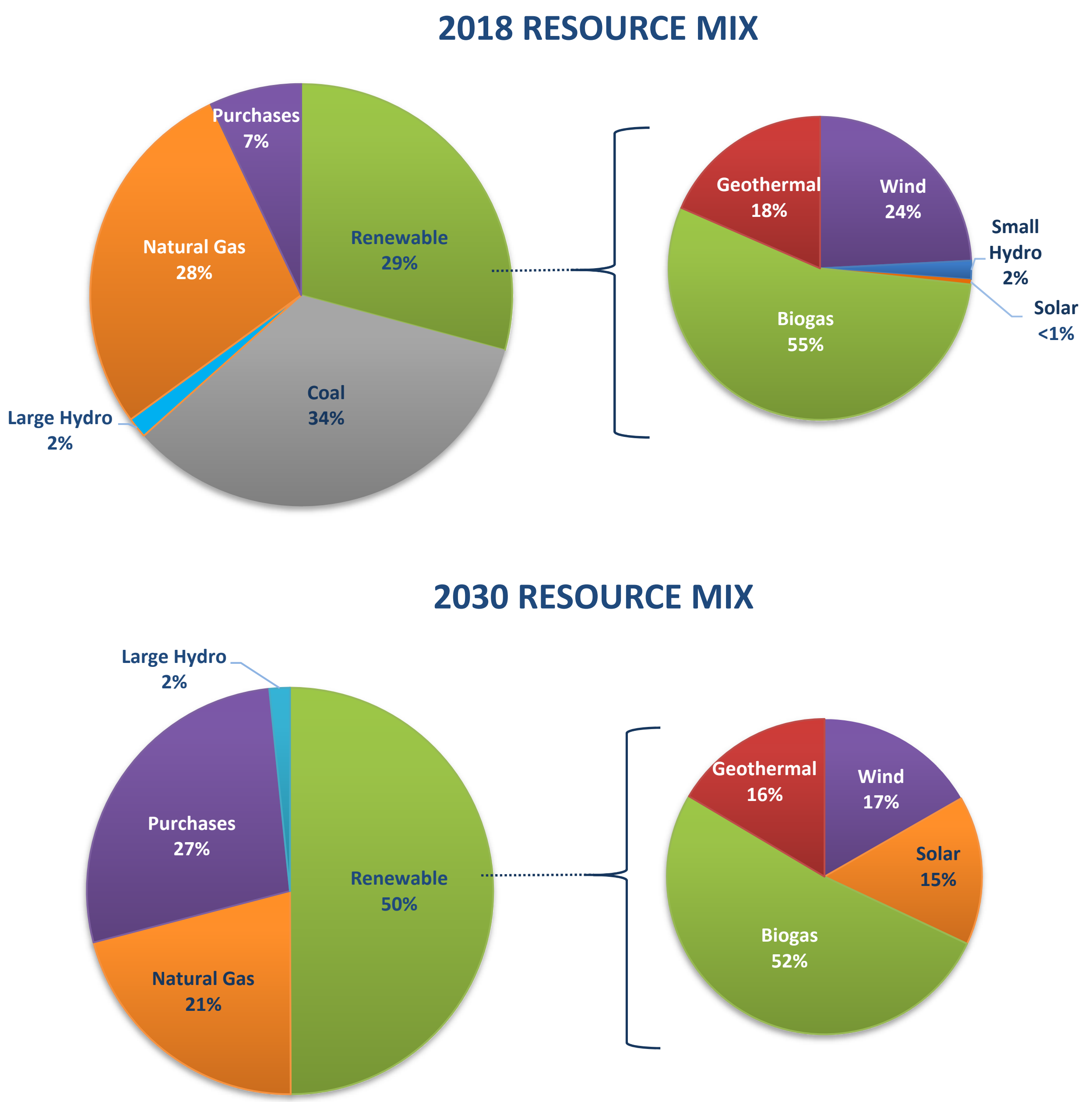
Graph 48: Variable Portfolio Forecasted Resource Adequacy



DIVERSIFICATION

Graph 49 below displays the changing resource mix under the Variable Portfolio.

Graph 49: Resource Mix for Retail Energy Demand: 2018 vs. 2030



The change in resource mix has a corresponding impact on the cost structure in the future years.

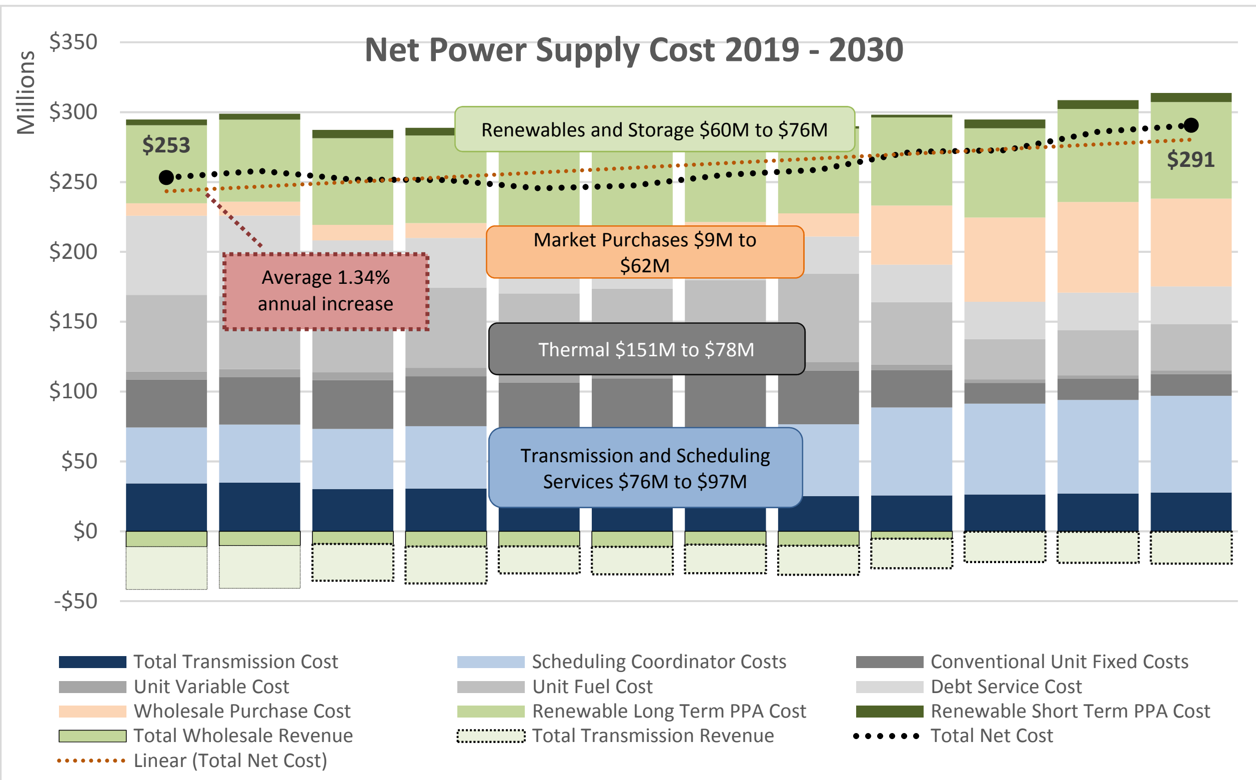
Graph 50 displays the power supply cost structure of the portfolio in 2019 and 2030. In total, the net cost to supply power is estimated to be $38 million higher in 2030 compared to 2019, or a 1.34% average annual increase over the next 12 years. The increase is mainly caused by estimated scheduling services fees outside of the power supply.

Scheduling services costs are expected to be $21 million higher in 2030 compared to 2019. These charges consist of CAISO transmission access charges, grid management fees, congestion, losses, ancillary services, and other energy charges, and are expected to increase by approximately 4% annually. Capacity purchases to meet the resource adequacy requirements are also included here.

The total energy costs will decrease even though each component may move up or down depending on the energy category. The highest increase in cost is *wholesale energy purchases* to serve load, which are estimated to be $53 million higher in 2030. This increase is due to higher prices and volumes purchased. The average wholesale market energy price is forecasted to be $62/MWh in 2030, compared to $36/MWh in 2019. Also, an additional 680 MWh are forecasted to be procured in the wholesale energy in market in 2030, compared to 2019.

As more *renewable energy sources* are being included into the portfolio, the cost of renewable energy is expected to increase by $16 million. Conversely, the divestiture in *fossil fuel resources* results in a cost savings totaling $73 million.

Graph 50: Variable Portfolio Power Supply Cost Structure



*Net power supply costs = Total power supply costs net of transmission revenues and wholesale energy revenues

MARKET RISK

While the Variable Portfolio has a higher market risk due to exposure to market price spikes, it still performed the best under extreme market conditions. When energy costs are either extremely high or extremely low, the cost to maintain the Variable Portfolio is consistently the lowest.

1. When the market cost is extremely low, APU purchases the low-cost energy from the wholesale energy market.

2. When the market cost is extremely high, the APU resources are dispatched to meet retail customer needs, therefore limiting the market risk.

The Variable Portfolio has the best ability to leverage lower market prices, and market risks are capped by the resources available in APU's portfolio.

H. RATE IMPACT

ANAHEIM ELECTRIC RATES

APU strives to find resources that are cost-effective and minimize rate impacts on customer utility bills, while still meeting its compliance obligations for increased renewables and lower GHG emissions. By responsibly divesting of its coal assets and utilizing its peaking resources to integrate more renewable purchases, APU has been able to maintain affordable electric rates. The recommended Variable Portfolio is expected to help APU maintain affordable electric rates over the planning period as net power supply costs are expected to increase by only 1.34% per year, on average, which is less than the expected rate of inflation.

APU strives to provide just and reasonable rates for the service it provides to customers as required by Federal Law and, at the same time in compliance with the California Constitution, the electric rates do not exceed APU's reasonable cost to provide electric service to its customers. Consistent with these state and federal mandates, Section 1221 of the Anaheim City Charter requires that electric rates be based on the cost of service requirements for each customer class. The Anaheim City Council has adopted electric rates in accordance with this requirement and the additional Charter requirements that the electric rates be sufficient to pay for (1) operations and maintenance of the APU's electric system, (2) the payment of principal and interest on debt, (3) creation and maintenance of financial reserves adequate to assure debt service on bonds outstanding, (4) capital construction of new facilities and improvements of existing facilities, or maintenance of a reserve fund for that purpose, and (5) other costs. APU has designed its rate schedules to maintain simplicity and send appropriate pricing signals that encourage prudent consumption of electricity while fully complying with federal, state mandates, and the Charter. To accomplish these objectives, Anaheim offers several base rates as well as optional rates that customers may opt into if they choose.

Base Electric Rates

- Domestic Service (i.e., residential)
- Small Commercial
- Medium Commercial
- Large Commercial
- Industrial
- Agricultural
- Lighting
- Municipal

Optional Rates

- Thermal Energy Storage
- Feed-In-Tariff
- Economic Development / Business Retention
- Domestic Time-Of-Use
- Commercial Time-Of-Use
- Net Energy Metering
- Domestic Electric Vehicle

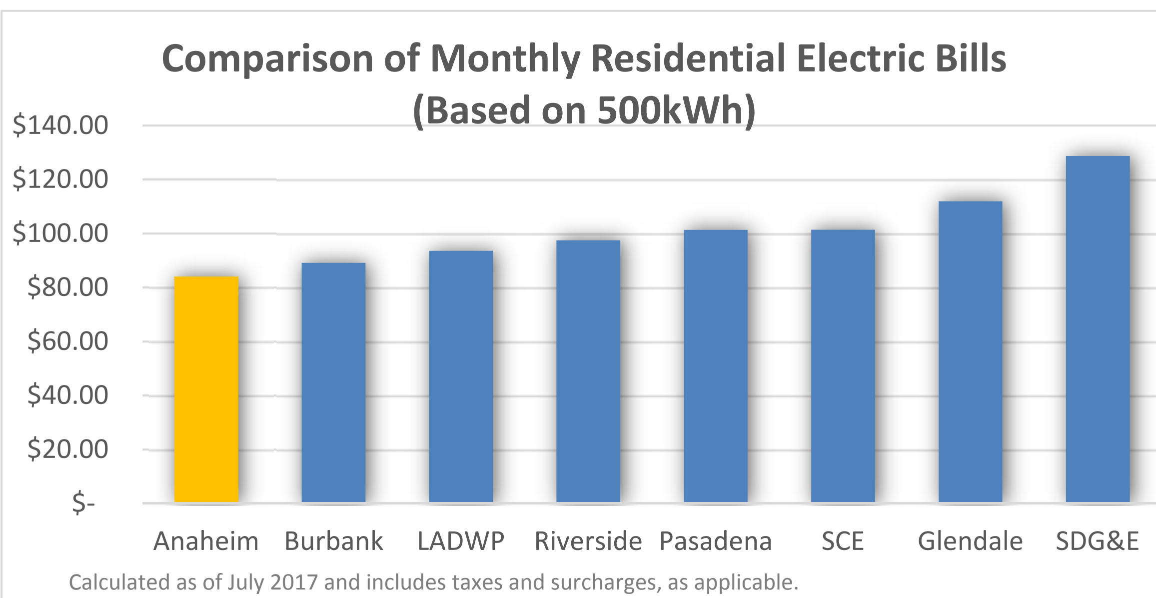
Generally, all costs of APU's Electric System, including power supply costs, are recovered through the application of these base rates. Anaheim's customer rates also include a Rate Stabilization Adjustment (RSA) which contains two components (1) a Power Cost Adjustment (PCA) to recover fluctuations in power supply costs and other relevant operational costs, and (2) an Environmental Mitigation Adjustment (EMA) to recover fluctuations in environmental mitigation costs related to the procurement, generation, transmission, or distribution of electricity. The RSA helps facilitate timely recovery of costs and thereby helps to maintain financial performance goals including debt service coverage ratios and reserve levels. The RSA also provides a mechanism to reduce rates when costs decrease. Additionally, APU offers a low income energy discount to seniors, military veterans, and disabled customers who meet specified income thresholds.

APU continuously monitors its rates, rate options, and fees to ensure it provides customers with options that meet their needs and that encourage adoption of environmentally friendly technologies. To that end, APU has added a commercial electric vehicle (EV) rate to encourage further adoption of electric transit buses, school buses, delivery vehicles, and other fleet vehicles within the City. This effort will also enhance the City's economic justice efforts by encouraging public transportation agencies to invest in EV fleets that serve a broad array of demographics within the City.

AVERAGE RESIDENTIAL RATE COMPARISON

APU's residential electric rates are competitive with other electric utilities serving Southern California. APU residents benefit from electric bills that are 17% to 35% lower than those charged by Southern California Edison and San Diego Gas & Electric, the only electric utilities that serve Orange County residents, other than Anaheim.

Graph 51: Comparison of Monthly Residential Electric Bills



APU balances its goal of maintaining low electric rates with the goal of providing reliable electric service to its customers and maintaining the long-term financial viability of APU. In addition to continuous cost mitigation efforts, this requires periodic rate adjustments to help ensure adequate funding is available for investing in the system and to maintain key financial metrics that support APU's investment grade credit rating. Key metrics include debt service coverage with a goal of 2.0x coverage and sufficient financial reserves with a goal of 90 days operating cash plus $50 million in the rate stabilization account. The rates APU charges to its customers must be sufficient to recover, among other things, the full cost of providing reliable service and maintaining financial stability.

RATE STRUCTURES

APU's rate structures include a fixed customer charge, tiered energy rates, the RSA, and an underground surcharge that pays for undergrounding of overhead power lines to improve reliability and beautify the City. Rates for each customer classification employ these components while medium and large commercial and industrial rates include a demand charge. Additionally, time-of-use rates also include higher rates during on-peak time periods when the demand for energy is high and lower rates during mid-peak and off-peak time periods when the demand for energy is lower.

As mentioned earlier, the RSA contains two components, i.e. the PCA and the EMA. The PCA is structured so that it can increase up to ½¢ per kWh in any 12-month period to collect for changes in power production costs, purchased power costs, regulatory compliance costs, debt service, and any other costs involved in delivering energy. The EMA is structured similarly to the PCA in that the annual limit of the increase is ½¢ per kWh in any 12-month period to collect for environmental mitigation costs such as greenhouse gas emissions, purchase of emission credits, taxes on emissions, and any cost differential between renewable power supply and traditional carbon-based power supply not recovered by the PCA.

With respect to any RSA adjustment, APU first considers costs of service recovery and the impact on customer bills with a goal of maintaining total electric charges that are competitive with those of other utilities in the region. Any change indicated by the RSA calculation is reviewed against other known long-term factors prior to any automatic implementation of rate changes. This allows APU to blend forecasted increases or decreases in the projected power supply or operational costs to meet financial requirements and mitigate large fluctuations in electrical costs to customers.

RATE IMPACT UNDER RECOMMENDED PORTFOLIO

Using the Variable Portfolio, APU performed rate impact analyses under the high, medium, and low load growth scenarios.

APU performs financial modeling for the purpose of monitoring and forecasting the financial performance of its electric utility and for identifying necessary rate adjustments. This financial model is used to help determine the cost impact of various changes in regulatory requirements, power supply scenarios, capital improvements, and debt issuances.

For purposes of the IRP, the different scenarios under evaluation were overlaid onto the existing forecasts of capital, O&M, debt service, and other cost of service requirements. In developing the IRP, scenarios were eliminated that would result in large customer impacts. Rate impacts reflected in the IRP are calculated on a system-wide basis.

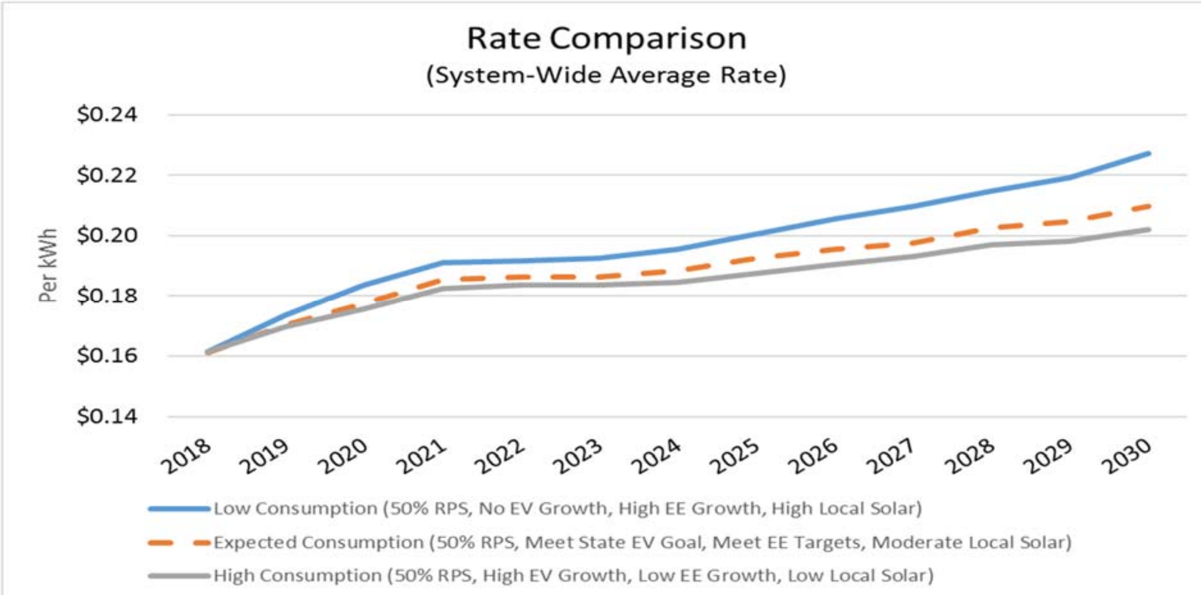
APU's forecasting model, like any other, includes significant assumptions. While the model used for the IRP analysis was based on information available at a single point in time, it is not uncommon for assumptions to change over time as new or better information is made available. An analysis was conducted for multiple scenarios and a range of potential rate impacts was developed to illustrate what management believes to be a realistic bandwidth of potential rate impacts over the course of the period analyzed.

The expected scenario assumes APU will meet the 50% RPS requirement, its allocated portion of the State goal of 1.5 million electric vehicles (EV) on the road in California, and meet all energy efficiency (EE) targets. It also assumes moderate local solar growth of 5 MW per year. The high energy consumption scenario assumes 50% RPS, high EV growth, low EE growth, and low local solar. The low energy consumption scenario assumes 50% RPS, no EV growth, high EE growth, and high local solar. The overall upward trend in estimated rates for all three scenarios reflects a modest increase in power supply, operating, maintenance, and debt service costs.

The results of the study suggest that the high energy consumption scenario results in lower average rate increases, as compared to the expected and low consumption scenarios. This is primarily the result of fixed system-wide costs being recovered over a greater number of billing units. The low consumption scenario, on the other hand, is expected to result in higher average rate increases due to system-wide costs being recovered over a smaller number of billing units. As noted, the study is based on forward-looking assumptions and is subject to change due to commodity price fluctuations, policy changes, technological developments, changes in cash requirements, and/or changing customer behavior.

APU will continue to update its long-term plan as expectations change in order to maintain accurate forecasts. The following chart illustrates the results of the study based on the three scenarios described above. The chart represents forecasted average rates based on system-wide averages and does not account for rate structure variations across and within customer classes.

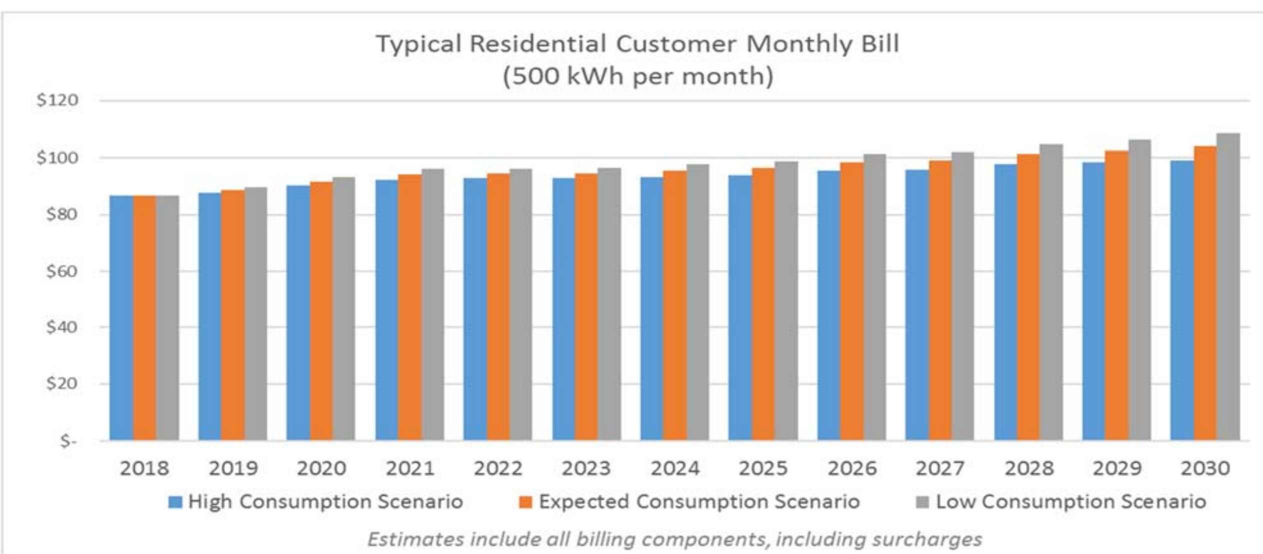
Graph 52: Rate Comparison



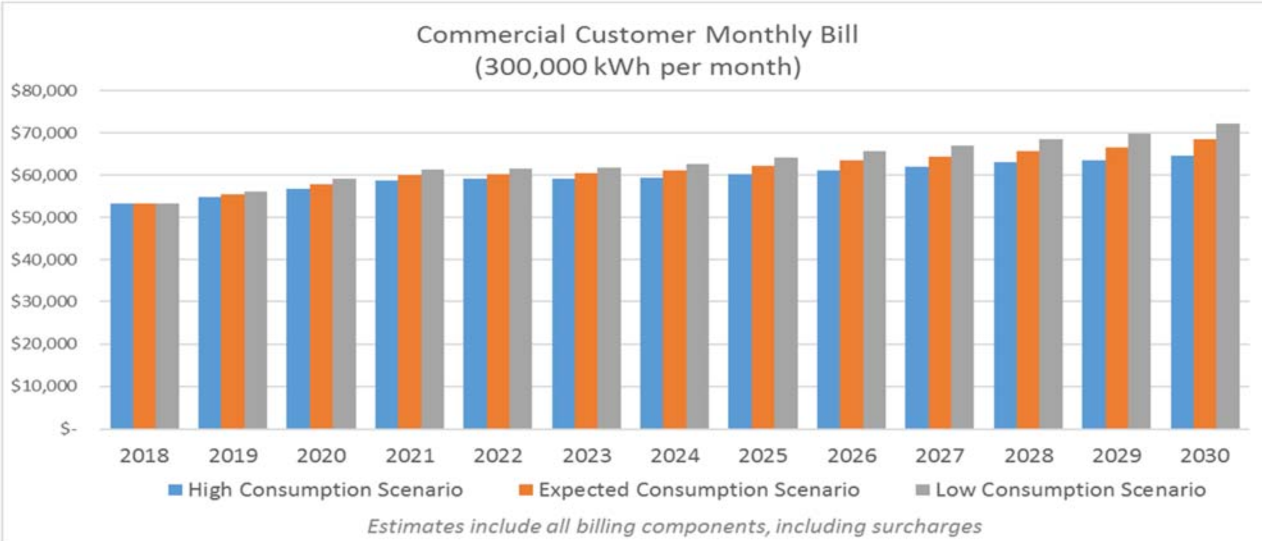
The above graph shows the results of a rate analyses performed pursuant to this IRP, which includes the expected power supply costs associated with the three IRP portfolio scenarios as well as non-power supply operating and maintenance costs, debt service, and financial metric requirements. For the expected consumption rate projection case and the Variable Portfolio, net power supply costs are expected to increase an average of 1.34% per year from 2019 to 2030, which is less than the expected rate of inflation over the same time period.

Monthly bills for individual customers and customer classes may be more or less than these estimates due to the different rate structures of the various customer classifications and variations in individual customer energy consumption profiles. The charts below reflect the estimated impact to monthly customer bills for a typical residential customer and a commercial customer.

Graph 53: Total Residential Customer Monthly Bill



Graph 54: Commercial Customer Monthly Bill



VIII. RELIABILITY & ELECTRIC SYSTEM OVERVIEW

This section starts with an introduction to APU's electric system (**A. APU Electric System Overview**) and generation and transmission resources (**B. Generation and Transmission Resources**).

PUC Section 9621 requires POUs to adopt an IRP to ensure that the POU meets the goal of ensuring system and local reliability. APU's Balancing Authority is the CAISO, which has reliability and Resource Adequacy requirements for load serving entities. Section **C. CAISO Resource Adequacy Requirements** discusses how APU plans to meet the CAISO system, local and flexible capacity requirements during the IRP's planning horizon.

PUC Section 9621 also requires POUs to adopt an IRP to ensure POUs achieve the goal of strengthening the diversity, sustainability, and resilience of the bulk transmission and distribution systems, and local communities.

APU entered into several transmission contracts through Southern California Public Power Authority (SCPPA) and with the Los Angeles Department of Water and Power (LADWP) in order to ensure the energy from APU's owned or contracted resources is consistently delivered into the CAISO from resources located outside of the CAISO footprint. On October 10, 2006, APU transferred operational control of all contracts for transmission resources to CAISO. According to the North American Electric Reliability Corporation (NERC) reliability standards, APU is a Distribution Provider (DP), and not a Transmission Operator (TOP), Transmission Owner (TO), Transmission Planner (TP), Transmission Service Provider (TSP), Generator Owner (GO), or Generator Operator (GOP). As such, the CAISO is responsible for evaluating the regional short-term and long-term infrastructure needs during its annual Transmission Planning Process.

APU has a long standing reputation of providing its customers with highly reliable electric distribution services over a robust and well-maintained electric distribution system. In 2017, the American Public Power Association recognized APU once again as a Reliable Public Power Provider (RP3). The RP3 designation lasts three years and recognizes utilities that demonstrate high proficiency in reliability, safety, work force development, and system improvement. Of the 2,000 public power utilities nation-wide, only 235 hold the RP3 designation. APU's distribution system and reliability considerations are described in section **D. Distribution System Overview**.

A. APU ELECTRIC SYSTEM OVERVIEW

The City of Anaheim is the second largest city in Orange County and tenth largest city in California. It is best known as the home to the Disneyland® Resort and the Anaheim Convention Center.

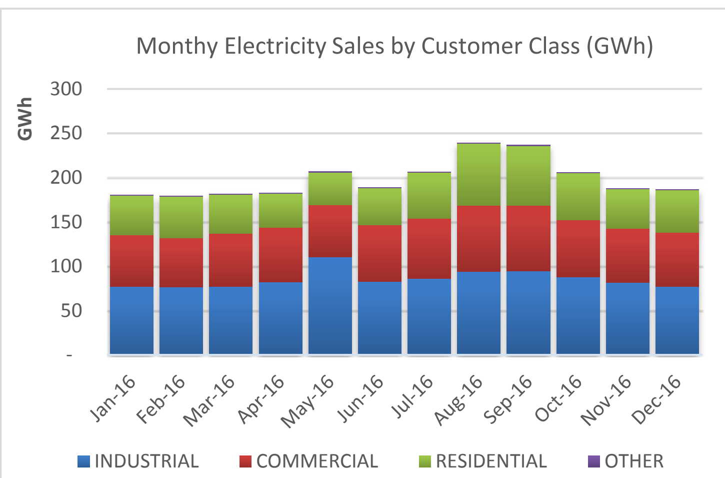
APU is a city-owned, not-for-profit electric and water utility that offers quality electric and water services to residents and businesses in Anaheim at rates among the lowest in California. It operates the only municipal electric utility in Orange County. That means that the customers of this community own their utility, and therefore, have a say in decisions concerning its operation.

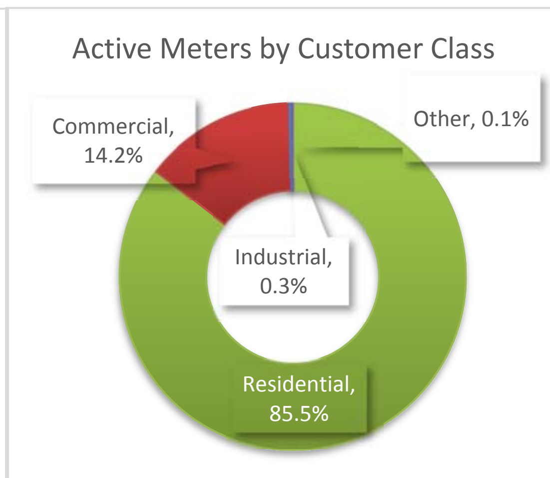
Anaheim citizens are more than just utilities customers; they are owners of their utility. They have input to the decision process both directly and through an appointed citizen advisory Public Utilities Board. With final authority vested in Anaheim's elected City Council, decisions are made in the best interest of its citizens, quality of life, and local economy. As a municipal, not-for-profit utility, APU's rates are based on the costs of providing water and electricity.

APU's system delivers electricity to Anaheim's 350,000 residents and more than 15,000 businesses, including multi-million dollar tourism, sports, and manufacturing customers.

Although residential customers make up 85% of APU's total customers, nearly 75% of total electrical load is consumed by commercial and industrial customers. APU experiences seasonal trends in which the summer months experience higher loads due to cooling needs, while the rest of the year tends to remain fairly stable. Total retail load is estimated as total system load less system losses, which have historically been approximately 3.5%.

Graph 55: Customer Class Data





B. GENERATION AND TRANSMISSION RESOURCES

APU's power supply comes from resources located in Anaheim and across the western United States. This section introduces APU's long-term generation and transmission resources.

GENERATION RESOURCES

ARP-LOYALTON BIOMASS PROJECT

APU, along with nine other California publicly-owned utilities, has contracted with ARP-Loyalton Cogen, LLC for the purchase of renewable biomass electricity from a biomass project located in northern California. Transmission is provided by the CAISO. This contract provides Anaheim with 0.81 MW of its proportionate share of renewable biomass energy as required pursuant to Senate Bill 859. The 5-year contract expires on March 31, 2023.

BOWERMAN POWER FACILITY

APU executed a Power Purchase Agreement with Bowerman Power, LLC for the purchase of 19.6 MW of renewable energy generated from landfill gas from the Frank R. Bowerman Landfill in Irvine, California.

Transmission is provided by the CAISO. The 20-year contract expires on April 30, 2036.

BREA POWER II

APU executed a Power Purchase Agreement with Brea Power Partners, LP to deliver landfill gas renewable energy to APU to help satisfy demand.

The original 5 MW contract was

superseded by a second long-term contract for a total of 27 MW from the new unit at the Olinda Landfill project. The 33-year contract expires on October 31, 2045.

DESERT HARVEST OR MAVERICK FACILITY

The Cities of Anaheim, Burbank, and Vernon have contracted with Desert Harvest II, LLC through SCPPA for a share of intermittent solar energy from one of two solar projects: the Desert Harvest project or the Maverick project. APU's share is 36 MW. Transmission is provided by the CAISO. The 25-year contract expires on November 30, 2045.

HEBER SOUTH

The Cities of Anaheim, Banning, Glendale, and Pasadena have contracted with Ormat Technologies, through Southern California Public Power Authority (SCPPA) for a share of a 14 MW (net) geothermal project. The renewable energy is delivered to the Imperial Irrigation District's Mirage Interconnection and then imported into the CAISO.

The contract includes mutual termination rights at years 15 and 20. The 25-year contract expires on December 31, 2031.

THERMO NO. 1

APU executed a Power Purchase Agreement with this resource for energy from an 11 MW geothermal project. The project is located in central Utah and energy is being delivered over the Northern Transmission System at the Mona interconnection tie in the Los Angeles Department

of Water and Power (LADWP) control area. Additional transmission costs are required to get the energy delivered from Thermo No. 1 to the Mona interconnection point. This 20-year agreement expires on September 30, 2033.

HIGH WINDS ENERGY CENTER

APU has purchased 6 MW of intermittent renewable wind energy from Avangrid Renewables, LLC (a subsidiary of Iberdrola USA, Inc.). Transmission is provided by the CAISO.

The contract includes mutual termination rights at year 20 provided notice is given on or before December 31, 2022. The 25-year contract expires on December 31, 2028.

PLEASANT VALLEY ENERGY CENTER

APU has purchased 30 MW of intermittent renewable wind energy from Avangrid Renewables, LLC (a subsidiary of Iberdrola USA, Inc.). Energy from the Pleasant Valley Wind Energy Center is delivered through the Northern Transmission System at the Mona interconnection tie into the LADWP control area.

APU receives and pays for energy only when the units are operating. The 20-year contract expires on June 30, 2025.

SAN GORGONIO WIND FARM

APU executed a Power Purchase Agreement with San Gorgonio Farms, Inc. for 31 MW of intermittent renewable wind energy from the existing San Gorgonio Farms Wind Farm located in Whitewater, California (near Palm Springs). Transmission is provided by the CAISO. This agreement has an initial term of ten years ending

December 31, 2023, with an option to extend for two additional 10-year periods.

WESTSIDE SOLAR WSP PV1

APU executed a Power Purchase Agreement with Westside Assets, LLC for the purchase of 2 MW of renewable intermittent solar energy. This project is located in Kings County, California.

Transmission is provided by the CAISO. This 25-year contract expires on June 30, 2041.

MWD COYOTE CREEK, PERRIS, RIO HONDO AND VALLEY VIEW

The Cities of Anaheim, Azusa, and Colton have contracted with The Metropolitan Water District (MWD) of Southern California, through SCPPA, for 17.1 MW of intermittent renewable hydro electricity from four small hydroelectric plants located in the Los Angeles Basin. APU is entitled to 56.5% of the project's output, or 9.7 MW from all four plants. Transmission is provided by the CAISO. The 15-year, 2-month contract expires on December 31, 2023.

HOOVER DAM

The Boulder Canyon Project (Hoover Dam) consists of 17 hydroelectric generating units located approximately 25 miles from Las Vegas, Nevada. Forty-six (46) participants within the states of Arizona, California, and Nevada participate in the Hoover Dam project. SCPPA members have obtained entitlements totaling 665 MW (32% of the Plant Capacity, of which APU has 1.9477%) through its Power Sales Agreements with SCPPA.

The new Electric Service Contract with Boulder Canyon commences upon expiration of the existing Agreement on October 31, 2017, and expires on September 30, 2067.

CANYON POWER PROJECT

APU entered into a Power Sales Agreement with SCPPA for all of the 200 MW nameplate capacity and energy from the Canyon Power Project (CPP). The CPP is a conventional simple cycle, natural gas-fired peaking facility comprised of four combustion turbine generators located in the Canyon industrial area of Anaheim. CPP provides enhanced local reliability and is dispatched when its generation costs are less than the cost to serve APU's load.

KRAEMER PEAKING PLANT

APU owns 100% of the Kraemer Peaking Plant (KPP), also known as the Anaheim Peaking Plant. It is a 48 MW natural gas-fired, combustion turbine conventional electric generating plant located in the northeast part of the City, adjacent to the City's Dowling Substation. There is also a heat recovery steam generator for emissions control and power augmentation.

Since 2000, the operations of the Kraemer Peaking Plant have increased as the California energy market has been redesigned. KPP is now dispatched when its generation costs are less than the cost to serve APU's load.

MAGNOLIA POWER PROJECT

The Magnolia Power Project (MPP) is a clean, natural gas-fired, combined cycle conventional electric generating plant located in Burbank, California. MPP is owned by SCPPA and is operated by Burbank Water & Power.

APU has a 38% (92 MW base capacity and 26 MW of peaking capacity) entitlement in the project through a Power Sales Agreement with SCPPA.

INTERMOUNTAIN POWER PLANT (IPP)

APU executed a Power Sales Agreement with Intermountain Power Agency (IPP) in the early 1980s for 13.225% of the energy output from IPP. Thirty-six utilities serving California and Utah receive capacity and energy from this project. Energy is delivered to Anaheim and other California participants through the Southern Transmission System to the Victorville/Lugo interconnection with the CAISO. The 40-year contract expires on June 15, 2027.

TRANSMISSION RESOURCES

MEAD-ADELANTO TRANSMISSION PROJECT

APU entered into a transmission service contract with SCPPA to acquire transmission capacity from the Mead-Adelanto Transmission Project to bring in energy from Nevada based projects.

A 202 mile, 500 kV AC transmission line that runs from the Marketplace Substation near Boulder City, Nevada to the Adelanto Substation near Victorville, California. The transmission line has a transfer capability of 1,291 MW; APU's share is 159 MW.

MEAD-PHOENIX TRANSMISSION PROJECT

APU entered into a transmission service contract with SCPPA to acquire transmission transfer capacity from the Mead-Phoenix Transmission Project.

A 256 mile, 500 kV AC transmission line that extends from the Westwing Substation near Phoenix, AZ, connects with the Mead substation near Boulder City, NV, and terminates at the Marketplace Substation nearby. The transmission line has a transfer capability of 1,923 MW; APU's share is 155 MW.

NORTHERN TRANSMISSION SYSTEM

APU entered into a transmission service contract with LADWP to acquire a share of LADWP's transfer capability of the Northern Transmission System to bring power from the Intermountain Power Plant (IPP) in Utah to the Mona substation in Utah and the Gonder substation in Nevada.

A 490 mile, 500 kV DC transmission line that extends from IPP near Delta, Utah to the Adelanto Substation in Southern California, with an AC/DC converter station at each end of the transmission line. The transmission line has a transfer capability of 2,400 MW; APU's share is 257 MW.

SOUTHERN TRANSMISSION SYSTEM

APU entered into a transmission service contract with SCPPA to acquire transfer capability of the Southern Transmission System to bring power from the Intermountain Power Project (IPP) near Delta, Utah to the Adelanto Substation in Southern California.

A 490 mile, 500 kV DC transmission line that extends from IPP near Delta, Utah to the Adelanto Substation in Southern California, with an AC/DC converter station at each end of the transmission line. The transmission line has a transfer capability of 2,400 MW; APU's share is 424 MW.

ADELANTO-VICTORVILLE/LUGO TRANSMISSION SYSTEM

APU entered into a firm bi-directional transmission service contract with LADWP to bring power between the Adelanto and Victorville Substations and the Lugo/Victorville line near Victorville, California to the City.

The approximately 23 mile, 500 kV AC transmission line extends between the Adelanto and Victorville Substations and the midpoint of the Lugo/Victorville 500 kV line. The transmission line has a transfer capacity of 2,400 MW; APU's share is 110 MW.

C. CAISO RESOURCE ADEQUACY REQUIREMENTS

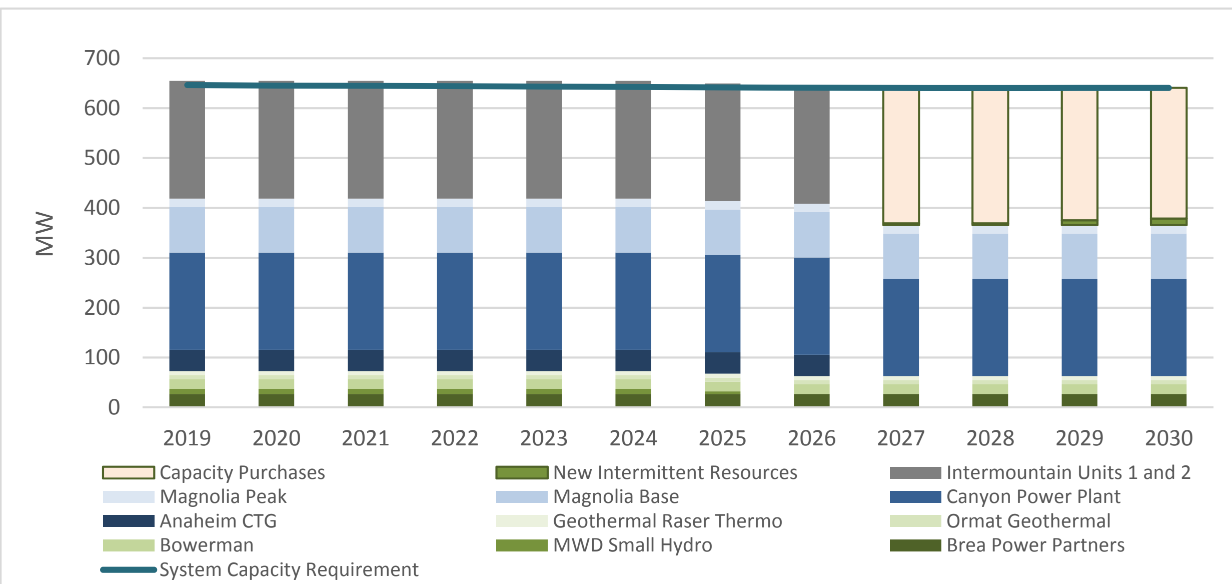
C.1. SYSTEM RESOURCE ADEQUACY

The consequences of the California energy crisis from 2000 to 2001 highlighted several fundamental flaws in California's existing electricity market design soon after the partial deregulation of the electric market. Key issues were identified such as the lack of long-term contracting between the unbundled generation and distribution sectors, and the over-reliance on spot market transactions as major causes for the market disruptions impeding system reliability. Immediately after the energy crisis, the CAISO began addressing underlying infrastructure challenges such as transmission and generation deficiencies, and began a comprehensive market redesign and technology upgrade (MRTU) program upon the Federal Energy Regulatory Commission's (FERC) approval.

State regulators implemented a Resource Adequacy (RA) obligation in 2004 requiring Load Serving Entities (LSE), such as APU, to procure capacity resources for 100% of their total forecasted customer load, as well as an additional 15% Planning Reserve Margin (PRM), for a total of 115% to ensure adequate energy resources are available when needed. This requirement is known as the "system" RA requirement.

APU uses a mix of its owned and contracted resources to meet the system RA obligations. These resources include both renewable and conventional generation within the State, and imported into the State from various regions. The optimum portfolio – Variable Portfolio – requires capacity purchases to meet system RA requirements. Graph 48 displays the change in capacity from 2019 to 2030. Capacity purchases will be acquired after 2027 to replace the system capacity lost with the divestiture of IPP. The cost of capacity contracts are included in the power supply cost evaluation.

Graph 48: Variable Portfolio Forecasted Resource Adequacy



C.2. LOCAL RESOURCE ADEQUACY

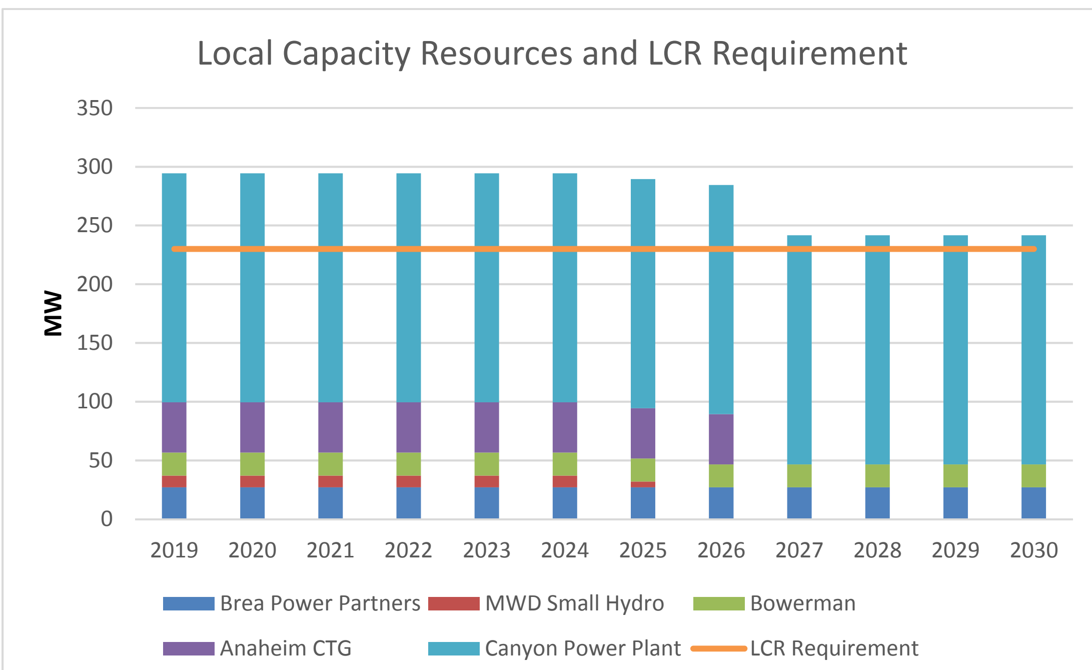
In addition to the overall system RA requirement, the CAISO also requires that a certain amount of a LSE's RA obligation must meet criteria known as "local" and "flexible" RA requirements. The local RA requirement addresses reliability concerns within transmission-constrained areas where local generation resources are needed to ensure reliable electric grid operations to serve the area.

Under the CAISO Local Capacity Requirement (LCR) program, CAISO completes an LCR study each year using the most up-to-date information available for transmission system configuration, generation tied to the grid, and load forecasts approved by the CEC. The CAISO uses the annual LCR Study results as a basis for establishing each LSEs proportionate share of LCR for RA purposes.

The CAISO identifies 10 transmission-constrained local pockets. APU is in the local area defined as the LA Basin Area. Results from the 2018 Local Capacity Technical Analysis issued by the CAISO on May 1, 2017, assigned a LCR of 225 MW for APU within the LA Basin Area.

The CAISO local capacity requirement for APU has been below 230 MW in the past few years and remained stable. APU has over 290 MW of natural gas and baseload renewable power plants located within the LA Basin. During the planning horizon of this IRP, APU has sufficient local resources that exceed CAISO's local capacity requirements.

Graph 36: Local Capacity Resources and LCR Requirement

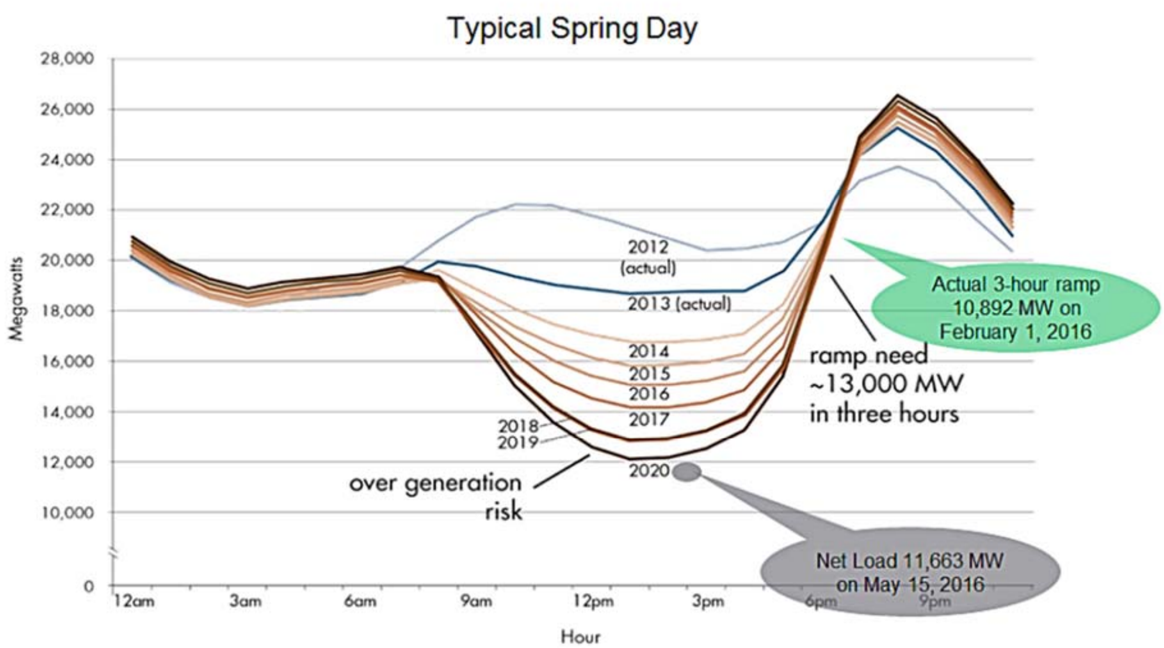


C.3. FLEXIBLE CAPACITY RESOURCE ADEQUACY

The last component of RA procurement addresses the need to have generation resources available that can respond quickly to "up" and "down" electrical demand on the Grid. In order to meet energy demand at certain times of the day when the CAISO must respond quickly to variations in load, LSEs are required to procure a certain amount of its RA obligation from resources defined as "flexible" in the CAISO tariff.

Increased amounts of variable energy resources puts further stress on what is known as the "Duck Curve" or the effect solar and wind generation resources have on net demand (demand less variable energy resources). As illustrated in Graph 56 below, in order to manage the effects of variable energy resources, the CAISO must have a resource mix to call upon that can react and adjust quickly to meet net demand while mitigating the risk of over generation. To do so, the CAISO must ramp generation resources down in the morning hours when solar generation begins to produce and ramp resources back up in the evening when solar generation drops off as the sun sets.

Graph 56: CAISO "Duck Curve" - Impacts of Variable Energy Resources



Similar to LCR, the CAISO performs annually a system wide assessment of flexible capacity needs using a Monthly Maximum Three-Hour Net Load Ramp plus 3.5% of expected peak load to determine the required procurement target for each LSE. The net load curves represent the variable demand that the CAISO must meet in real-time. In order to maintain reliability, the CAISO must match the demand for electricity with the supply on a second by second basis using the remaining dispatchable generation fleet. To ensure reliability under the changing conditions seen on the Grid, the CAISO requires flexible resources with operational characteristics as follows:

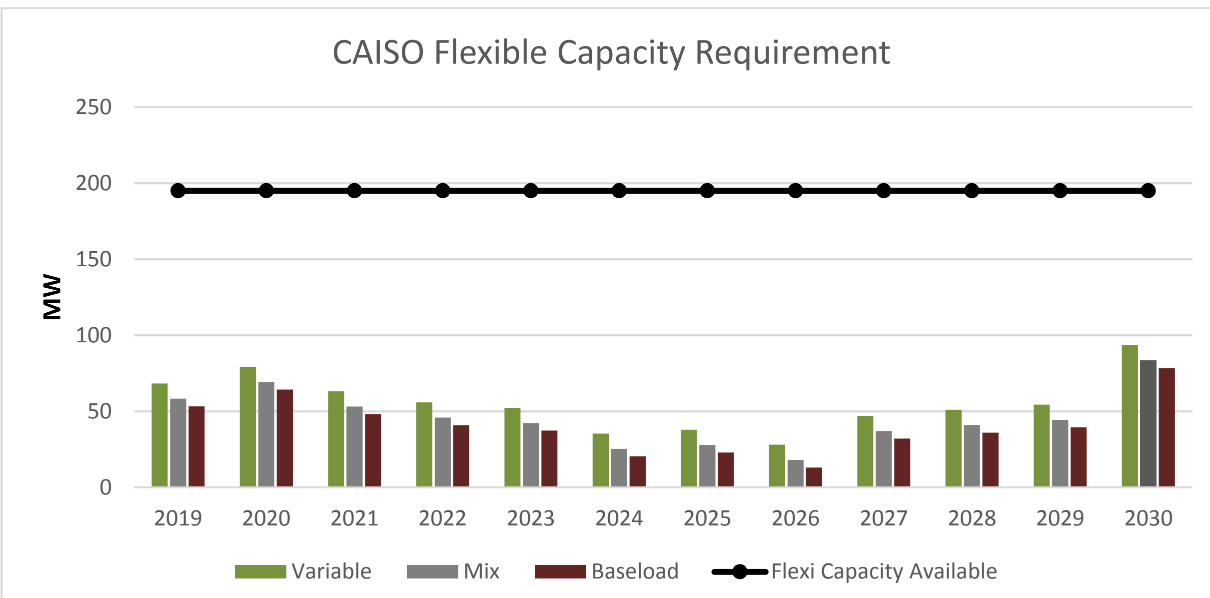
- Ability to sustain upward and downward ramps
- Respond for a defined period of time, change ramping direction quickly
- React quickly and meet expected operating levels
- Start with short notice from zero or low electric operating level
- Start and stop multiple times per day

To satisfy the CAISO's procurement target for flexible capacity, APU typically utilizes the Canyon Power Plant. This resource is not only local to APU's load, but has the ability to start at a moment's notice to ramp up or down as needed throughout the day providing 194 MW of eligible flexible capacity.

On average, APU has a monthly flexible capacity requirement of 40 MW, which peaks in December with a capacity requirement of 80 MW. The introduction of additional intermittent resources is estimated to increase the flexible capacity requirements by 3 MW for a 20 MW solar contract and 5 MW for 20 MW wind contract.

As Canyon Power Plant has 194 MW of eligible flexible capacity, APU has sufficient flexible capacity available through Canyon to meet the additional requirements for flexible capacity. Even though the optimum portfolio – Variable Portfolio – requires the highest amount of flexible capacity, the Canyon Power Plant provides more than sufficient flexible capacity to accommodate the additional intermittent resources.

Graph 37: CAISO Flexible Capacity Requirement



D. DISTRIBUTION SYSTEM OVERVIEW

D.1. DISTRIBUTION SYSTEM

D.1.1. Electric System Overview

APU delivers electricity to its approximately 350,000 residents and more than 15,000 businesses, including the Anaheim Resort Area, Platinum Triangle, sports arena, Honda Center, City National Grove of Anaheim, etc. APU serves about 119,000 electric meters throughout 50 square mile service area.

The APU electric system is a carefully planned and robust system. It consists of a 69 kV radial network serving eleven 69/12 kV distribution substations, where reliable power is transformed and distributed to homes and businesses, with a total combined historic peak demand of approximately 600 MW. APU has emergency procedures and redundancy built into its system to address the unlikely event of a catastrophic failure of a substation.

D.1.2. Distribution System

APU's distribution system includes approximately 110 distribution circuits fed by eleven distribution substations across 50 square miles. It provides high quality and reliable power service to customers. The system is evaluated thoroughly on an annual basis to ensure it can meet forecasted peak demand in the five year planning horizon, as well as maintain and improve its reliability performance under normal and emergency conditions. To achieve these goals, APU has upgraded and reinforced its electrical infrastructures with various on-going programs, and capital projects.

A new Harbor 69/12kV Substation is planned to be constructed and placed in service in the summer of 2019. It is needed in order to serve new hotels and residential/commercial units under construction and planned future developments in the Platinum Triangle and Anaheim Resort areas. This project will add needed transformer capacity in the fast growing area and also provide loading relief to the adjacent substations. It also greatly improves system reliability in the area.

A new 69/12kV transformer is planned to be constructed and placed in service in 2019. Similarly, this project is needed to accommodate new industrial and commercial loads in Eastern Anaheim area. It also will provide loading relief to adjacent substations and improves system reliability in the area.

APU is currently upgrading the 12kV switchgears to higher ampacity rating at one of the substations located in the east end of the City. It is expected to be completed in 2018. This project is needed to serve increased load growth in the area. It will also improve the system reliability and provide operational flexibility.

D.1.3. Recent Reliability Projects

In 2008, APU upgraded its electrical infrastructure to increase system reliability by constructing the Vermont 220/69 kV Substation which is radially fed from Lewis Substation, normally opened at Lewis terminal. A major 69kV network in the affected area was reconfigured and about 4,500 circuit feet were also undergrounded. The new Vermont Substation was built to serve as a back-up source for Anaheim load in the event of a total loss of the Lewis 69 kV Substation. Photo 1 shows Vermont 220 kV GIS switchgear.

Photo 1: Vermont 220kV GIS Switchgear

In 2006, APU accomplished a first-of-its-kind in the United States when it constructed under a park an electric substation with gas insulated switchgear (GIS) and with the capacity to provide power to 25,000 residential customers. This project also improves system reliability in the east of Anaheim system. Photo 2 shows Park Substation underneath the park.

Photo 2: Park Substation

In addition, Anaheim operates two gas-fired generating plants, Canyon Power Plant and Kraemer within its service territory with a total combined capacity of about 240 MW. These generating resources are used to offset power imported from outside resources during peak load periods, and they both have black start capability to serve APU load independent of the Grid in the event of a sustained regional blackout. Canyon Power Plant was built in 2011. The facility received silver LEED certification by utilizing systems that limit environmental impacts; these systems are using 100% recycled water and powering the control room with solar energy. The plant produces enough energy to power 150,000 residential customers annually. Photo 3 shows Canyon Power Plant.

Photo 3: Canyon Power Plant

D.1.4. Underground Conversion Program

In 1991, Anaheim City Council established the Underground Conversion Program to improve reliability and aesthetics along the City's major streets by removing overhead power, phone, and cable TV lines. Anaheim residents and businesses benefit from improved reliability of the electric system. As of today, APU has converted approximately 128 circuit miles or 50% of its existing overhead circuits. Photo 4 shows before and after of one of the underground projects.

Photo 4: Before and After Underground Project

D.1.5. Distributed Generation

In 2014 APU completed, what was at the time of installation, the largest city-owned convention center roof-mounted system in North America. This 2.4 MW solar plant can generate enough energy to support approximately 600 homes a year. Photo 5 shows the 2.4 MW Anaheim Solar Energy Plant at the Convention Center.

Photo 5: The 2.4 MW Anaheim Solar Energy Plant at Convention Center

Approximately 25 MW of rooftop solar generation is installed throughout the Anaheim system. To date, there are little to no impacts to the distribution network resulting from these installations, which are relatively small in size and not concentrated in one area, but rather scattered throughout the system.

Similarly, APU has not experienced or expects any significant impacts to the distribution network due to plug-in electric vehicles (PEV) since they are not concentrated in one area or on a specific circuit at this point in time.

APU continues to monitor potential impact from distributed generation and from electric vehicle charging stations and will make necessary infrastructure investments to maintain system reliability and resiliency. As an example, APU evaluates commercial customers' plans to install charging stations, and will upgrade local transformers when multiple charging stations are planned to be installed in a concentrated area.

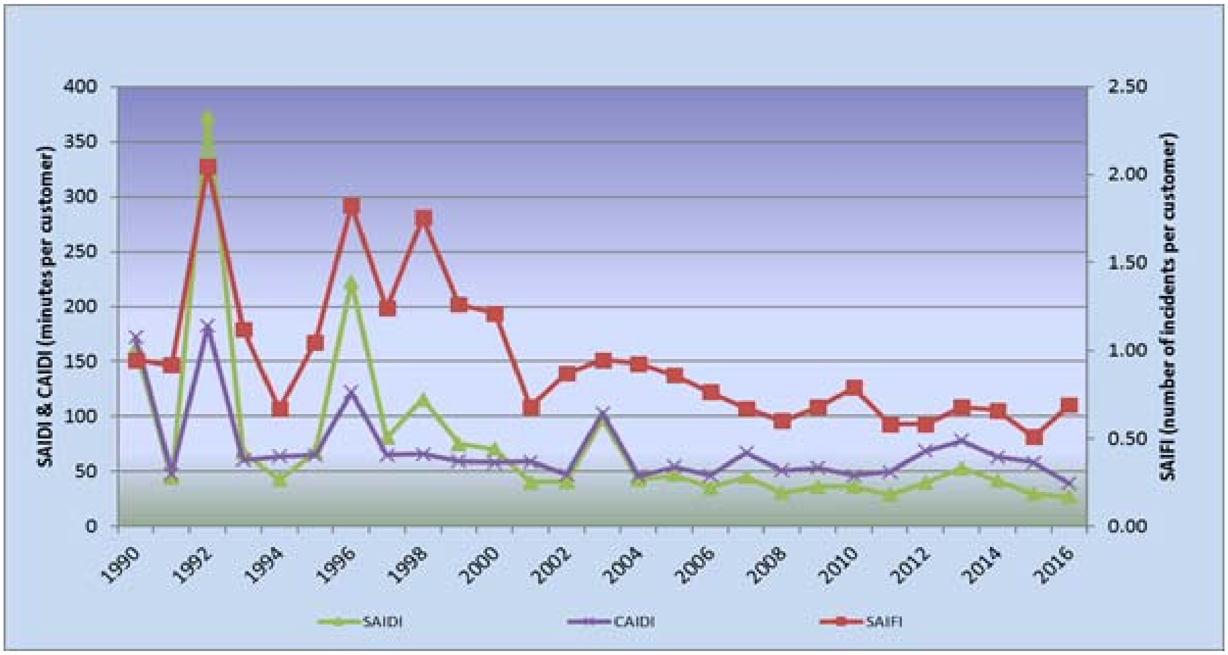
D.2 SYSTEM RELIABILITY

APU provides high quality electric service to approximately 119,000 metered residential and business customers through a modern and well maintained distribution network.

In 2017, the American Public Power Association recognized APU once again as a Reliable Public Power Provider (RP3). The RP3 designation lasts three years and recognizes utilities that demonstrate high proficiency in reliability, safety, work force development, and system improvement. Of the 2,000 public power utilities nation-wide, only 235 hold the RP3 designation.

Performance metrics are regularly utilized to measure outage duration, number and type of outage events, as well as restoration time. Electric reliability is measured by recording how many times service is interrupted (System Average Interruption Frequency Index or SAIFI), how long the average customer is interrupted (System Average Duration Index or SAIDI), and how long it takes to restore service once a customer is interrupted (Customer Average Interruption Duration Index or CAIDI). These three measures of reliability have been standardized and are recognized by the electric industry as best practices for comparing reliability performance among utilities. Below is a graph showing Anaheim's reliability performance in terms of SAIDI, SAIFI, and CAIDI since 1990.

Graph 57: Anaheim's Reliability Performance in Terms of SAIDI, SAIFI, and CAIDI Since 1990

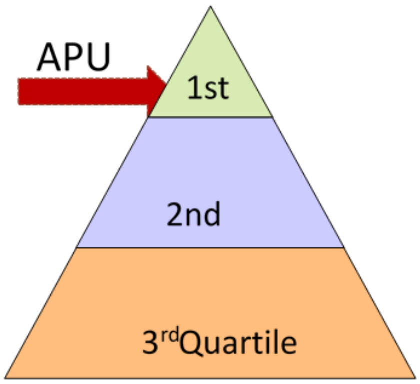


Many factors that affect service reliability are beyond APU's control, such as wind, vehicles hitting power poles, earthquakes, etc. However, other factors are controllable, such as maintaining equipment in good operating order by continually monitoring and inspecting the system, tightening connectors, cleaning dirt from insulators, detecting and replacing damaged or aging components before they fail, and systematically replacing equipment nearing the end of its useful life.

APU is continually working to improve its electric distribution system. For example, APU has installed a significant number of remotely controlled field switching to improve outage restoration times, in conjunction with a program to remove old direct-buried cable from the system and replacing it with cable encased in conduit. APU is also aggressively converting existing overhead lines along major streets to underground as a way of enhancing reliability and the visual appeal of streetscapes throughout the community.

APU is ranked in the top 25% (quartile) of utilities nationwide when it comes to electric system reliability, which means that APU customers have fewer and shorter power outages than the other 75% of utilities nationwide.

Graph 58: APU at the Top Quartile of Utilities Nationwide for Reliability



D.3 SYSTEM RESILIENCY

The City of Anaheim has undertaken a comprehensive planning effort in developing the Hazard Mitigation Plan[11] by organizing resources, assessing risks, and developing and implementing a mitigation plan and monitoring process. On May 9, 2017, the Anaheim City Council adopted the Hazard Mitigation Plan, which was developed through City and community collaboration. It evaluates the risk of hazards and demonstrates how Anaheim will lower its risk and exposure to potential disasters, including earthquake, wildfire, and climate change.

Specifically, Section 9 of the Hazard Mitigation Plan details the risk factors of wildfire and preventative measures including fire mitigation education, vegetation management, routine inspections, fire resistant building material, and fire preventive building features. To ensure rapid response and adequate fire protection in times of major fire events, Anaheim also participates in the Standardized Emergency Management System, which enhances multi-agency coordination for local and regional emergencies.

D.4 SMART GRID

APU has always strived to enhance its system reliability, improve efficiency and power quality, and empower customers with real time knowledge of energy demand through implementation of new commercially available and proven technologies, including but not limited to distribution automation, smart grid applications, and advanced metering infrastructure programs.

D.4.1 Distribution Automation

Smart Grid refers to modernization of the electricity delivery system primarily through automation. It allows for a more reliable, secure electrical service, and is characterized by a two-way flow of

[11] http://local.anaheim.net/docs_agend/questys_pub/13502/13532/13533/13578/13581/2.%20Hazard%20Mitigation%20Plan13581.pdf

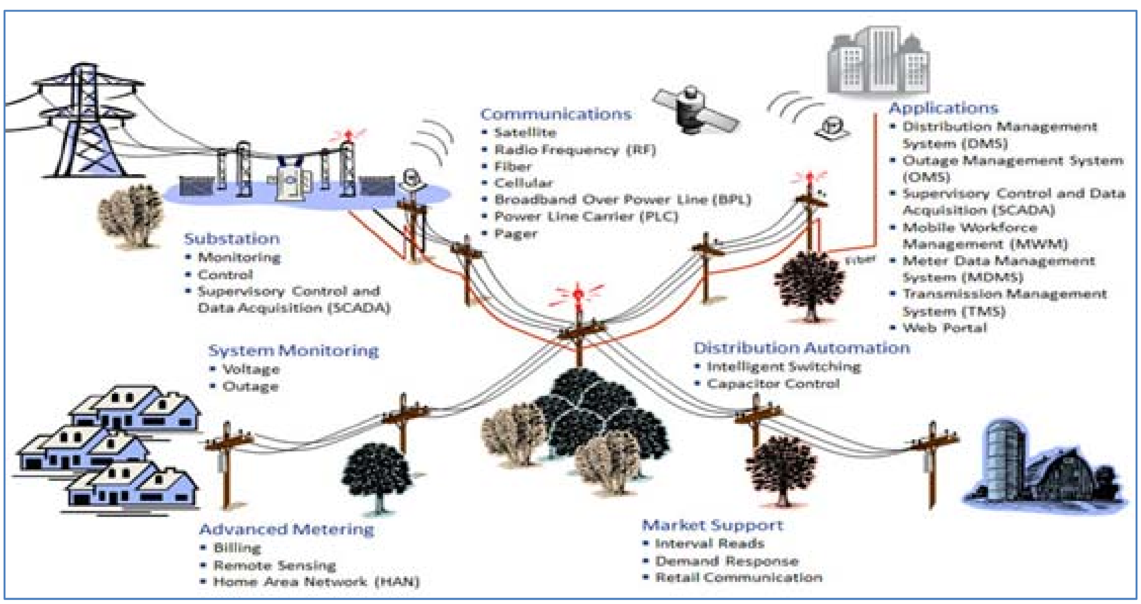
information, control systems, and computer processing to create an automated, widely distributed energy delivery network. These cutting edge technologies include advanced sensors and relays that sense and recover from faults in the substation automatically, automated feeder switches that re-route power to other feeders, automatic re-closers with smart protective devices that quickly restore power following momentary outages, and automated feeder capacitors that switch on/off automatically as needed to maintain fairly constant feeder voltages.

Some major advantages of implementing Smart Grid projects are 1) a self-healing power system which uses digital information and automated control to supply more reliable power with fewer, briefer outages, 2) the ability to immediately and/or remotely validate and manage outages and restoration work which reduces the time needed to restore service, 3) a reduction in the number of times employees are sent to a particular address to validate power supply to a meter, and 4) reductions in total energy use, peak demand, energy loss, as well as potential reduction in end-user consumption.

APU performed a Smart Grid study to assess each of the distribution circuits in the system and to identify which overhead and underground switches, field capacitor banks that need to be automated, and where branch line fuses should be installed. In addition, the study also identifies the potential locations to install automatic re-closers (AR).

Anaheim's electric system has continually been reinforced and enhanced to meet increasing load demand while maintaining system reliability. The use of computer based remote control and communication equipment can help ensure that the distribution system communicates and works together to deliver electricity more reliably and efficiently. The automated infrastructure modernizes the grid, makes it more resilient. It further reduces the number of customers affected during power outages, the frequency and duration of power outages, and the impacts of naturally occurring events. In addition, APU also benefits from a modernized grid, including improved security, reduced peak loads, increased integration of renewables, and improved operational efficiency.

Graph 59: Basic Characteristics of Smart Grid



APU has actively promoted, implemented, and expanded Smart Grid projects for its electric system since 2010. To date, APU has spent several million dollars on Smart Grid projects and automatic devices system-wide including, but not limited to, automated re-closers, automated switches, automated capacitor banks, and SCADA linked fault indicators.

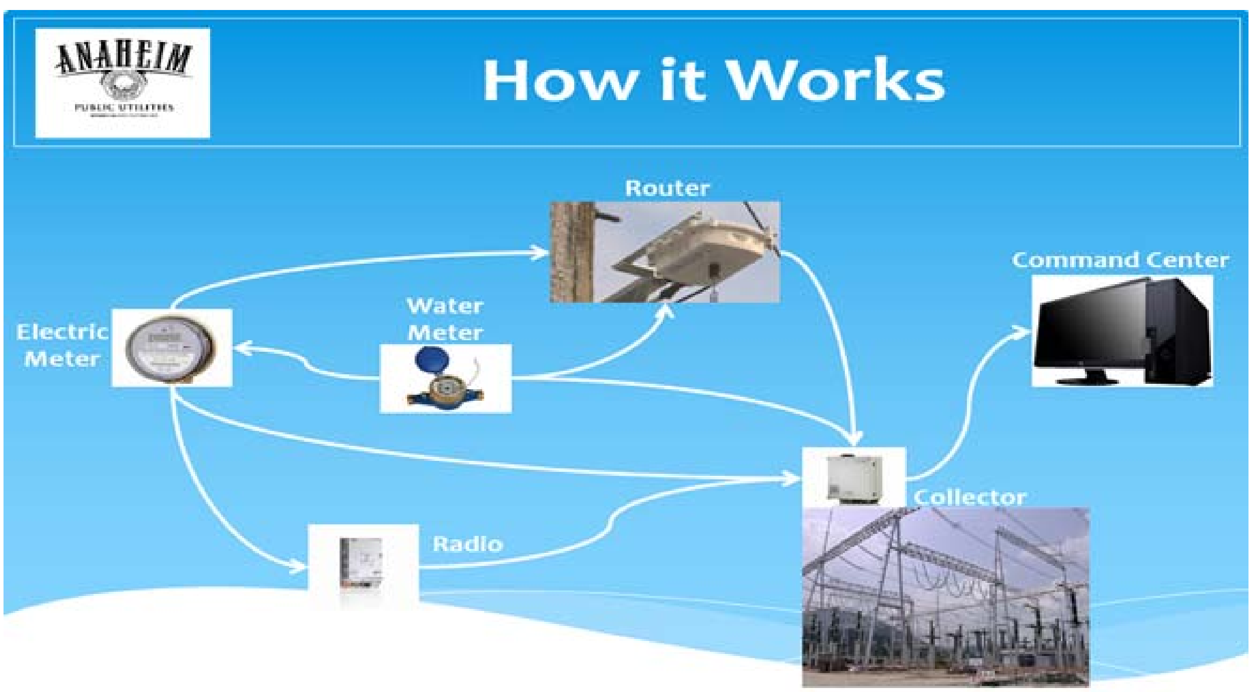
Future application of Smart Grid projects will evolve into more sophisticated and complex operations, such as predicting failing equipment and automatically isolating faulty equipment before a failure occurs, automatically restoring customers immediately after outages (self-healing), and integrating distributed energy resources and demand response programs.

D.4.2 Advanced Metering Infrastructure

As a critical component of the Smart Grid, APU has deployed approximately 9,000 Advanced Metering Infrastructure (AMI) systems within its service territory.

APU used a radio frequency network communication for its electric distribution automation system for almost 20 years. The network consisted of over 400 radios and 130 routers installed throughout the City. In order to leverage the existing communication network and gain the greatest synergy and lower long-term costs, APU plans to deploy compatible smart meters while phasing out dated technology.

Graph 60: Advanced Metering Infrastructure



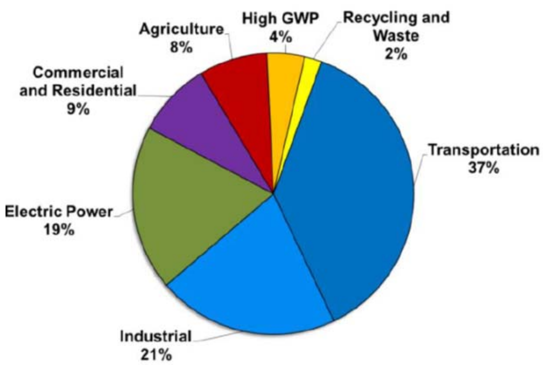
Currently, APU is looking at improving the deployment process and performing other testing as needed prior to a full scale AMI deployment. Full deployment of smart electric meters will begin FY 2018/2019, along with smart water meters a year later. A full deployment of electric and water meters is expected to take approximately 5-6 years.

IX. GREENHOUSE GAS EMISSION REDUCTION

STATEWIDE GHG EMISSION PROFILE

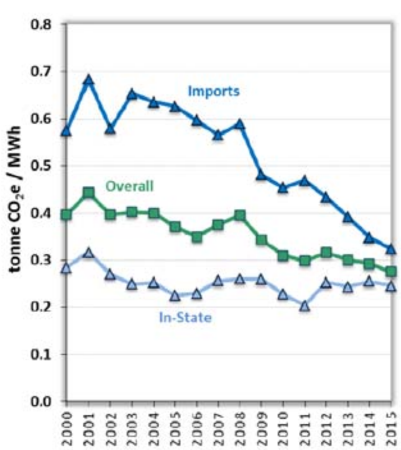
The passage of AB 32 in 2006 established statewide target to reduce GHG emissions to 1990 levels by the year 2020; effectively a 30% decline in emissions from current statewide output. In 2016, SB 32 expanded the statewide GHG emissions reduction goal to 40% below 1990 levels by the year 2030.

Graph 61: 2015 GHG Emissions by Sector[12]



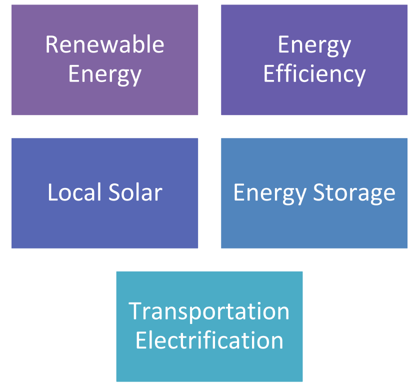
According to CARB's 2017 GHG Emission Inventory report, emissions from the electric power sector comprised 19% of 2015 statewide GHG emissions, and was the third largest source of GHG emissions following the transportation (37%) and industrial (21%) sectors.[12] From 2000 to 2015, the electricity sector has reduced emissions by 20%, while the transportation and industrial sectors reduced emissions by 6% and 2%, respectively.[13] The overall emission decrease in the electricity sector is driven by reduced reliance on carbon-based fuels, increased use of renewable energy, incrementally higher energy efficiency standards, increased deployment of distributed renewable generation, vehicle electrification, and energy storage technologies.

Graph 62: GHG Intensity of Electricity[12]



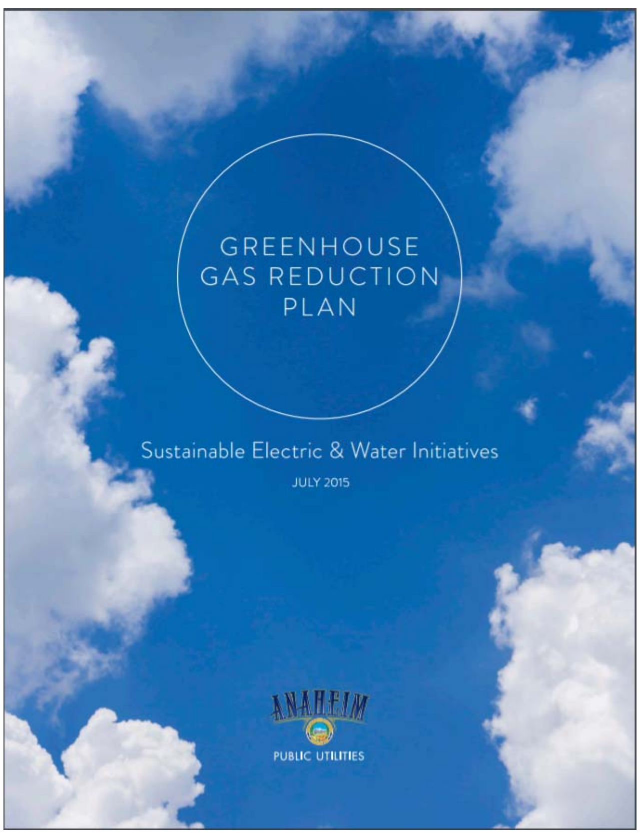
[12] https://www.arb.ca.gov/cc/inventory/pubs/reports/2000_2015/ghg_inventory_trends_00-15.pdf
[13] 2017 Edition California Greenhouse Gas Inventory for 2000-2015 — by Sector and Activity; downloaded from: https://www.arb.ca.gov/app/ghg/2000_2015/ghg_sector.php

APU'S EMISSION REDUCTION EFFORTS



To meet the AB 32 and SB 32 goals, APU began reducing its reliance on generation resources that produce GHG emissions by transitioning from fossil fuel-fired generating resources to renewable resources and cleaner natural gas generation technologies. The most significant contribution that APU can make in reducing GHG is the reduction of energy resources that produce GHG emissions from its power supply. In addition to GHG emission reductions from APU's power supply, further GHG reductions will come from complementary efforts including increased energy efficiency measures, local solar, energy storage, and electrification of the transportation sector.

2015 GREENHOUSE GAS REDUCTION PLAN



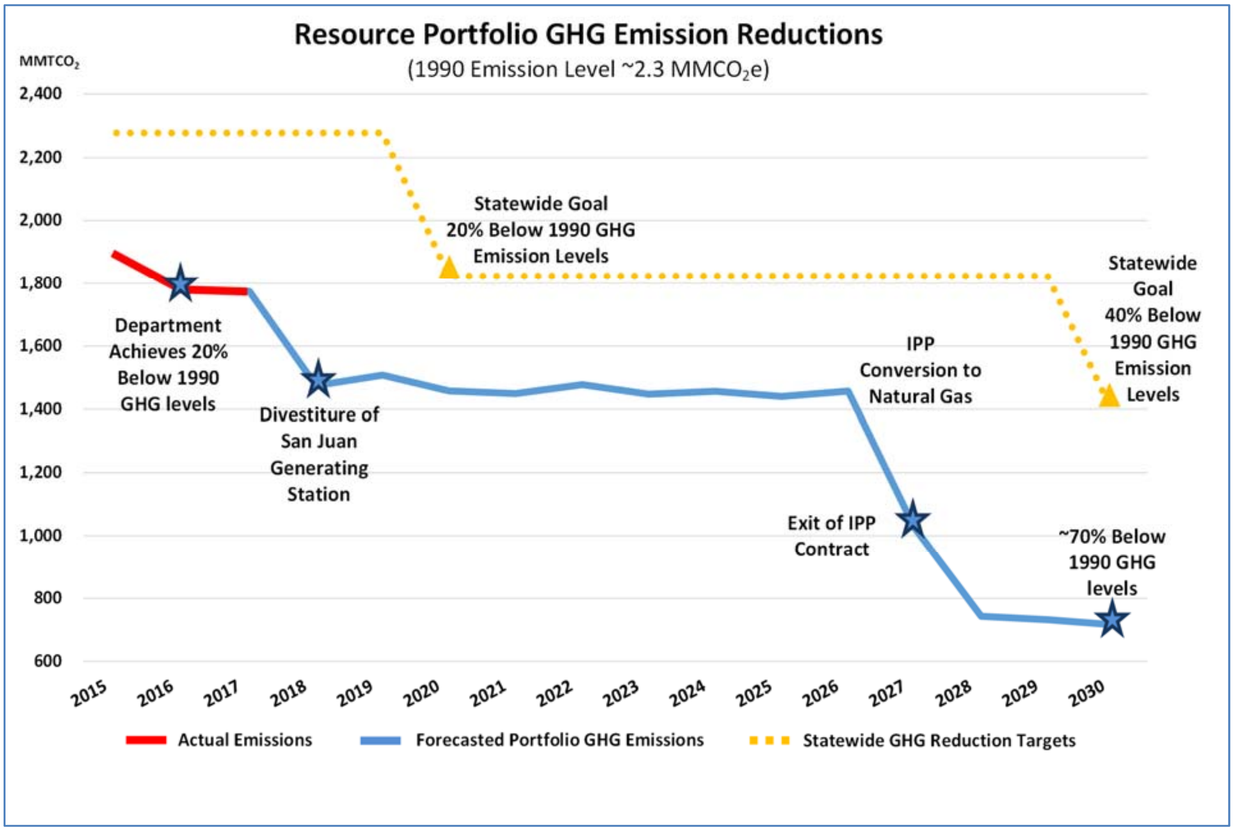
In July 2015, APU developed its first utility-specific Greenhouse Gas Reduction Plan[14] with the purpose of developing a clear and comprehensive long-term strategic framework to reduce GHG emissions. The Plan identifies a goal to reduce GHG emissions by 20% below 1990 levels by 2020 and a minimum of 40% below 1990 levels by 2030. It is important to note that the 40% reduction below 1990 levels is a statewide goal; however, California utilities will likely be called upon to do more.

APU achieved its goal of 20% below 1990 levels through the increased renewable generation from 11% in 2010 to 33% of overall sales in calendar year 2015. Further GHG emissions reductions are expected to reach near the 40% target in 2018 due to the divesture of the San Juan Generating Station in 2017. Upon APU's exit from the Intermountain Power Project in 2027, APU's overall GHG emissions from its power

[14] http://www.anaheim.net/DocumentCenter/View/7996

supply portfolio is expected to reach or exceed 70% below its 1990 emissions by 2028. Significant emission reductions are observed in each of the portfolio scenarios analyzed and discussed in Section VII. Resource Portfolio Evaluation.

Graph 63: APU GHG Reduction Targets



EMISSION REDUCTIONS ASSOCIATED WITH TRANSPORTATION ELECTRIFICATION

Electric vehicle growth is estimated using the CEC's "2016 SB 350 Common Assumption Guidelines for Transportation Electrification Analysis 3.0" workbook published in April 2017.[15] According to the CEC workbook, APU's share of total California registered electric vehicles is 0.63%, or an estimated 16,280 electric vehicles by 2030.

The model also provides estimates of the emissions savings per vehicle. In 2015, the estimated savings in emissions per electric vehicle is 2.31 $MTCO_2e$. As more electric vehicles are deployed, the impact on emissions per EV is expected to decline to 1.761 $MTCO_2e$ by 2030.

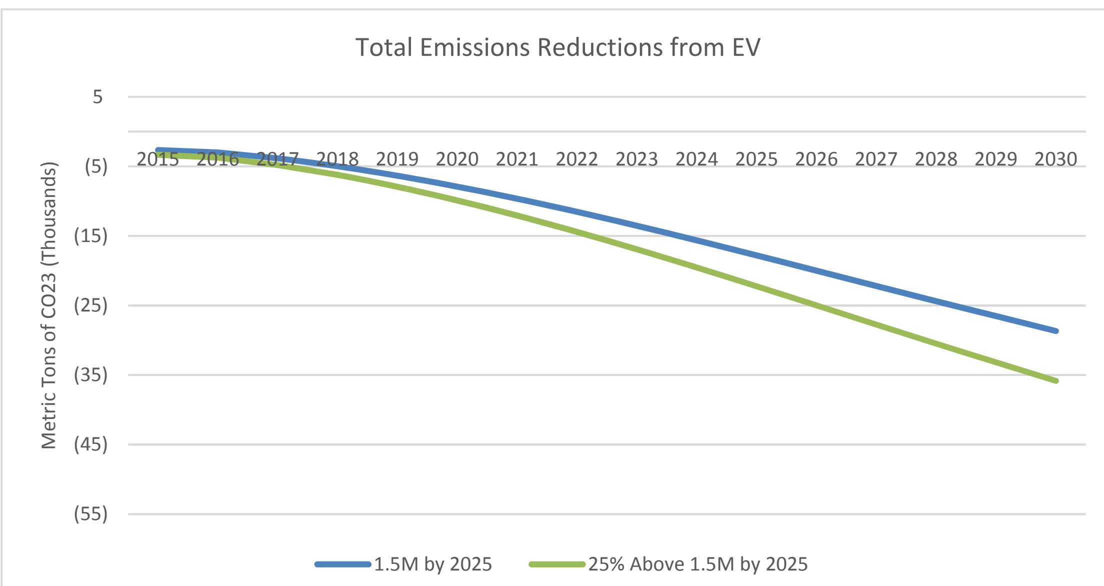
[15] "2016 SB 350 Common Assumption Guidelines for Transportation Electrification Analysis", Version 3.0, Updated 4/6/2017. This workbook is subsequently replaced by updated versions and no longer available via the CEC website. The most updated version is available for download at http://www.energy.ca.gov/sb350/IRPs/.

Table 7: Anaheim EVs and Emission Savings per Vehicle

Year	Estimated Number of Vehicles	Emissions Savings Per Vehicle (MTCO$_2$e)
2018	2,343	2.125
2019	3,045	2.082
2020	3,870	2.044
2021	4,807	2.009
2022	5,844	1.976
2023	6,970	1.945
2024	8,171	1.916
2025	9,434	1.887
2026	10,748	1.860
2027	12,100	1.833
2028	13,478	1.808
2029	14,874	1.784
2030	16,280	1.761

Based on the CEC's estimates, APU could have a total of 16,280 EVs within the service territory by the year 2030, resulting in a GHG emission reduction of approximately 28,675 MTCO$_2$e. In APU's high extreme energy demand forecast, the projected EV's registered in Anaheim are 25% above the 1.5M statewide goal, which estimates 20,350 EVs by 2030 and an emissions reduction of 35,844 MTCO$_2$e.

Graph 64: Emission Reductions Resulting from Transportation Electrification



The CEC has since released several updated versions of "2017 SB 350 Common Assumption Guidelines for Transportation Electrification Analysis" in late 2017 through early 2018.[16] The most updated analysis

[16] The most updated Light-Duty Plug-in Electric Vehicle Energy and Emissions Calculator may be found on the CEC's Integrated Resource Planning webpage: http://www.energy.ca.gov/sb350/IRPs/

(Version 3.5-2, dated 1/12/18) available as of the writing of this IRP resulted in slightly higher number of EVs that were still lower than the high EV extreme scenario. The updated analyses also resulted in slightly higher emission savings per vehicle. This IRP presents the original emission savings per vehicle to be consistent with the rest of the EV calculations. It also reflects a more conservative approach in EV emission savings calculation.

EMISSION REDUCTION TARGET – SYSTEM ENERGY DEMAND

Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015 (de León, Chapter 547, Statutes of 2015) (SB 350) requires the California Public Utilities Commission (CPUC) and the California Energy Commission (Energy Commission) to establish IRP processes to ensure that load-serving entities (LSEs) and qualifying publicly owned utilities (POUs)[17] meet the GHG emission reduction targets established by the California Air Resources Board (CARB) for the electricity sector and each LSE and POU for the year 2030.

CARB, in conjunction with CEC, is in the process of developing utility-specific GHG reduction planning target ranges for California POUs as mandated through the passage of SB 350. The development of utility-specific GHG reduction target ranges is not expected to be finalized before the adoption of this IRP.

While the CARB is ultimately responsible for setting the GHG reduction target ranges for all utilities, the CEC released a memo titled "Proposed Method for Setting POU-Specific GHG Emission Reduction Targets for Integrated Resource Planning" dated February 15, 2018. In this memo, the CEC provided their interim guidance and recommended POU GHG reduction planning targets to inform and assist the CARB with establishing the official target planning ranges. As of the writing of this IRP, CARB has indicated that the GHG reduction targets being established for APU by CARB are intended to be IRP GHG reduction planning targets only.

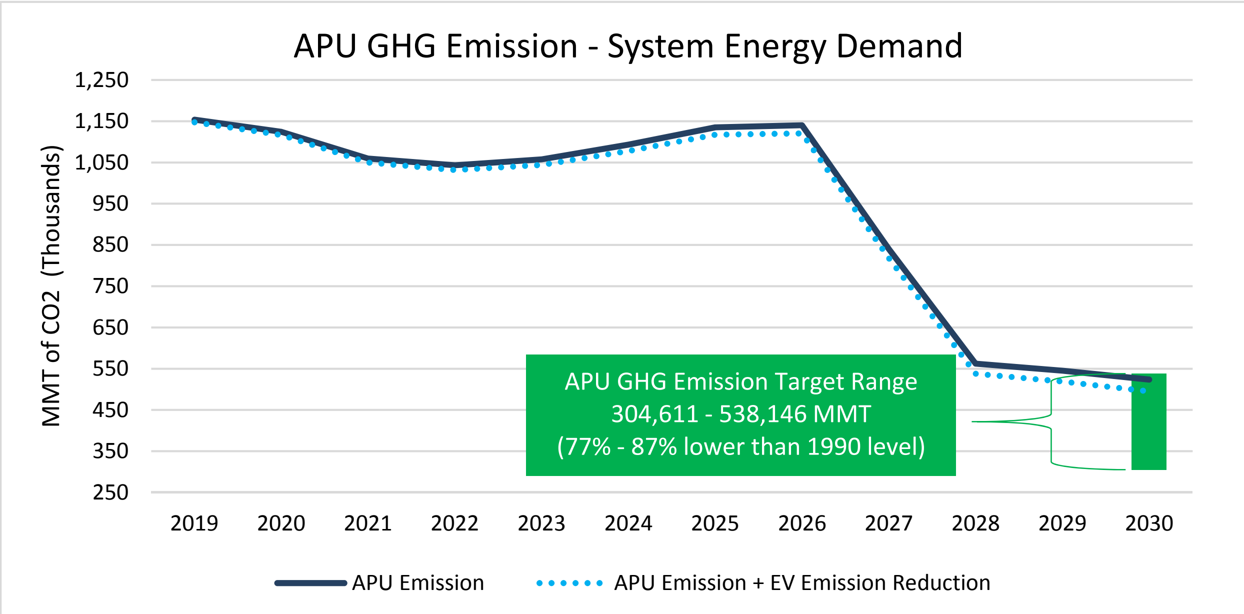
The CEC's methodology established a proposed range of GHG reduction targets for APU between 304,009 and 537,957 $MTCO_2e$. This proposed target range represents an approximate emission level between 77% - 87% below APU's 1990 emission levels. If this GHG reduction range is ultimately adopted by CARB, then it would be significantly greater than the statewide targeted reduction of 40% below 1990 emission levels established by SB 32, and lower

The CEC's proposed target range represents an approximate emission level between 77% - 87% below APU's 1990 emission levels.

[17] The IRP requirement applies only to POUs with annual demand exceeding 700 GWh.

bound of the range would be difficult to achieve without significantly increasing APU power supply costs.

Graph 65: APU GHG Emission for System Energy Demand



APU's resource portfolio will be coal-free by mid-2027 and, at a minimum, 50% of APU's electricity deliveries will come from renewable energy resources. Based on current law and regulations, APU's optimum resource portfolio under this IRP will achieve the upper bound of the proposed GHG reduction target range; however, the lower bound of the range (i.e., 87% GHG reduction) will not be achieved without significant cost impacts. If CARB adopts the more stringent 87% GHG reduction target it would cause a significant rate impact to APU customers as it would require the shutdown, or "stranding," of a very reliable and efficient baseload natural gas resource Magnolia Power Plant, which has 20-years of unavoidable debt service costs that would still need to be paid by APU customers in addition to replacement renewable resources. APU is closely following relevant regulatory proceedings and will work with CARB and CEC to recommend methodologies to further reduce APU carbon emissions, such as accounting for the effect of electric vehicle (EV) penetration on emission reduction.

X. TRANSPORTATION ELECTRIFICATION

Transportation Electrification (TE) is the transition from fossil-fuel powered vehicles to vehicles powered by clean and sustainable electricity. This includes passenger and commercial automobiles as well as transit buses and medium to heavy-duty trucks. APU's holistic efforts related to TE date back to 2012, soon after modern EVs became commercially available. APU had a vision to facilitate customers' interests in EVs by addressing EV readiness, charging infrastructure plans, financial tools for customers, ease of permitting, and enhanced customer service. Since then, APU has developed various programs and continues to support TE while providing environmentally sustainable and competitively priced power.

A. Quantification, Characterization, and Location

LOAD IMPACT & GHG EMISSION REDUCTIONS

Using the CEC "Transportation Electrification Common Assumptions 3.0" workbook that was distributed to California utilities in 2017, APU estimated the electricity consumption and net NOx, particulate matter, and GHG emissions reductions associated with Light Duty Plug-In Electric Vehicle (LD PEV) deployment through 2030. APU's demand forecast assumes the CEC growth assumptions to meet the Governor's order of 1.5 million electric vehicles on the road by 2025. The CEC workbook calculates Anaheim's share of total California registered electric vehicles to be 0.63%, which equals an estimated total of 16,280 electric vehicles contributing to 63,261 MWh in load growth in Anaheim by 2030.

EV CHARGING STATIONS

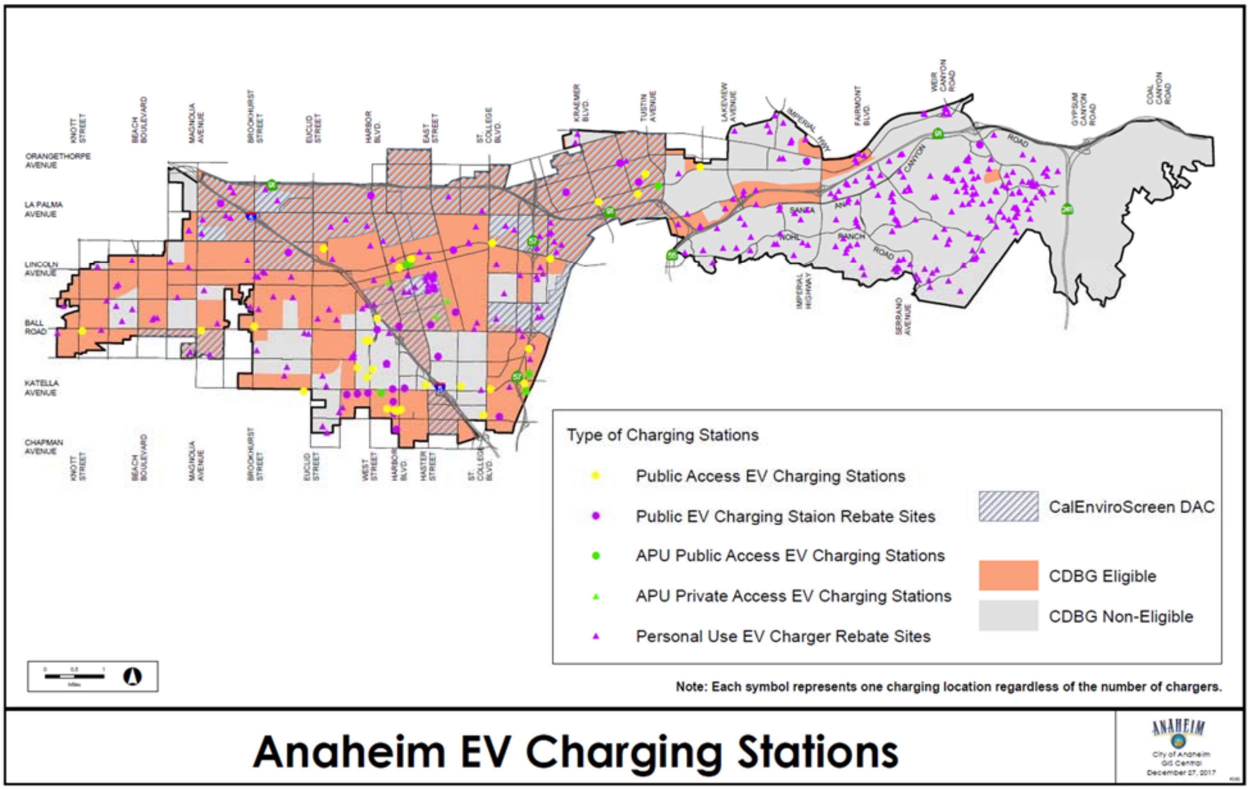
As of December 2017, APU has installed a total of 69 charging stations. While some of these charging stations are located within APU and the City's facilities, 48 out of 69 (or 70%) are open to the public and strategically located in key public venues or transportation hubs.

Photo 6: Charging Stations at Anaheim Regional Transportation Intermodal Center

The IRP Customer Survey results indicate that the surveyed residential customers who anticipate acquiring an EV within the next three years spread evenly throughout APU's service territory. Additionally, about half of these customers live in multi-family dwellings, signifying the possible need for public access charging stations. APU's public charging stations will provide these potential EV owners geographical convenience for their fueling options.

According to the Alternative Fuels Data Center[18] of the U.S. Department of Energy (DOE), within the City of Anaheim, there are a total of 193 public access charging stations (3 Level 1 stations, 186 Level 2 stations, and 4 DC Fast Charging stations) as of December 2017. These charging stations include both privately-owned stations and the above mentioned public access stations under APU control.

Graph 66: EV Charging Stations within APU Service Territory



Utilities Fleet

APU's earliest effort of fleet electrification focuses on the light-duty field services vehicles since 1) these vehicles tend to have frequent stops such as for meter reading and 2) light-duty EVs and hybrid plug-in EVs are more technologically mature and commercially available. APU has achieved 10% low or zero emission vehicles in its light-duty fleet. In addition, 36% of APU's light-duty fleet are low emission Compressed Natural Gas (CNG) vehicles.

Photo 7: Early Model Electric Toyota RAV-4 Used by APU for Fleet Testing

[18] U.S. Department of Energy's Alternative Fuels Data Center, http://www.afdc.energy.gov/data_download, December 20, 2017.

APU will continue to convert the older and higher-polluting vehicles to EVs and hybrid EVs to meet South Coast Air Quality Management District (SCAQMD) and DOE requirements. For example, APU's current field services light duty fleet has a total 14 vehicles, of which 6 are already low or zero emission. APU anticipates transforming its field services fleet into 100% low or zero emission vehicles by acquiring 10 Chevrolet Bolt EVs.

Medium-duty and heavy-duty vehicles provide essential services such as emergency response and outage restoration during blackouts. APU relies more on traditional or biodiesel fuel to ensure that the services will not be interrupted due to mileage range limitations. As of December 2017, biodiesel (20% blend) powers 5% and 76% of APU's medium-duty and heavy-duty fleet, respectively.

It is worth mentioning that APU owns a hybrid electric bucket truck. APU acquired the truck to gain first-hand experience with heavy-duty low emission vehicles and is still evaluating the performance of the hybrid truck. APU will continue to evaluate technological readiness for the electrification or the medium and heavy-duty fleet.

Photo 8: Current Nissan Leaf EV in APU Fleet

B. Transportation Electrification Programs

APU's transportation electrification programs including the following:

B.1. EMPLOYEE WORKPLACE CHARGING PROGRAM

To the extent possible, APU offers its employees and the City's employees free charging at its EV charging stations located in the employee and fleet parking facilities. APU will continue to encourage and support its employees' adoption of EVs whenever feasible.

B.2. EV RATES

APU offers residential customers the option to charge their electric vehicles on a time-based rate (Developmental Schedule D-EV of City of Anaheim's Electric Rates, Rules and Regulations, available online at http://www.anaheim.net/documentcenter/view/1248). The rate currently charges $0.2634 per kWh and $0.1117 per kWh for energy used during on-peak and off-peak hours, respectively from June 1 through September 30. The rate charges $0.2563 per kWh and $0.1056 per kWh for energy used during on-peak and off-peak hours, respectively from October 1 through May 31. On-peak hours are 12:00 p.m. to 7:00 p.m. everyday all year long, and off-peak are all other hours. APU plans to establish EV rates for commercial customers in 2018.

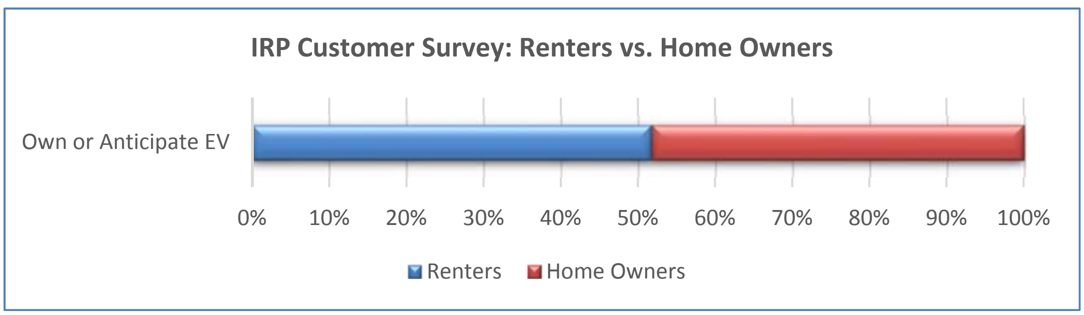
B.3. PUBLIC PROGRAMS FOR CUSTOMERS INCLUDING DISADVANTAGED COMMUNITIES

B.3.1. IRP Customer Survey Results

The IRP Customer Survey results indicate that 6% of the surveyed residential customers currently own or lease an EV, and 14% anticipate acquiring an EV within the next three years. The residential customers also indicated that the $500 EV charger rebate and the availability of public charging stations would increase their likelihood of acquiring EVs.

Per 2015 census data, 53% of Anaheim housing units are renter occupied. The IRP Customer Survey indicates that within APU territory, renters are more supportive of renewable initiatives than home owners; and slightly more renters already own or anticipate acquiring an EVs within the next three years.

Graph 67: IRP Customer Survey Result: % Renters vs. Home Owners Who Own, Lease or Anticipate Acquiring an EV within the Next Three Years



Furthermore, in the IRP Customer Survey, the large business customers indicated that the $5,000 EV charging station rebate would positively impact their likelihood of obtaining EVs.

B.3.2. Plug-In Electric Vehicle Charger Rebate Program (2012 – Current)

This program offers rebates to residential, commercial, and industrial customers who install Level 2 or higher EV chargers at their home or business. This program was initially implemented with a rebate of up to $1,500 per charger for early adopters and has reduced the rebate amount over time as participation has increased.

Currently APU reimburses customers for out-of-pocket expenses up to $500 per EV charger for a maximum of five EV charger rebates per customer, and the charging facility may be used for personal or business purposes without being made available to the public. Eligible expenses include the cost of the charger and the cost of installation. In addition to the rebate, APU pays the City's permitting fees for the EV charger.

Since the program inception in 2012, APU has issued rebates for a total of 364 EV chargers. These rebates sum up to $350,138 and are funded by APU's Business Development Funds.

APU plans to continue offering the $500 rebates and promoting the Public Access EV Charging Station Rebate Program, which is discussed in the next section.

B.3.3. Public Access EV Charging Station Rebate Program (2016 – Current)

Program Design

The new Public Access EV Charging Station Rebate Program is designed with multi-unit dwelling customers and disadvantaged communities in mind. It provides rebate of actual equipment and installation costs up to $5,000 per EV charging station installed for public access at workplace, schools, or multi-unit dwelling locations within Anaheim. This program also pays for City of Anaheim building permit fees.

Disadvantaged Communities, Schools, and DC Fast Charging

Charging locations serving Affordable Housing locations or K-12 schools will receive a rebate for actual equipment and installation costs up to $10,000 per EV charging station, including City of Anaheim building permit fees. In 2017, APU revised the program design to extend the $10,000 allocation to customers installing direct current (DC) fast charging stations. APU recognizes the need for more publicly available EV charging station infrastructure and considers the typical charging duration of 4-8 hours on Level 2 chargers to be a barrier to EV adoption and ownership. APU believes the revision to include DC fast charging stations can help enhance Anaheim's EV-friendly environment.

Funding

The funding of this program is from the sale of Low Carbon Fuel Standard (LCFS) credits, which are part of the California Air Resources Board (CARB) LCFS funding program. The additional rebates for the Affordable Housing installations are funded by APU's Public Benefits Funds under the low income category, and the additional rebates for K-12 schools are funded by Business Development Funds. Additional rebates for DC fast charging stations are funded by GHG Allowance proceeds if LCFS funds are exhausted.

Customer Participation

Since inception, the program has had over 60 rebate reservations, which are anticipated to incentivize about 180 public access charging stations. The additional $5,000 for locations serving Affordable Housing locations and personalized customer outreach (described more in detail under Education and Outreach Plans below) show APU's efforts in prioritizing disadvantaged communities.

APU plans to continue offering the rebates and working closely with customers to understand their specific needs and how to best assist them.

B.3.4. Future Programs

Public Space Charging

APU is collaborating with other City departments including Public Works, Community & Economic Development, and Community Services to identify more locations to install city owned EV charging stations. In neighborhoods with high concentrations of multi-unit dwellings, public spaces such as parks, community centers, and police stations may be locations where residents can potentially charge their EV's. APU anticipates to begin with a pilot program, and then evaluate the feasibility of program expansion. APU is currently evaluating two locations for the pilot program: Brookhurst Community Center and Ponderosa Park Family Resource Center. Both locations are located in disadvantaged communities and are adjacent to schools and parks.

DC Fast Charging Plaza

As previously discussed, APU believes DC fast charging stations can help enhance Anaheim's EV-friendly environment, and APU plans to facilitate DC fast charging plazas in Anaheim. The three major freeway corridors (Interstate 5 freeway, State Route 57, and State Route 91) give Anaheim a unique advantage to host a cluster of DC fast charging stations where EV drivers can quickly refuel their cars and then get back on the road. The revision of the Public Access EV Charging Station Rebate Program will help this concept come to fruition. Additionally, APU is in preliminary discussions with a number of private entities to evaluate the feasibility of installing DC fast charging plazas within Anaheim.

CtrCity MicroTransit

CtrCity MicroTransit is a project proposed by Anaheim Transportation Network (ATN). ATN has applied for grant funds to transform transit/transportation in downtown Anaheim (CtrCity) through the creation of a new CtrCity Microtransit service. The service will be a combination of "alternative transit services" and "ride hailing" using zero-emission "Micro-cruiser" vehicles. CtrCity Microtransit will be tailored to the specific needs of the disadvantaged neighborhood to ensure zero-emission transit becomes an integral part of the community.

The proposed service will encourage visitors to use public transit from nearby ARTIC and use free Micro-cruisers for first/last mile connections. Service will also be available from area parking garages, to discourage motorists from circling/idling in cars while waiting for parking spaces. Community residents and workers will be able to use the service to reach the larger regional transit system, through both fixed-route and demand-responsive elements of a hybrid fixed/flex route system. APU will provide electrical charging infrastructure advice to assist ATN to operate its "Micro-cruiser" fleet to eliminate pollutant-heavy short trips and encourage car-free living in downtown Anaheim.

Photo 9: A Micro-Cruiser Vehicle

Electric Buses at Anaheim School Districts

Three school districts within APU's service territory – Savanna School District, Anaheim Elementary School District, and Anaheim Union High School District – each received a $536,000 grant ($496,000 to purchase two electric buses and $40,000 for charging infrastructure) from the South Coast Air Quality Management District.[19] APU is in discussion with these three school districts to provide advice on charging infrastructure and energy usage management.

B.3.5. MARKET BARRIERS AND SOLUTIONS

APU has observed two main market barriers related to TE:

1. Infrastructure capital costs of charging stations: More grants and incentives can help solve this barrier;

[19] South Coast Air Quality Management District, "SCAQMD Awards $8.8 Million for Electric School Buses," http://www.aqmd.gov/docs/default-source/news-archive/2017/scaqmd-awards-$8-8-million-for-electric-school-buses---june-2-2017.pdf

2. Americans with Disabilities Acts (ADA) requirements: Parking spaces are often scarce, especially in popular public areas, and the ADA requirements on disabled access parking spaces may deter the adoption of more charging stations. APU will continue to work with City of Anaheim's Planning Department to overcome these barriers.

C. Prioritization and Funding Leverage

Where feasible, APU maximizes external funding sources to facilitate transportation electrification. Below is a summary of external grants and credits APU has utilized to build up the EV charging infrastructure.

INCENTIVES AND GRANTS

1. ChargePoint America Program (June 2011)

   ChargePoint provided 9 free EV Level 2 "ChargePoint" charging stations (approximately $50,000 value) and APU paid for the labor used to install the stations (approximately $7,000). These stations were installed at the parking areas for Anaheim West Tower, Anaheim City Hall, Anaheim Canyon Metrolink Station, and Anaheim Convention Center.

2. ECOtality North America (September 2012)

   ECOtality awarded 10 free EV Level 2 "Blink" charging stations (approximately $50,000 value) and also for the installation of these stations. These stations were installed at the parking areas for Anaheim West Tower, Anaheim City Hall, Anaheim Maintenance Yard, and Anaheim Police Department.

3. Mobile Source Air Pollution Reduction Review Committee (April 2014 – ongoing)

   Grant funds are up to $69,000 for purchasing and installing 20 Level 2 EV charging stations. APU has installed 6 charging stations at the Anaheim Regional Transportation Intermodal Center. Other locations will possibly be at Anaheim City Hall, Anaheim Public Works Facilities, and other City parking structures.

4. CEC's Alternative and Renewable Fuel and Vehicle Technology Program (PON-13-606) through SCPPA (January 2014)

   CEC provided approximately $50,000 towards the purchase and installation of 4 Level 2 EV charging stations and 1 DC fast charger. These stations are all located at the Anaheim Regional Transportation Intermodal Center.

5. Nissan North America, Inc. (August 2015)

   Nissan donated 3 non-network Level 2 Aerovironment EV charging stations (approximately $1,500 value) for APU's fleet. APU leased 6 Nissan Leaf EVs through a Nissan dealer and was eligible for this donation. These stations were installed at Anaheim West Tower.

6. ChargePoint Trade Out Program (September 2017)

ChargePoint provided opportunities for APU to swap out existing EV chargers with newer EV chargers at a discounted price. APU was able to replace older, single-port EV chargers with dual-port EV chargers equipped with communication module and retractable cord management for $3,000 each instead of the normal cost of about $6,000 each. This program allowed APU to renovate its EV chargers at CtrCity Anaheim (Anaheim West Tower) and the Anaheim Convention Center.

Photo 10: Public Access Charging at CtrCity Anaheim, Funded in Part by the ChargePoint Trade Out Program

CREDITS

1. Low Carbon Fuel Standard (LCFS) Credits

Under the CARB LCFS funding program, APU has reported energy usage and applied for the associated LCFS credits. The reported energy usages are generated from three categories: APU's public EV charging stations, residential EV charging data, and the electric forklift data within the City of Anaheim. APU sells these LCFS credits through competitive solicitation to generate revenues and to fund the abovementioned Public Access EV Charging Station Rebate Program. The use of LCFS credit revenue is limited to the benefit of current and future EV customers.

2. Energy Policy Act (EPAct) Alternative Fuel Vehicle (AFV) Credits

Under Department of Energy's State and Alternative Fuel Provider Fleet Program, APU filed reports to demonstrate its compliance with EPAct requirements to acquire alternative fuel vehicles. From Model Years 2015 and 2016, APU banked a total of 5 AFV credits. The credits may be sold to generate funding in the future.

D. Education and Outreach Plans

CITY DEPARTMENT ENGAGEMENT EFFORTS

The City of Anaheim's Planning & Building Department is following the California Green Building Standards Code to prepare for the City's EV readiness. APU provides advice and assistance related to EV charging infrastructure for development projects. APU also meets with the Community and Economic Development Department regularly to discuss EV charging opportunities for future projects.

CUSTOMER ENGAGEMENT EFFORTS

APU offers a suite of tools and helpful links on its public website (http://www.anaheim.net/590/EV-Readiness-Guide) to encourage customers to research their options prior to purchasing or leasing an EV. Interested customers can browse the website to learn about topic areas including charger rebates, EV acronyms, EV buying guide, FAQ, EV readiness guide, and types of plug-in EVs. Additionally, customers can contact APU's EV Concierge, a dedicated phone line and an online inquiry form, for further questions and assistance.

For the Plug-In Electric Vehicle Charger Rebate Program, customer engagement efforts have been focused on marketing. All the relevant program information is posted on APU's public website and physical flyers are distributed at public events, which average about 40 a year. For the Public Access EV Charging Station Rebate Program, APU's staff personally reached out to large business customers, school districts, and affordable housing developers via emails, mailers, and/or phone calls. Both programs have yielded positive results, and APU will continue to engage customers and prioritize disadvantaged communities as much as possible.

E. Alignment with State Policy and Local Needs

STATEWIDE GOALS AND POLICIES

2016 Zero Emission Vehicle (ZEV) Action Plan (California State Governor)

Applicable Goals/Policies	APU's Investments
Achieve mainstream consumer awareness of ZEV options and benefits • Led by CPUC: Support utility efforts, including partnerships between utilities, infrastructure developers and other stakeholders, to accelerate the adoption of ZEVs and educate consumers about the benefits of ZEV transportation. Identify appropriate approaches for utility investment in education and outreach programs that build awareness of ZEVs in low income, moderate-income and disadvantaged communities.	• APU offers a suite of tools and helpful links on its public website to encourage customers to research their options prior to purchasing or leasing an EV. Customers can also contact APU's EV Concierge, a dedicated phone line and an online inquiry form, for further questions and assistance. • Information on federal and state incentives is provided as relevant links on APU's public website.
Make ZEVs an affordable and attractive option for drivers • Led by CARB: Work with air districts and stakeholders to develop a strategy to secure sufficient incentives to accelerate fleet turnover and enable outreach to fleet owners. • Led by CARB: Extend credit generation opportunities under the Low Carbon Fuel Standard to zero-emission and near zero-emission freight transportation applications.	• APU continues to convert the older and higher-polluting vehicles to EVs and hybrid EVs to meet South Coast Air Quality Management District (SCAQMD) and DOE requirements for fleets. • APU is actively participating in the LCFS funding program to use the proceeds to fund its Public Access EV Charging Station Rebate Program.
Ensure convenient charging and fueling infrastructure for greatly expanded use of ZEVs • Led by CEC: Develop and implement strategies to ensure that publicly-funded PEV chargers remain open, reliable and convenient to the general public. Similar operations and maintenance funding already exists for hydrogen stations. • Led by CPUC: Develop guidance for utility investment, evaluate utility proposals and monitor implementation of PEV charging infrastructure deployments. • Led by CEC: Establish a data collection system on PEV charging infrastructure usage, reliability, location and other relevant data to inform and make recommendations that improve infrastructure planning and subsequent reductions in infrastructure	• APU has installed publicly accessible EV charging stations at key public venues or transportation hubs. APU also performs routine inspections on these chargers. • Under its Public Access EV Charging Station Rebate Program, APU requires the rebate recipients to make the charging stations publicly accessible. • APU maintains its list of charging station infrastructure to ensure that it contains the most current information. • Under its Public Access EV Charging Station Rebate Program, APU offers an additional rebate of $5,000 for locations serving Affordable Housing locations or schools. APU's staff also personally reached out to large business customers, school districts, and affordable housing developers via emails,

costs. This effort would support broad PEV grid impact analyses. • Led by CEC: Address PEV charging station congestion in areas of high adoption by exploring and demonstrating new charging and pricing strategies to deploy stations and expand infrastructure capacity where necessary. • Led by CEC: Assess and develop strategies to increase availability of PEV charging and hydrogen fueling stations in areas of low PEV and Fuel Cell Electric Vehicle (FCEV) adoption and in disadvantaged communities. • Led by CEC: Create resources and outreach opportunities to broaden the diversity of stakeholders that are aware of and benefit from ZEV grant opportunities. • Led by CARB: Pursue strategies to promote conversion of parking spaces to PEV charging spaces in new or existing destination, commercial and workplace locations without jeopardizing requirements or use permits relating to total number of parking spaces. • Led by CEC: Continue to support activities identified in Regional ZEV Readiness Plans such as infrastructure permitting, siting and installation processes as well as ZEV awareness, local government code adoption and training, ZEV charging and fueling infrastructure signage and the development of new regional ZEV readiness plans. • Led by CEC: Explore funding options for PEV charging infrastructure installations in disadvantaged, low- and moderate-income communities and neighborhoods with a high concentration of multi-unit dwellings complexes. • Led by CEC: Explore incentives for managers and property owners of existing residential buildings to install make-ready PEV infrastructure and charging equipment. Coordinate with existing pilot programs and investments. • Led by CEC: Expand types of financial incentives for employers and commercial property managers to install workplace PEV charging, including the possibility of a simple rebate that reduces costs for employers to	mailers, and/or phone calls to increase the awareness of the incentives. • APU complies with ADA requirements when converting public parking spaces into EV charging spaces. • APU's public programs offer rebates to both private use and publicly accessible EV charging stations. Also, EV rates are available for residential customers. • APU installed a DC fast charger at the Anaheim Regional Transportation Intermodal Center, which is in a centralized transportation hub.

install PEV charging. • Led by CEC: Track the development of DC fast chargers across California to identify where gaps may exist between regions. Continue funding or other incentives to stimulate station development along interregional corridors.	
Maximize economic and job opportunities from ZEV technologies • Led by CEC and CARB: Establish strategies to improve the ability of small businesses to deploy ZEVs in their fleets.	• APU offers a suite of tools and helpful links on its public website to encourage customers to research their options prior to purchasing or leasing an EV. Customers can also contact APU's EV Concierge, a dedicated phone line and an online inquiry form, for further questions and assistance. • APU's public programs offer rebates to both private use and public accessible EV charging stations.
Bolster ZEV market growth outside of California • Led by CPUC: Review best practices in California for investor- and publicly owned utility efforts to accelerate ZEV adoption and infrastructure deployment in a manner that benefits customers and supports the electrical grid. Seek to disseminate best practices through national or international forums.	• APU maintains its list of charging station infrastructure to ensure that it contains the most current information.

2016 Mobile Source Strategy (CARB)

Applicable Goals/Policies	**APU's Investments**
• Increased ZEV sales coupled with expansion of necessary infrastructure • Incentive funding to achieve further ZEV deployment beyond vehicle regulations • Electricity grid representing 50% renewable energy generation • Increased use of renewable fuels	• APU offers a suite of tools and helpful links on its public website to encourage customers to research their options prior to purchasing or leasing an EV. Customers can also contact APU's EV Concierge, a dedicated phone line and an online inquiry form, for further questions and assistance. • Information on federal and state incentives are provided as relevant links on APU's public website. • APU has installed public accessible EV charging stations at key public venue or transportation hubs. APU also performs routine inspections on these chargers. • Under its Public Access EV Charging Station Rebate Program, APU requires the rebate recipients to make the charging stations

	publicly accessible. • APU's Renewables Energy Procurement Plan and Enforcement Program governs its progress and compliance with the 50% renewable generation by 2030, as required by Senate Bill 350. • APU is actively participating in the LCFS funding program to use those proceeds to fund its Public Access EV Charging Station Rebate Program. • APU continues to convert the older and higher-polluting vehicles to EVs and hybrid EVs to meet South Coast Air Quality Management District (SCAQMD) and DOE requirements for fleets.

California Sustainable Freight Action Plan (California Department of Transportation, CARB, CEC, and Governor's Office of Business and Economic Development)

Applicable Goals/Policies	APU's Investments
• Invest strategically to accelerate the transition to zero and near-zero emission equipment powered by renewable energy sources, including supportive infrastructure.	• APU's Renewables Energy Procurement Plan and Enforcement Program governs its progress and compliance with the 50% renewable generation by 2030, as required by Senate Bill 350.

Vehicle-Grid Integration Roadmap (California Independent System Operator)

Applicable Goals/Policies	APU's Investments
• Confirm VGI electrical system impacts: assess VGI physical impacts to the electrical system for each use case	• Under its Public Access EV Charging Station Rebate Program, APU has a "right to interrupt service" condition to remotely or manual interrupt electric service to the EV charging station in the event of a generation capacity shortage or a transmission or distribution system emergency.

COORDINATION WITH OTHER UTILITIES

APU actively participates in the EV Working Group of Southern California Public Power Authority (SCPPA) to coordinate efforts with other publicly owned utilities. Highlights of activities and accomplishments are listed below.

- CEC EV Charging Infrastructure Grant: Through SCPPA, APU collaborated with other utilities and applied for the EV Charging Infrastructure Grant under CEC's Alternative and Renewable Fuel and Vehicle Technology Program (PON-13-606) in 2014. SCPPA was a successful awardee and received funds to acquire EV charging equipment and installation services on behalf of SCPPA members.
- California Electric Transportation Coalition (CalETC): CalETC is a non-profit advocate for TE programs and also directly responsible for much of the state and federal grant-funding and EV rebate programs that are available to utilities and consumers. SCPPA is a voting board member of CalETC.

XI. SOLAR AND OTHER DISTRIBUTED GENERATION

A. Customer Owned Solar PV

Customer owned solar photovoltaics (PV) are evenly spread throughout the APU territory. As of the end of 2017, 2,827 solar PV systems have been installed in Anaheim for a combined total of 26 MW of solar capacity. Solar growth is expected to continue, increasing by roughly 500 new solar PV systems annually for an estimated 5 MW of new solar capacity each year in APU territory. As solar panel costs continue to decline, APU expects more customers to adopt solar.

RESIDENTIAL AND COMMERCIAL SOLAR PV

1. Residential and Commercial Customers

The SB 1 program was successful in accelerating the rapid growth of solar in Anaheim. With the SB 1 solar incentives and the 30% Federal income tax credit, residential customers were able to recover more than 50% of the cost of a solar PV system in the early years of the ten-year program. The majority of commercial customers that installed solar were able to do so because of the SB 1 program.

Solar growth in APU territory has climbed at a steep rate over the last five years and has plateaued to about 500 new solar installations annually for an additional five (5) MW each year. With the 30% Federal income tax credit scheduled to sunset on December 31, 2019, APU expects to see a drop in solar installations in 2020 before picking back up in 2021 and beyond.

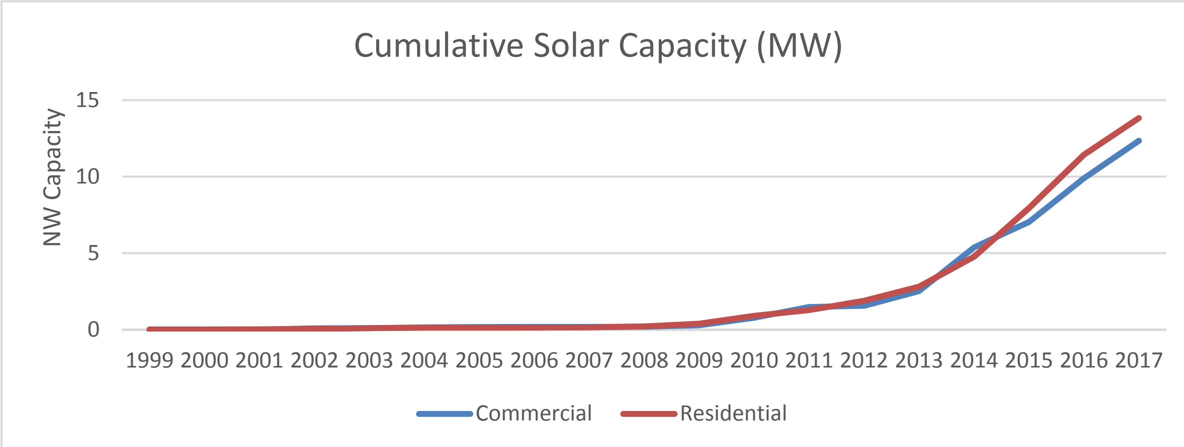
2. Income-qualified Customers

The State required SB 1 incentives for residential customers to start at $2.75 per watt, or higher, for each solar watt installed. APU offered an additional income-qualified solar incentive to those that met the U.S. Department of Housing and Urban Development low income guidelines. Approximately $2.9 million in income-qualified solar incentives were paid out to 141 customers for a total of 650 kW capacity of solar which equals $4.46 per watt installed. Almost all of the low income customers who received SB 1 incentives would not have been able to afford solar otherwise and will continue to benefit over the lifetime of their solar panels.

OVERALL PRIVATELY OWNED SOLAR GROWTH

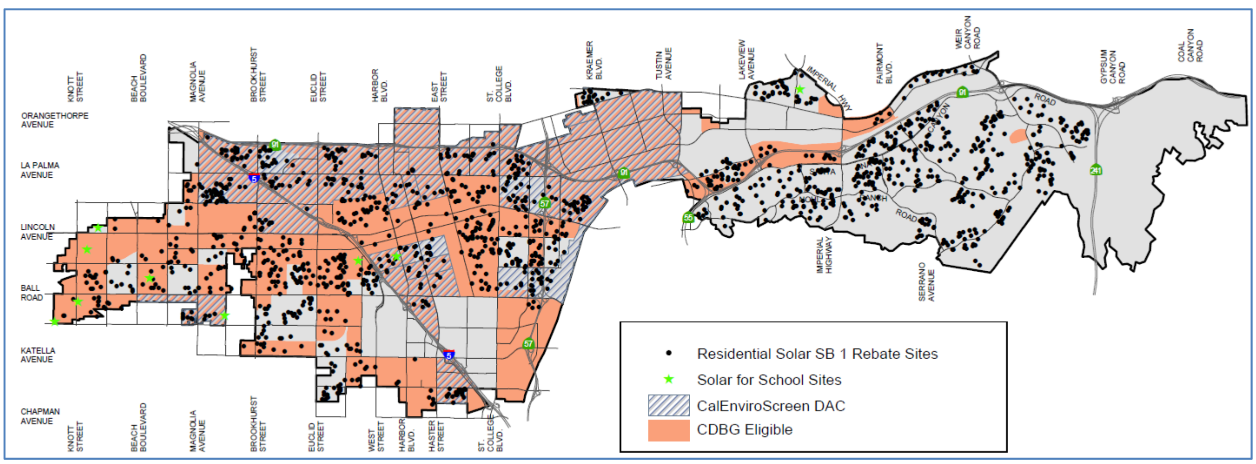
The chart below shows the rapid growth of solar in Anaheim that resulted from declining solar panel prices and SB 1 incentives. Over the past decade, APU's commercial and residential customers have installed over 26 MW of solar.

Graph 68: Cumulative Solar Capacity Installed - Customer Owned Solar Systems



The map below shows the geographic dispersion of all residential solar incentives in Anaheim during the ten-year SB 1 program. Due to the availability of solar loans, leases, and APU's enhanced low income rebate, the benefits of having solar are enjoyed throughout Anaheim. Solar for Schools sites, as detailed in the following section, are also included in this map.

Graph 69: Map of SB 1 Residential Solar Rebate and Solar for School Sites



Net Energy Metering

Net energy metering (NEM) is a special billing arrangement that provides a credit to customers with eligible renewable electric generation facilities (e.g., solar PV systems) that send excess energy back to the Grid. Customers can then use that excess energy to offset the energy provided by APU. Customers with renewable electric generation facility installations enter into the Interconnection Agreement for Net Energy Metering with APU to receive an energy credit or an annual compensation payment for the excess solar generation greater than the total energy usage.

NEM 1.0

State law requires that APU offer customers retail NEM until the total generated capacity of eligible customer-generators exceed 5% solar penetration of APU's all-time peak aggregate load of 593 MW, which equates to 29.6 MW. Currently, the total generated capacity of NEM customers is at approximately 4.2% and is projected to reach 5% in late 2018. Approximately 2,800 NEM customers currently participate in the retail NEM program and when APU transitions to a successor program they will have the option to remain in the original NEM program until 2040.

NEM 2.0

APU is in the process of developing a successor NEM program to become effective once the Utility reaches its 29.6 MW goal under the current NEM program. The new Net Energy Metering Program 2.0 (NEM 2.0) is expected to become effective, upon City Council approval, in 2019. It is anticipated that NEM 2.0 will compensate customers at avoided cost for all excess energy that APU receives from any customer owned distributed energy resource (DER) that is designed to offset 100% or less of their load.

B. Solar for Schools

APU created a pilot Solar for Schools program that builds solar carport facilities and/or lunch shelters on school properties throughout Anaheim and compensates the school for use of the property. This program solicited local school districts to submit an application for two schools of their choosing to be evaluated to be a host solar site for APU. The program was very well received by the school districts, and APU received seven applications for a total of fourteen host solar sites to be evaluated. After a consultant evaluated each solar site for feasibility of solar being installed at each school, nine schools were selected to be a host solar site. A nationwide Request for Proposals (RFP) was advertised for a solar developer to design and build these nine school solar sites. A solar developer was selected and awarded the design and build contract in December 2017. The total capacity of all nine schools is rated at 1.5 MW.

Construction of the Solar for Schools projects is estimated to cost $6 million and be completed during the summer of 2018. Once in operation, these systems are to be included in a pilot Solar Power Program described below. In return for licensing their property to the City, the school districts will receive a fixed annual license payment without the risk of intermittent solar production. These projects will be built, owned, and operated by APU and all energy produced will be included in APU's renewable energy portfolio. Along with supporting local school districts and the new Solar Power Program, the projects themselves will provide real-life examples to support students pursuing an education in science, technology, engineering, and mathematics (STEM) fields. APU plans on subsequent phases of the Solar for Schools program pending success of this pilot program.

Photo 11: The Solar for Schools Program Will Install Carport Shade Structures

C. Solar Power Program

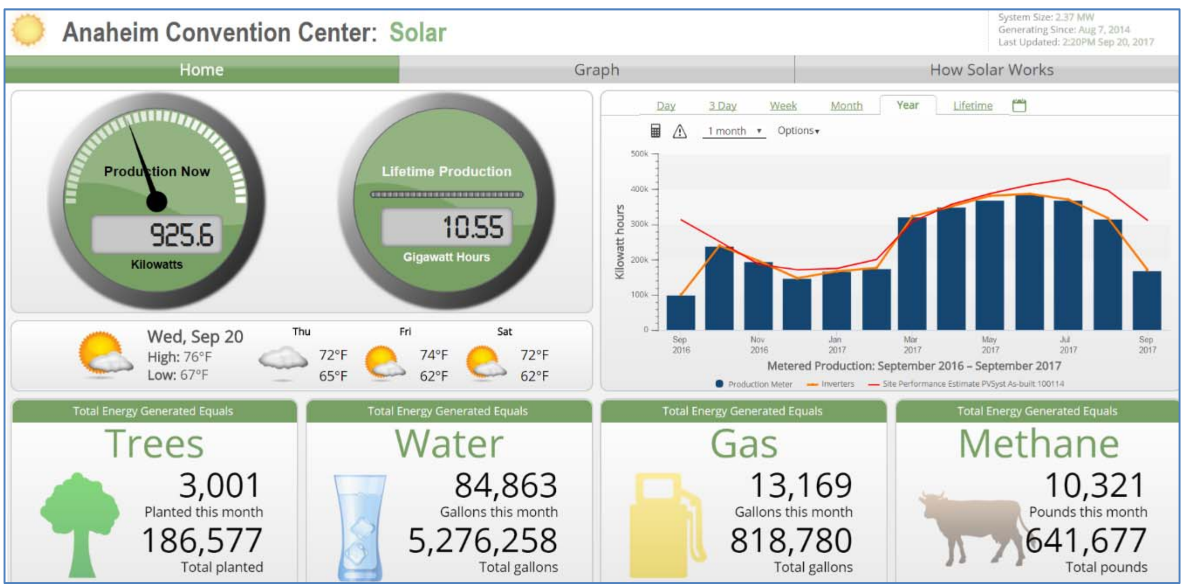
APU is planning a Solar Power Program pilot that will encourage participation from income-qualified customers. At its inception, APU's Solar Power Program will utilize energy locally produced from the Solar for Schools program, but could be expanded to include other renewable resources. This pilot program will be available to income-qualified customers and is designed to extend the benefits of solar energy to customers who may not otherwise have access to solar energy due to the cost or because they do not own their own roof. By participating in the program, income-qualified customers would receive a set amount of solar energy each bill cycle at a discount over their normal rates. As APU builds more solar resources within its service territory, the program could expand to include more income-qualified customers.

D. Anaheim Solar Energy Plant at the Convention Center

In 2013, APU partnered with the Anaheim Convention Center to install a 2.4 MW solar PV system on the roof of the Anaheim Convention Center. Completed in August 2014, the Anaheim Solar Energy Plant includes 7,902 panels, produces 3,500 MWh annually, and supplies about 17% of the convention centers annual electricity needs. The solar PV system allowed the Convention Center to attain LEED Gold certification.

Photo 12: Solar PV System on the Roof of the Anaheim Convention Center

An interactive webpage is available on APU's website to demonstrate the solar output, energy equivalent, and environmental attributes of the Anaheim Solar Energy Plant at the Convention Center.



F. Non-Solar Distributed Generation

APU's services include assisting those customers who wish to develop distributed generation facilities within its service territory and interconnect with its electric system. The interconnection process is governed by Rule No. 22 of City of Anaheim's *Electric Rates, Rules and Regulations* and Generation Interconnection Standards and Guidelines (available online at Electric-Utility-Rules[20]). While there has not been a significant impact of non-solar distributed generation and energy storage (ES) on system load, APU is closely monitoring the development of these technologies.

Anaheim Owned Distributed Generation

At this time, solar generation is the only type of distributed generation that is owned by APU. APU owns and operates solar facilities on City-owned buildings, such as the Anaheim Convention Center, and locations licensed from nine (9) public schools located in Anaheim.

Behind the Meter – Customer Side

APU reports distributed generation and internal generation above 100 kW in the 1306C Report: UDC List of Power Plants Semi-Annual Report semi-annually to the California Energy Commission. Within the City of Anaheim, currently there is a total of 2.46 MW of installed capacity of fuel cell technology, and a total of 0.13 MW of installed capacity of micro turbine technology.

APU's IRP Customer Survey indicated that four (4) out of the six (6) large business customers, who were willing to disclose their on-site power generation, stated that they have fuel cells. Fuel cell technology appears to be the preferred non-solar distributed generation technology within APU's service territory.

The impact of these installations is part of APU's load forecast – accounting for future system expansions.

[20] http://www.anaheim.net/883/Electric-Utility-Rules

XII. ENERGY EFFICIENCY AND DEMAND RESPONSE PROGRAMS

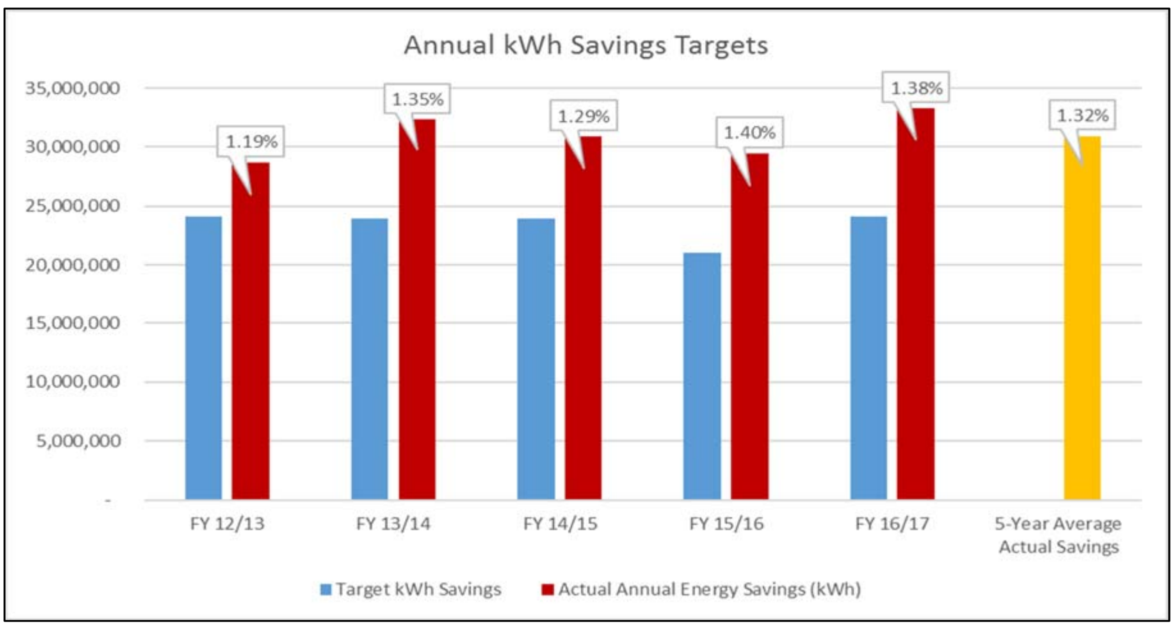
A. Program History

APU has historically provided energy efficiency (EE) programs to its customers, even before AB 1890. Since the inception of AB 1890, APU has set aside 2.85% from electric retail sales for the implementation of Public Benefit programs. The funds are allocated to the following four program categories:

1. Cost-effective energy efficiency and conservation activities;
2. Research, development, and demonstration programs to advance science or technology that are not adequately provided by competitive and regulated markets;
3. In-state operation and development of existing, new, and emerging renewable resource technologies; and
4. Programs and rate discounts for low income electricity customers.

Currently, there are over 45 energy and water efficiency programs to help Anaheim customers reduce their utility bills and operating costs. Since 1998, APU has expended nearly $135 million in residential, income-qualified and commercial energy efficiency programs. Over the past five years, APU reported savings of 154,630,745 kWh between FY12/13 and FY16/17. The following chart illustrates APU's FY energy savings over the past five years.

Graph 70: Annual kWh Savings Targets



B. Target Setting

SB 350 (De León, 2015) directed POUs to develop energy efficiency targets consistent with the statewide energy efficiency targets adopted by the California Energy Commission (CEC).

APU, in conjunction with other members within the California Municipal Utilities Association (CMUA), contracted with Navigant Consulting, Inc. (Navigant) to identify all potentially achievable cost-effective electricity efficiency savings and establish annual targets for energy efficiency savings for 2018-2027. The purpose of the study is not only to look back on the success of the past years, but also to look ahead and inform discussions on how to achieve additional energy savings in the future.

The final report "Energy Efficiency in California's Public Power Sector" was published and submitted to the CEC in 2017. Based on the Navigant report, APU presented its ten-year goals (required by AB2021 every four years) to the City Council in 2016 to achieve an average annual energy savings equal to 1.1% of retail electric sales.

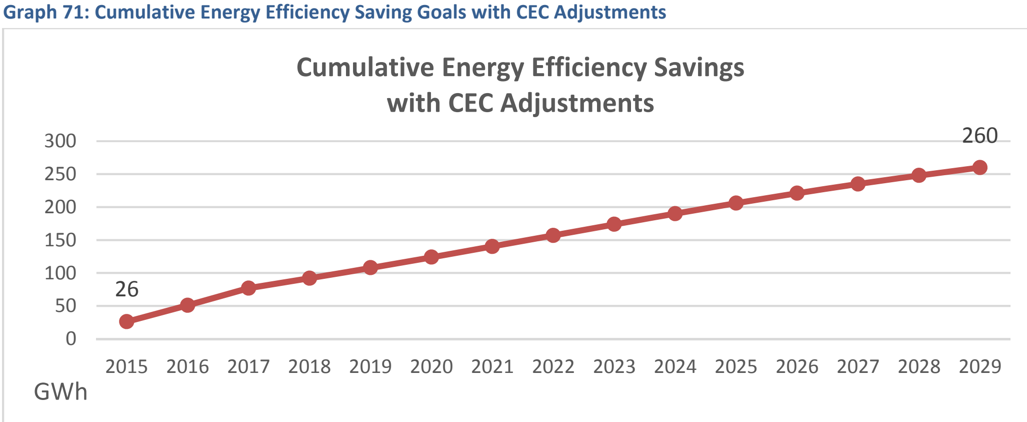
Table 2: APU Energy Efficiency Targets including Codes & Standards (Navigant Study)

	Targets w/ C&S													
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028 *	2029 *	2030 *	Avg. 10 Yr.
kWh	1.15%	1.15%	1.09%	1.06%	1.04%	1.00%	0.95%	0.91%	0.86%	0.80%	0.80%	0.80%	0.80%	1.00%
kW	1.11%	1.12%	1.13%	1.15%	1.19%	1.14%	1.15%	1.13%	1.09%	1.04%	1.04%	1.04%	1.04%	1.13%

* 2028-2030 are projections based on 2027 targets. 10-Yr Average Calculated for 2018-2027.

The CEC relied on the Navigant study, adjusted with building Codes and Standards and gross-to-net ratio, and concluded APU-specific energy efficiency target as below:

Graph 71: Cumulative Energy Efficiency Saving Goals with CEC Adjustments



*Source: Table A-10 of CEC Final Commission Report: "Senate Bill 350: Doubling Energy Efficiency Savings by 2030", 10/26/2017

The energy efficiency targets are incorporated into APU's demand forecast.

APU will continue to leverage internal and external resources to achieve the energy efficiency targets. This includes the continuation of existing programs, the recognition of challenges and the development of new programs, as detailed in the sections below.

C. Program Highlights

Collaboration with External Parties

The collaborative nature of the public power community allows for the development of joint resources and sharing of best practices. CMUA, NCPA (Northern California Power Agency), and SCPPA serve as forums for discussing and pursuing projects that benefit varying groups of all POUs. Anaheim is joint powers member of SCPPA, which allows collaboration among other publicly owned utilities which helps encourage volumetric discounts.

In addition to collaboration with other POUs, APU also collaborates with other stakeholders. One of the major program enhancements in FY15-16 was Anaheim's successful collaboration with the Southern California Gas Company (SoCal Gas Company) to provide the Weatherization Program. This program utilizes a one-stop approach to provide efficiency improvements to Anaheim's income-qualified residential customers. In this program, Anaheim residents receive electric, gas, and water conservation measures through a single point of contact and by a contractor qualified by the SoCal Gas Company.

Anaheim also has contracted with third party contractors that assist with the school, residential, and commercial programs. For school programs, contractors help promote and educate students about energy efficiency and water conservation. To date approximately 30 schools have participated in the school programs, which allowed over 21,000 students to participate in energy and water programs. Other contractors help with some of the residential and commercial programs, such as the Home Utility Check-Up and the Refrigerator Recycling Programs, as well as the Small Business Energy Management Assistance Program.

Creative Synergy with Other City Departments

APU works closely with other City departments, including Community Services, Community and Economic Development, Planning, and Public Works. Collaborating with other departments helps APU learn new ideas and find out ways to engage more customers in its various programs.

Inter-departmental collaboration also enables greater understanding of community needs, which results in better program design and participation. For example, Community Services interacts directly with seniors and income-qualified customers, and assists with promoting the Income-Qualified Energy Discount and Emergency Assistance programs, including referrals to APU for other programs that help customers manage their utility bills.

Community Outreach and Student Engagement

Anaheim holds 40 community outreach events annually throughout the City to promote the energy and water savings programs offered to residential customers. These events are held at City parks, Anaheim schools, local neighborhoods, home improvement stores, and on the Center Street Promenade near Anaheim City Hall and Anaheim West Tower during Farmer's Market days. Each event brings in numerous customers that visit APU booths to ask questions and receive information about the programs and services provided by APU. Community outreach remains a vital activity to keep customers informed and to help APU meet its energy and water savings goals.

Photo 13: Community Outreach Event at Farmer's Market

APU also provides multiple student engagement events throughout the year for high school, junior high, and elementary school students. Students get to learn how and where APU procures its water and power. They learn about the water cycle and greenhouse gas emissions, so they can incorporate the energy efficiency and water conservation lessons into personal actions at home and on campus.

Students at the high school level participate in the design, development and management of their own California friendly demonstration gardens. Students at all levels are taught how they can be leaders in their communities by incorporating sustainability into their personal lifestyles. In addition, APU sponsors student engagement activities that include mentorships and career exploration opportunities with APU.

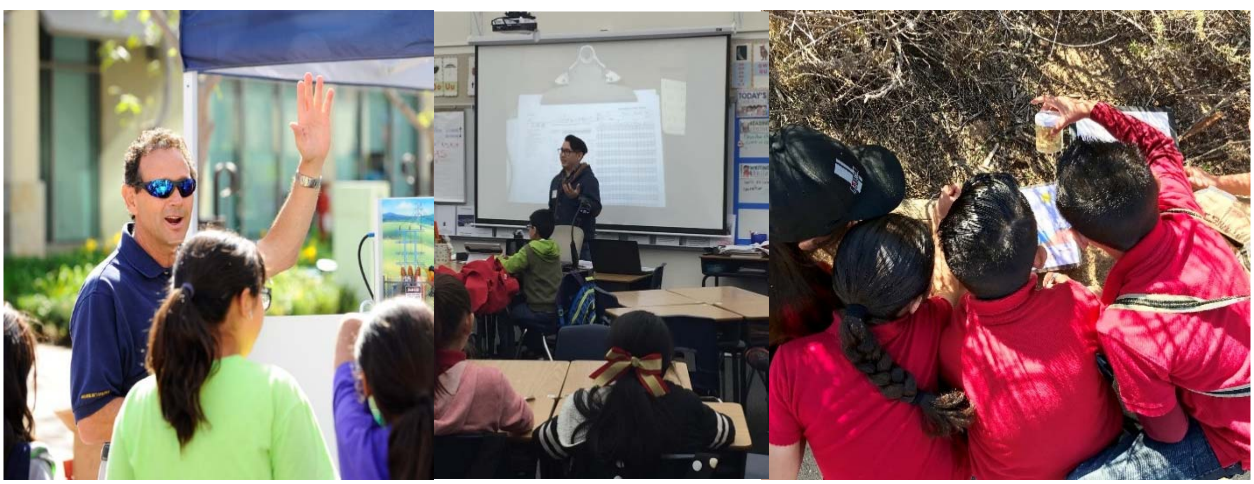


Photo 14: Various Student Engagement Activities

D. Existing Programs

In order to meet Anaheim's annual energy efficiency goal, it is important to reach both its residential and commercial customers. Anaheim residential customers make up 85% of APU's total customers; however, almost 75% of total load is consumed by commercial and industrial customers. A brief description and end use overview of Anaheim's existing EE programs are shown in the following section.

Residential Programs

Residential Low Income Programs

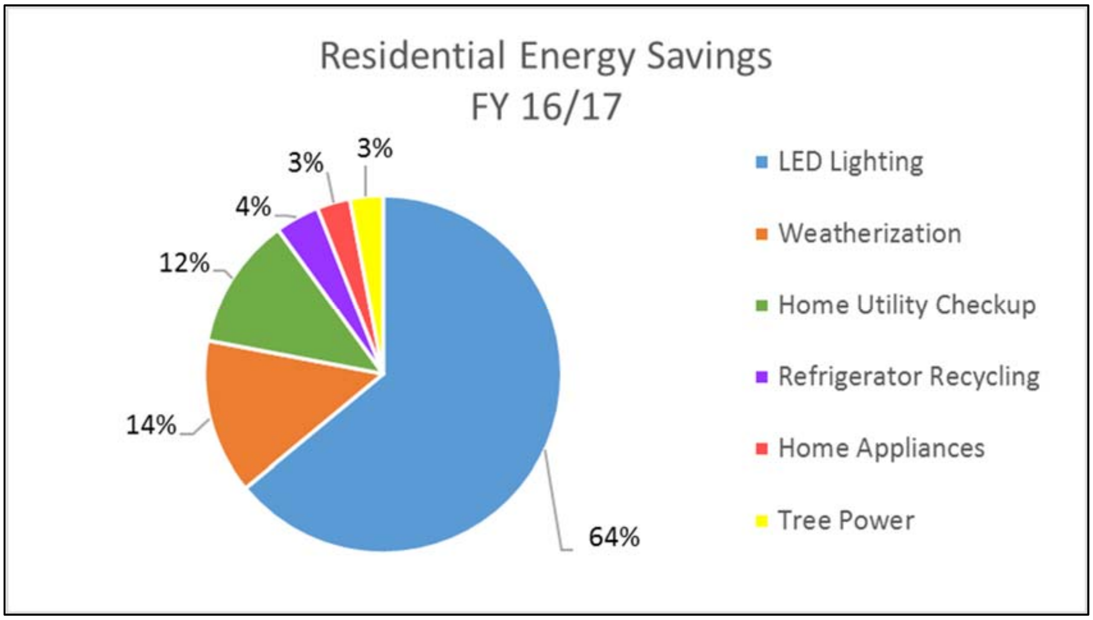
- **Weatherization** - Income-qualified program that provides plug load occupancy sensors in smart power strips, up to 10 LED bulbs, duct sealing, AC tune-ups with refrigerant charge testing, Energy Star room air conditioners, and additional water and gas saving measures.
- **Income-Qualified Senior, Military Veteran, and Disabled Customer Energy Credit** - Provides a 10% reduction on the electric portion of bills to seniors, military veterans, or long- term disabled customers at or below 80% of the Orange County median income.
- **Dusk to Dawn Income-Qualified Assistance** - In addition to receiving a free outdoor light, income-qualified residents may also have the light installed by one of Anaheim's approved and licensed electrical contractors free of charge.
- **Emergency Assistance** - Provides a one-time electric utility payment for customers in economic hardship.

Residential Programs

- **A/C Tune Up** - Provides incentives to residential customers who have a licensed HVAC contractor perform an A/C tune up.
- **TreePower** - Provides complimentary shade trees and incentives for residential customers. Shade trees when properly placed can help reduce air conditioning costs.
- **On-Line Home Utility Check-Up** - Customers can complete a detailed survey on the APU website. Customers receive money saving advice and learn about incentives designed to help them be more water and energy efficient.
- **Home Utility Check-Up Equipment and LED Direct Install** - A customized in-home survey of water and energy use and existing appliances. Customers receive free installation of up to five LEDs.
- **Home Utility Check-Up Audits** - A customized in-home audit of water and energy use and existing appliances.
- **LED Library Distribution and LED Distribution** - Distribution of two 8.5 watt 800 lumen bulbs to residents via Anaheim's Public Libraries and distribution via direct mail.
- **Holiday Lights Exchange** - Provides free holiday lights to residents who turn in old incandescent holiday lights.
- **Home Incentives** - Provides rebates for the purchase and installation of high efficiency ENERGY STAR® rated appliances and high efficiency conservation measures.
- **Refrigerator Recycling Program** - Provides a rebate to customers who recycle an old, operational refrigerator or freezer and replace it with a new ENERGY STAR® rated model.

The following graphic illustrates FY 16/17 energy savings achieved by through APU's residential programs.

Graph 72: FY 16/17 Residential Program Energy Savings



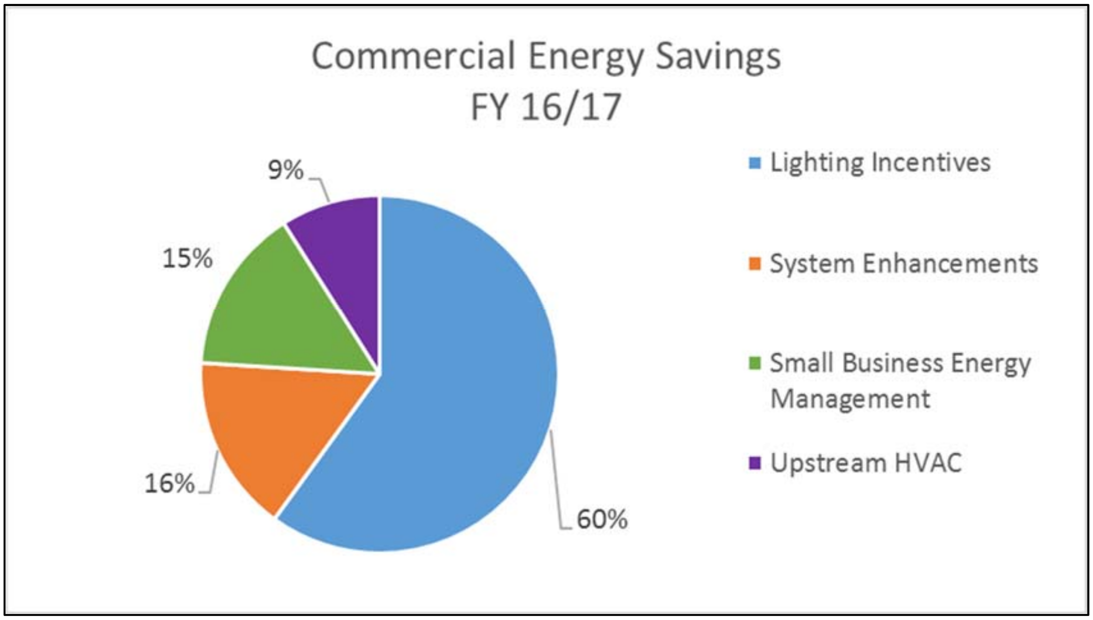
Commercial Programs

- **Customized Energy Incentives Program** - Customized financial incentives for installation of high-efficiency air conditioning, motor controls, and other production related equipment.
- **Comprehensive Energy Audits** - Customized on-site audits and recommendations designed to improve operating efficiencies and help customers reduce costs.
- **System Operations Enhancements** - Produces energy savings by increasing system performance through replacement of electrical infrastructure and by disabling large transformers that are not actively serving customers' loads.
- **Codes and Standards** - Savings are drawn from the statewide allocation of energy savings credits due to (building) Codes and Standards and based on Anaheim's percent share of statewide load.
- **Upstream HVAC** - Provides rebates to the sales channel that most influences the stocking and selling of qualifying high efficiency equipment; the goal is to facilitate the purchase of the high efficiency equipment by the end-use customer.
- **Heat Pump Incentives Program** – Provides rebates for installation of high-efficiency heat pumps.
- **Lighting Incentives** - Provides incentives to improve energy efficiency for a variety of lighting applications.
- **Small Business Energy Management Assistance Program** - Provides customers of less than 50 kilowatt demand with energy use evaluations, retrofit funding, and installation services; focus is on lighting upgrades, programmable thermostats, and air conditioning and refrigeration tune- ups.
- **Small/Medium Business Audits** - Customized on-site audits and recommendations designed to improve operating energy efficiency and help customers reduce costs.

- **Air Compressor Program** - Provides free comprehensive audits which approach this technology and its operation on a systemic basis and awards incentives for installing qualifying system components which improve energy system efficiency.
- **New Construction Program** – Provides incentives for business customers who exceed Title 24 in their new construction projects and large scale retrofits

The following graphic illustrates FY 16/17 energy savings achieved by through APU's commercial programs.

Graph 73: FY 16/17 Commercial Program Energy Savings



E. Challenges and Future Program Development

Address Diminishing Return by Embracing Emerging Technologies

The unit costs of implementing energy efficiency programs will decline with increases in scale, but at some point unit costs for the first year savings will increase due to diminishing returns. To achieve cost effectiveness, APU must identify programs and technologies that have not been impacted by the diminishing returns.

APU is dedicated to research and investment in new and emerging energy efficient technologies, such as lighting, HVAC and plug loads. Through these efforts, APU is looking into opportunities to enhance existing energy programs and expand customer participation in multi-family developments, Commercial/Industrial/Institutional (C/I/I) upgrades, new construction projects, and residential and business customer equipment rebates.

Address Evolving Communication Preference by Expanded Methods of Communication

Customers today are requesting information in a variety of ways, languages, and with an expectation of 24/7 accessibility. APU is continually adapting its methods of communication with customers through social media and all forms of electronic communication.

The Latino population in Anaheim increased from 46.8% to 54.8% in 2016. Anaheim has always offered its communication materials in both English and Spanish. Most community outreach events have Spanish-speaking staff to assist Spanish speaking customers with questions and program details. APU strives to keep pace with current technologies and be responsive to the best mechanisms to communicate with customers and offer its programs and services throughout a diverse community.

APU will continue to provide outreach events throughout the community to bring awareness and promote new programs and services. APU will also continue to expand its methods of communication through various social media outlets.

Approach Disadvantaged Communities with Targeted Outreach

One of the challenges that APU faces in meeting its energy efficiency target is being able to serve the income-qualified community in the rental housing market. Anaheim residents living in rental properties account for 50.9% of the population. However, due to the nature of some programs, consent is required from the property owners in order for income-qualified renters to participate in the programs.

Many of APU's incentive programs are designed to provide rebates directly to the customer account holder. However, if a renter would like to upgrade to new windows or HVAC system but does not have the homeowner's permission, or the homeowner is not willing to pay for the improvements, the efficiency upgrades are not implemented.

APU is making a concerted effort to design and promote programs to customers in low income and disadvantaged communities within Anaheim. Please see APU's full efforts in Section XIII. Programs for the Low Income and Disadvantaged Communities.

Two of the key assistance programs APU will promote and market moving forward will be the 1) free Home Utility Check Up program where customers receive energy and water savings measures, as well as a customized report on applicable programs and behavioral recommendations and 2) the Weatherization Program that provides free electric, gas, and water measures installed at customers' homes at no cost. Critical to all these efforts is APU's collaborative efforts with third parties, other utilities, other City departments, and community based organizations to provide the most comprehensive and targeted energy efficiency program and services.

F. DEMAND RESPONSE PROGRAMS

F.1. VOLUNTARY LOAD REDUCTION PROGRAM

The Voluntary Load Reduction Program is designed for large commercial, industrial, institutional, and municipal customers who can curtail a minimum of 200 kW of their load within 30 minutes of being notified APU. These eligible customers are capable of assisting APU comply with a CAISO order to curtail system load during a Stage 3 Alert and/or a transmission system emergency.

A CAISO Stage 3 Alert is called when statewide operating reserves for electric generation fall below 3%, which increases the likelihood of system and regional electric system outages. In order to prevent widespread outages, the CAISO will take certain actions to ensure the stability and reliability of the State's electric power Grid. During a Stage 3 Alert, the CAISO may institute mandatory load curtailment throughout the State for typically one to four hours to maintain system reliability when electricity usage is at its peak. APU may be ordered to participate in load curtailment if sustained high electric loads threaten blackouts throughout the State.

This voluntary program does not offer financial incentives to participants and does not include any financial penalties for not curtailing load when requested or not sustaining load curtailment during the duration of the CAISO Stage 3 Alert. Participating customers receive the benefit of eliminating the risk of unplanned total electric service outages that result from CAISO orders to curtail firm load during a Stage 3 Alert, in exchange for voluntary load reduction during the entire duration of a CAISO Stage 3 Alert.

The economic benefits to participating customers are a function of the savings realized from a coordinated interruption of individual business processes and the expected risk of a CAISO ordered load curtailment event. For those customers that maintain continued participation in this program, APU bypasses, where feasible, that customer's circuit from mandatory rotating outages during an order by the CAISO to curtail load.

Currently APU has 10,688 kW of load in the Voluntary Load Reduction Program that includes business customers, City properties, and water pump stations.

F.2. MYPOWER SAVINGS PROGRAM

APU currently has a one-year pilot residential demand response program named myPower Savings Program. It is based on behavioral demand response, and APU plans on calling events and sending dispatch signals to enrolled customers based on criteria such as high wholesale energy prices, CAISO Alert or Warning notices, system emergencies, and extreme or unexpected weather conditions. Events are limited to non-holiday weekdays, and the total number of events is capped during the program duration.

Eligible customers can receive a one-time bill credit for enrolling in the program. When a program event is called, APU notifies enrolled customers of the upcoming event by email or text message based on customers' preferences. Enrolled customers have the freedom to reduce energy consumption however they wish during the event hours, and they can also earn bill credits based on the kilowatt-hour (kWh) they reduce.

During the pilot period, APU assesses enrollment, customer participation, and actual performance during program events. The program was officially launched in July 2017, and six myPower Savings Events had been called thus far. The total estimated amount of kWh reduction of these events is 794 kWh.

The expected peak and load impact from the pilot program is deemed negligible. In addition, future program design is contingent upon measurable results from the pilot program. As such, APU does not include the impacts of demand response programs in its peak load and energy forecast at this time. APU anticipates conducting phase two of the pilot myPower Savings Program from July 2018 through June 2019 by expanding the program City-wide, and based on the outcome, APU may determine appropriate estimates of peak and load impacts.

XIII. PROGRAMS FOR THE LOW INCOME AND DISADVANTAGED COMMUNITIES

A. DEFINITION OF LOW INCOME AND DISADVANTAGED COMMUNITIES

Pursuant to Senate Bill 535 (De León), disadvantaged communities (DACs) are communities designated by CalEPA, using the California Communities Environmental Health Screening Tool ("CalEnviroScreen").

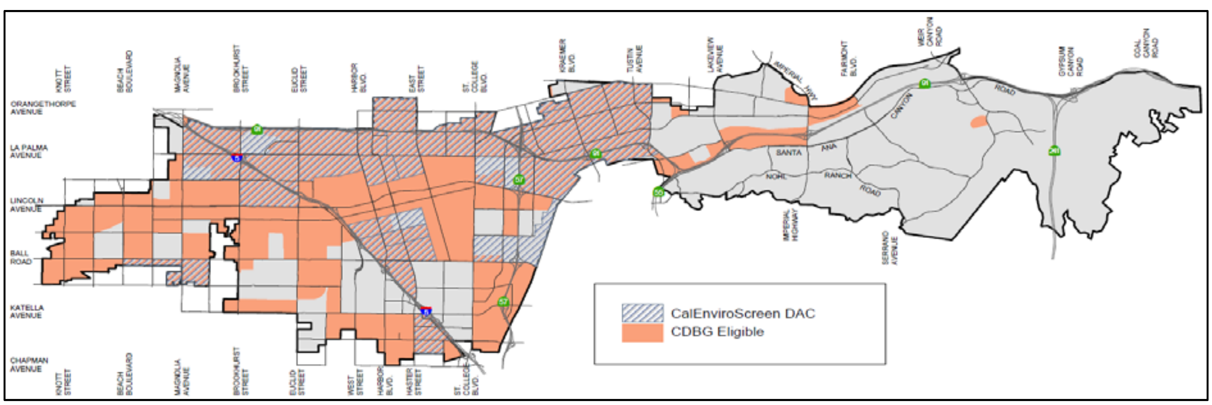
Anaheim's disadvantaged and low income communities include areas greater than the CalEnviroScreen-defined DAC areas.

Beyond the CalEnviroScreen defined DACs, Anaheim maintains information about the different types of neighborhoods of concern within the City. The areas that Anaheim provides assistance to include:

- Disadvantaged Communities as defined by Proposition 84 Integrated Regional Water Management (IRWM) Guidelines (2015).
- Community Development Block Grant (CDBG)[21] areas as defined by the Department of Housing and Urban Development.

Essentially, Anaheim's communities of concern include geographic areas greater than the CalEnviroScreen-defined DAC areas. The graph below is a comparison of DACs as defined by CalEnviroScreen versus the CDBG areas. The CDBG area is greater than the DAC area. For the purpose of this IRP, the DAC and CDBG areas are utilized to demostrate APU efforts in reaching out to the low income and disadvnataged communities (LI-DACs).

Graph 74: Map of APU's Low Income and Disadvantaged Communities



Anaheim has developed two primary strategies to assist communities of concern:

- Interdepartmental Strategies
- APU Strategies

[21] CDBG funds activities that benefit low- and moderate-income (LMI) persons, the prevention or elimination of slums or blight, or other community development activities that address an urgent threat to health or safety.

B. INTERDEPARTMENTAL STRATEGIES

Interdepartmental Collaboration Examples

- Affordable Housing Developments
- Private Development Opportunities
- Street Replacement Projects
- Residential Rehabilitation
- Public Access Electric Vehicle Charging Stations
- Expanded Customer Education
- Expanded Customer Outreach

The City of Anaheim has strong interdepartmental ties and APU works closely with Community and Economic Development, Public Works (Streets and Transportation), Planning and Community Services (which includes Parks and Libraries).

APU participates in a biweekly Interdepartmental Review Committee that examines all new proposed and rehabilitation projects. APU assists the other departments with their respective environmental and community health goals in particular, as it pertains to disadvantaged communities.

Below are examples of inter-departmental collaboration to ensure that investments are made in the City's most vulnerable communities.

AFFORDABLE HOUSING DEVELOPMENT

APU projects that approximately 750 new affordable housing units will be developed over the next 3 to 5 years, and works closely with the Community and Economic Development Department in writing RFPs for affordable housing developers. In these RFPs, APU requests enhanced energy efficiency requirements beyond Title 24 and the inclusion of at least two (2) fully functional Level 2 charging stations for electric vehicles. Both of these additionally requested elements are incentivized by APU. These additionally requested elements improve emissions reduction and promote transportation electrification within LI-DACs.

PRIVATE DEVELOPMENT OPPORTUNITIES

APU works with the Planning Department and Community and Economic Development Department on new, private developments to identify and leverage opportunities to improve the quality of life within LI-DACs. APU provides funding for eligible project elements such as weatherization, shade trees, and electric vehicle charging and tracks the following projects closely:

- Transitional housing shelters
- Homeless advocacy networks
- Multi-family private developments that are in low income or disadvantaged communities

- Multi-family private developments that are requesting density bonuses and require low income units
- Residential projects near freeways for shade tree opportunities that simultaneously improve air quality
- Commercial, industrial, and institutional projects in disadvantaged communities
- Commercial, industrial, and institutional projects near freeways for vehicle electrification opportunities

STREET REPLACEMENT PROJECTS

The Public Works Department identifies approximately two neighborhoods a year that are in need of street replacement. These neighborhoods are frequently located within LI-DACs. APU funds and installs LED street lights simultaneously with the street replacement. In addition, the Weatherization Program is offered to all qualifying properties and residences so that residences are enhanced at the same time.

INCOME-QUALIFIED RESIDENTIAL REHABILITATION

APU coordinates with Community and Economic Development on an income-qualified Residential Rehabilitation Program that provides forgivable loans to homeowners for major home improvements or repairs. APU funds the weatherization portion of the rehabilitation, including roof repairs, siding repairs, window repairs, and insulation.

ELECTRIC VEHICLE CHARGING STATIONS AT CITY SITES

APU has collaborated with the Community Services Department to identify two community center sites as a pilot project to install two Level 2 vehicle chargers at each. If proven successful, the pilot will expand into an annual program to install chargers at City sites with first priority within the disadvantaged or low income communities. In addition to community center and park sites, other public spaces are also examined for possible electric vehicle charging stations, such as libraries, police stations, and fire stations.

EXPANDED CUSTOMER EDUCATION

APU hosts a number of educational courses that can be used for both professional development and home improvement. These classes include energy efficiency for facilities managers and energy managers, water efficient landscaping to improve greenhouse gas reduction, and other climate and energy related classes that teach best practices.

Traditionally, these courses were only offered through the Public Utilities Department. Going forward, APU will host these courses through the Community Services Department and aim for a broader reach into LI-DACs. Classes will be advertised in Anaheim's recreation catalogue and offered to residences and small business owners in community centers throughout Anaheim.

EXPANDED CUSTOMER OUTREACH

APU has historically participated in Community Services hosted neighborhood events, such as neighborhood cleanup and other activities in the neighborhoods of concerns. This allows APU to reach out to communities that may not have means to obtain information on APU's programs.

Research has shown that associating programs with public libraries increases trust that utility efficiency programs are legitimate in low income and immigrant communities.

APU now also partners with the Library Division and reaches families that do not typically have time or resources to visit APU booths during scheduled community events. Anaheim's Library Division operates a bookmobile that makes 24 different neighborhood visits annually within LI-DACs. During these visits, APU distributes energy efficient devices such as lightbulbs, and shares information on energy efficiency incentives and assistance programs.

In addition, APU is working with the Planning and Housing Departments to develop training programs for the Code Enforcement officers and Section 8 inspectors regarding incentives and assistance programs available to qualified residents and property owners. The officers and inspectors are often at the front lines when working with customers in the City's neighborhoods of concern. After equipping the officers and inspectors with program information, APU can reach more customers going forward.

C. APU STRATEGIES

APU Strategies

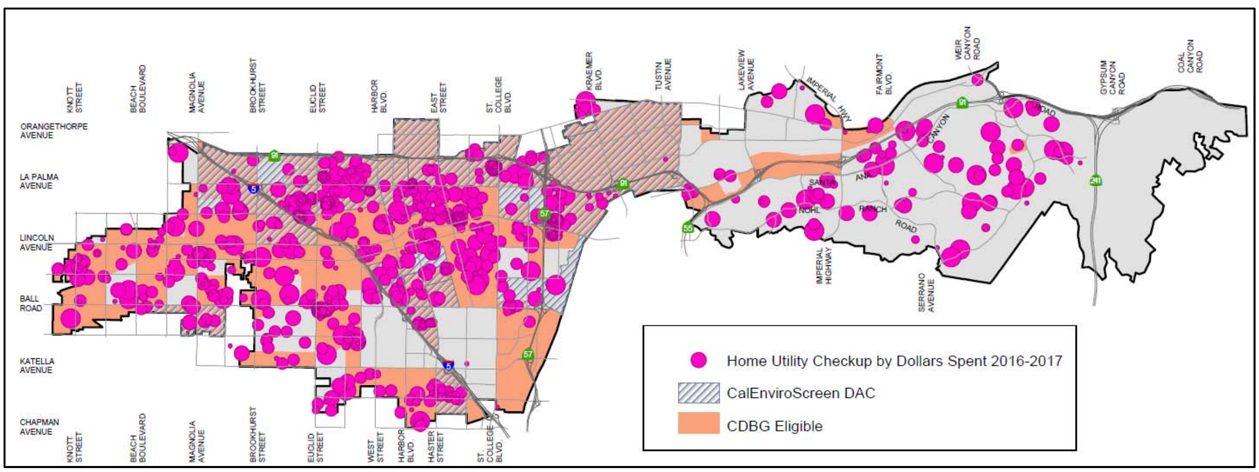
- Enhanced Data Analytics
- Targetd Communications
- Low Income Discount & Bill Assistance
- Transportation Electrification

In addition to all energy efficiency programs and rebates offered to all customers, APU has programs available to specifically assist residents in the neighborhoods of concern.

ENHANCED DATA ANALYTICS

Enhanced data analytics is utilized to maximize disadvantaged residents' participation in efficiency programs. As an example, through data analytics, APU found that a significant majority of the customers who participated in the Home Utility Checkup Program were within LI-DACs. In addition, many participants were simply having trouble paying bills and wanted to reduce the consumption for financial reasons.

Graph 75: Map of Home Utility Checkup by Dollar Spent 2016-2017



With this knowledge, the Home Utility Checkup is now enhanced to include one-stop education opportunities on how efficiency can be managed, and other programs that customers may be eligible for, such as the Weatherization Program that provides direct install measures to income-qualified customers.

The Weatherization Program provides smart thermostats, LED lighting, duct repairs, and many other home improvement and energy efficient devices. Traditionally, the Home Utility Checkup and Weatherization Programs are provided by two different vendors. APU is working to train the Home Utility Checkup contractors on income verification in order to pre-qualify customers for weatherization, so that the two programs appear seamless to APU's customers. For customers who have participated in the past, APU plans to go back and offer weatherization.

TARGETED COMMUNICATIONS

APU routinely conducts customer feedback surveys. Methods on reaching out and methods on improving APU's service for low income customers are part of the surveys. With customer feedback, APU's outreach team targets the LI-DAC neighborhoods with fliers in Spanish and English and information designed for broader reach within these communities.

LOW INCOME DISCOUNT AND BILL ASSISTANCE

APU offers multiple bill assistance programs and rate discounts for customers in need.

The Income-Qualified Senior, Long-Term Disabled, and Military Veteran Energy Discount Program provide a 10% discount on residential electric charges for income-qualified senior, long-term disabled, and military veterans. A medical lifeline allowance, which provides additional energy at the lowest tiered rate, is also offered to customers who rely on medical equipment powered by electricity.

The Low Income Home Energy Assistance Program (LIHEAP) program helps income-qualified residents receive financial assistance for their utility bill and other energy needs. Customers who are facing hardship can also receive forgiveness for one electric utility bill. In addition, APU provides arrears payment plans for customers that have fallen behind and prepayment plans for customers that would like assistance in budgeting their month-to-month consumption.

TRANSPORTATION ELECTRIFICATION

APU's disadvantaged communities are primarily along freeway corridors. The air quality associated with freeway corridors is a major contributor to health concerns. Through its transportation electrification programs, APU reduces area pollutants along freeway corridors and improves quality of life within the disadvantage communities. Please see the Transportation Electrification section for more information.

APPENDIX A – RENEWABLE PROCUREMENT PLAN

RENEWABLE RESOURCE PROCUREMENT PLAN*

Compliance Period (CP)						CP 1	CP 2	CP 3	CP 4	CP 5	CP 6
Calendar Year (CY)						CY 2011-2013	CY 2014-2016	CY 2017-2020	CY 2021-2024	CY 2025-2027	CY 2028-2030
Estimated APU Retail Sales (GWh)						7,085	7,074	9,393	9,407	7,032	7,032
Grandfathered Projects	Technology Type	Location	Online Year	Contract Term (Years)	PCC	**CP 1 (GWh)**	**CP 2 (GWh)**	**CP 3 (GWh)**	**CP 4 (GWh)**	**CP 5 (GWh)**	**CP 6 (GWh)**
Iberdrola (High Winds)	Wind	CA	2003	20	0	41.93	36.76	63.46	70.08	52.56	17.52
Iberdrola (Pleasant Valley)	Wind	WY	2005	20	0	239.31	222.99	290.07	285.41	38.73	0.00
Ormat (Heber South)	Geothermal	CA	2005	15	0	194.38	178.72	252.16	252.09	191.92	189.06
Cryq (Thermo No. 1)	Geothermal	UT	2009	24	0	90.11	185.77	261.55	263.50	197.63	197.63
Broadrock (Ridgewood)	Landfill Gas	CA	2007	36	0	253.66	623.19	868.53	866.47	649.85	649.85
MWD (Various Small Hydro)	Small Hydro	CA	2008	20	0	46.85	40.71	69.61	41.31	0.00	0.00
Total Grandfathered Resources						866.23	1,288.13	1,805.38	1,778.85	1,130.68	1,054.06
Contracted Projects	Type	Location	Contract Year	Contract Term (Years)	PCC	**CP 1 (GWh)**	**CP 2 (GWh)**	**CP 3 (GWh)**	**CP 4 (GWh)**	**CP 5 (GWh)**	**CP 6 (GWh)**
San Gorgonio Wind Farm	Wind	CA	2012	10	1	142.11	242.77	327.96	200.28	0.00	0.00
Noble	Municipal Solid Waste	CA	2013	2	1	0.00	459.04	0.00	0.00	0.00	0.00
SoCal Biomethane	Biogas	CA	2015	20	1	0.00	0.00	0.00	100.23	80.19	80.19
Anaheim Solar Energy Plant (Convention Center Roof)	Solar	CA	2014	Utility-owned	1	0.00	0.00	10.68	12.66	9.33	9.19
Westlands	Solar	CA	2015	25	1	0.00	3.64	16.29	15.07	11.31	11.31
Bowerman	Biogas	CA	2015	20	1	0.00	115.86	631.02	638.71	479.03	479.03
Loyalton	Biomass	CA	2018	5	1	0.00	0.00	17.48	14.30	0.00	0.00
Planned Biomass Contract	Biomass	CA	2018	5	1	0.00	0.00	9.86	9.86	0.00	0.00
EDF	Solar	CA	2020	25	1	0.00	0.00	5.86	462.83	347.08	347.05
Planned Bucket 1 Wind Contract	N/A	CA	2024	20	1	0.00	0.00	0.00	0.00	35.68	261.78
Short-Term WSPP (CPP 1)	Various	WECC Region	N/A	<1 year	1	215.82	0.00	0.00	0.00	171.99	570.02
Short-Term WSPP (CPP 2)	Various	WECC Region	N/A	<1 year	2	168.83	171.41	53.94	0.00	36.08	568.18
Unbundled RECS	N/A	WECC Region	2011	<1 year	3	135.96	0.00	0.00	0.00	0.00	0.00
Unbundled RECS	N/A	WECC Region	N/A	<1 year	3	0.00	132.06	29.00	0.00	0.00	0.00
APU Small Solar Program (SB 1)	Solar	CA	2012	N/A	3	3.44	0.00	0.00	0.00	0.00	0.00
Total Contracted Resources						666.15	1,124.78	1,102.04	1,453.94	1,170.69	2,344.74
RPS TARGET						20%	25%	33%	40%	45%	50%
ESTIMATED APU RPS%						**20%**	**25%**	**33%**	**40%**	**45%**	**50%**
ESTIMATED APU RPS (GWh)						1,532	2,413	2,907	3,233	2,301	3,399
ESTIMATED APU RPS COST						$95,611,405	$159,692,302	$233,034,728	$268,230,744	$191,259,369	$219,686,120

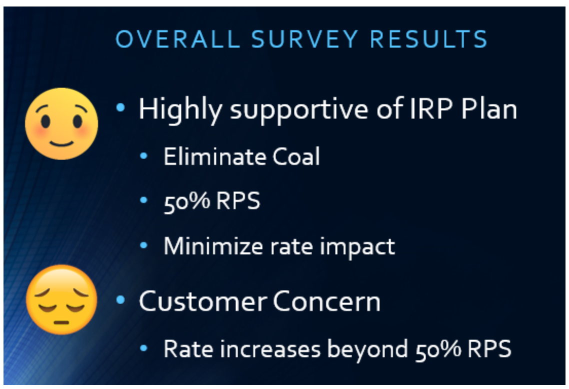
* Per Section V.C.2., Appendix A may be revised, with the approval of the General Manager, without further City Council approval.

APPENDIX B – PUBLIC ENGAGEMENT

A. CUSTOMER SURVEY SUMMARY

In late 2016, APU retained a market research and consulting firm to gain a better understanding of customers' thoughts and preferences regarding APU's plans to increase renewable power to 50% by 2030, reduce coal power to zero as contracts expire, and doing so over a 10-year period to help keep the impact on electric rates to a minimum. This outreach consisted of a series of surveys conducted over a period of five months starting in early 2017, and reached nearly 1,200 APU customers including residential, large businesses, small-to-medium business customers, high school students, and Anaheim's Latino Utilities Coalition representatives.

The survey results showed **high satisfaction with APU services**. Customers indicated they are likely to contact APU for advice on solar and other distributed generation, and feel that APU will offer fair and balanced advice. Customers also expressed **high support of the IRP plan** to eliminate coal and reach a renewable energy target of 50% by 2030. However, they expressed concern with potential rate impacts should APU procure renewables beyond 50%.



B. CUSTOMER SURVEY TYPES

Two types of surveys were conducted: controlled surveys and open surveys.

CONTROLLED SURVEYS – RESIDENTIAL AND LARGE BUSINESS CUSTOMERS

The controlled surveys were conducted by invitation only, with samples selected via a random statistical approach for the residential customers and by business representation for the large business customers. A controlled survey collects additional user demographics data for analysis and offers greater precision.

According to the 2015 census, 19% of Anaheim's population are primarily Spanish speaking; as such, the residential survey was made available in both English and Spanish.

Also according to the 2015 census, 53% of Anaheim housing units are renter-occupied. To ensure correct representation, the survey's sampling results were weighted by renters versus homeowners percentage to ensure it is reflective of the general population. Several key residential survey topics were analyzed by income level and also by renters vs. homeowners.

OPEN SURVEYS – ALL CUSTOMERS

In addition to the controlled surveys, APU further extended an open survey which was available in English and Spanish to all APU customers. Mail inserts, email invitations, and website announcements were used to encourage customer participation over a four month period.

The open surveys were conducted without a random sampling selection. As such, minimal customer demographic data was collected due to the uncontrolled nature of the survey.

APU examined the open survey results to capture customer input, along with comparisons and contrasts versus the controlled survey results to identify differences, if any.

*Customer bill insert announcing the controlled and open surveys.

C. TOTAL SURVEYS COLLECTED

APU collected input from 1,173 customers which are summarized in the table below.

Table 8: Types of Customer Surveys and Number of Surveys Collected

Survey Type	# of Surveys Collected
Residential – Controlled	444
Residential - Open	295
Large Business – Controlled	33
Small to Medium Business - Open	119
High School - Open	263
Latino Utilities Coalition - Open	19
Total	1,173

RESIDENTIAL CUSTOMERS

1. **Controlled**

   In this controlled survey, 444 randomly selected APU residential customers were interviewed, with 200 by phone and 244 via online questionnaires. 402 were completed in English while 42 in Spanish. Among the 244 online interviews done, 100 were taken from a mobile device and 144 were taken from a desktop.

2. **Open**

   295 residential customers participated in the open web survey. 292 were completed in English and 3 in Spanish.

BUSINESS CUSTOMERS

1. **Controlled (Large business)**

   In this controlled survey, 33 large business customers were interviewed and all responded to the survey online.

2. **Open (Small to Medium)**

   119 small and medium businesses participated in the survey and all responses were completed in English.

HIGH SCHOOL STUDENTS

APU encouraged local high school students to share their thoughts about a clean energy future. The City of Anaheim has a long history of engaging local students, the next generation leaders. The high school students were reached in the following recurring student engagement events:

Table 9: High School Student Events and Number of Surveys Collected

Student Event	# of Surveys Collected
Engineering Career Pathways Tour	31
Career Pathways Symposium	43
Youth in Government Day	72
Summer Intern Orientation	117
Total	263

LATINO UTILITIES COALITION REPRESENTATIVES

The Latino Utilities Coalition (LUC) is an outreach and advocacy group established by APU to help solicit input and feedback on utility matters pertaining to the Latino community. Members are comprised of community leaders, City policy makers, school administrators, concerned citizens, and members of the business community.

The key goals of the LUC include: provide community outreach and education on utility services and programs; improve communication with the Latino customers; and explore collaborative opportunities to support the Latino community.

During the May 2017 LUC meeting, APU facilitated a roundtable discussion regarding the sustainable energy options. 19 surveys were collected to assist the development of the IRP and other APU programs.

D. SURVEY TOPICS AND SUMMARY RESULTS

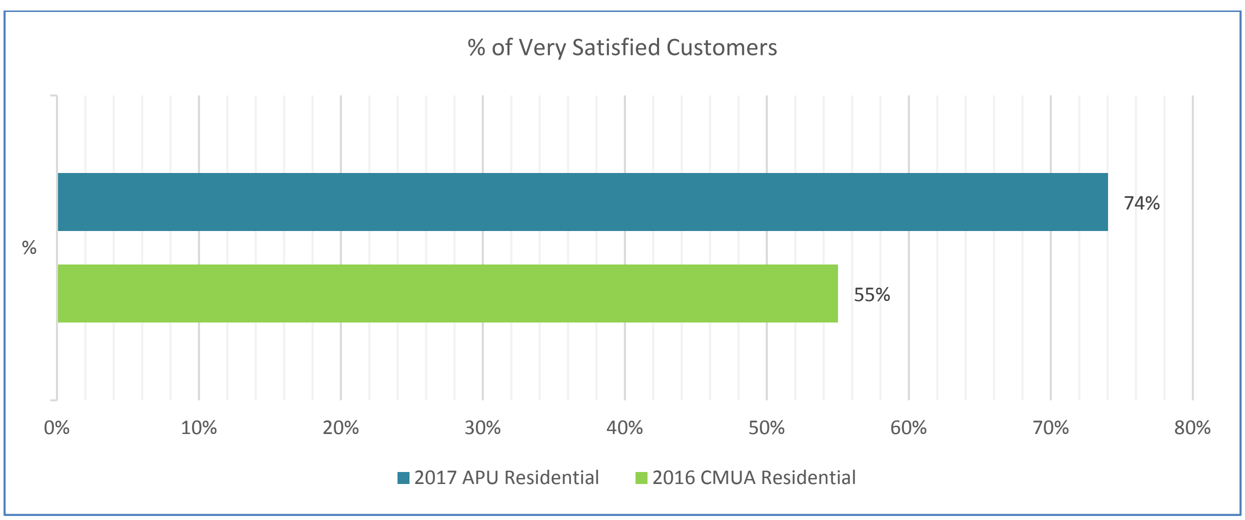
APU sought customer input on the following topics: customer satisfaction, perceived value of services, energy sustainability, planning for future electric needs, perceived air quality, rooftop solar, community solar, electric cars, and energy efficiency. The survey results are summarized below:

CUSTOMER SATISFACTION AND PERCEIVED VALUE OF SERVICES

Customer satisfaction sets the tone of the survey. When customers are satisfied with APU, they tend to agree with APU's plan for the future. This set of questions was intended to assess customer satisfaction with APU services; and if satisfaction has improved, stayed the same, or worsened. Customers were also asked about their perceived value of APU services for the price they pay.

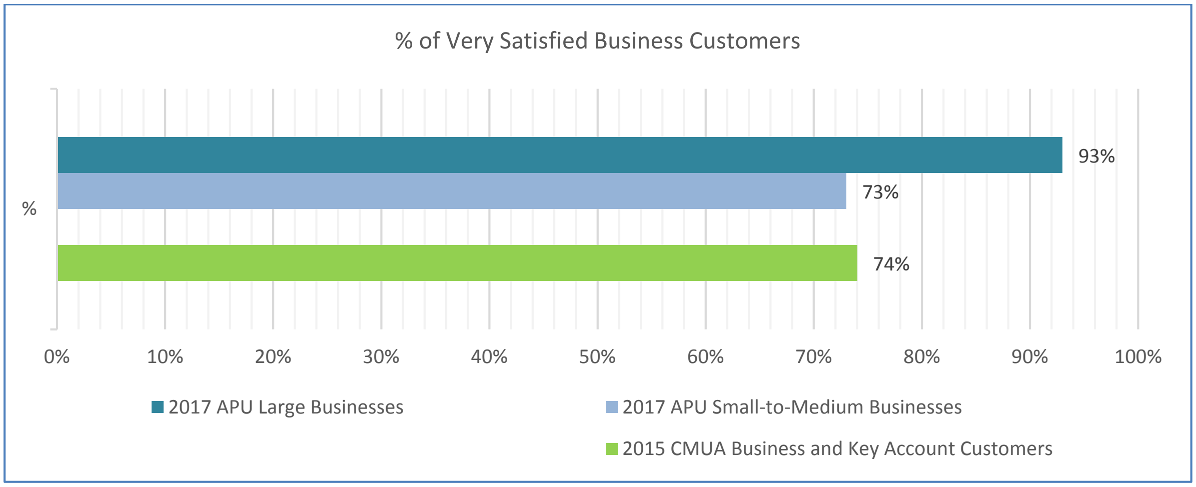
Customers from all surveys overwhelmingly expressed their high satisfaction of APU electric services. 74% of Anaheim residential customers from the controlled survey awarded APU a top three box (8, 9, and 10 on 0-10 scale) score or "very satisfied" rating. As a point of reference, the California Municipal Utilities Association's (CMUA) 2016 Statewide Residential Survey found municipal customers statewide offering a 55% "very satisfied" score. This means APU's residential customer satisfaction is significantly – 19 points – higher. The residential open survey observed similar results; with 75% of the survey respondents awarding APU a "very satisfied" rating.

Graph 76: Residential Customer Satisfaction Rating: APU vs. CMUA



APU's customer satisfaction rated by small-to-medium businesses is in line with the 2015 CMUA statewide survey for Business and Key Accounts Customers, which included both small-to-medium and large business customers. Notably, APU's customer satisfaction rated by large business customers is significantly – 19 points – higher than statewide municipal customers' average results. In addition, 46% of large business customers felt satisfaction has improved. The survey results validated APU's efforts to continuously improve customer satisfaction.

Graph 77: Business Customer Satisfaction Rating: APU vs. CMUA

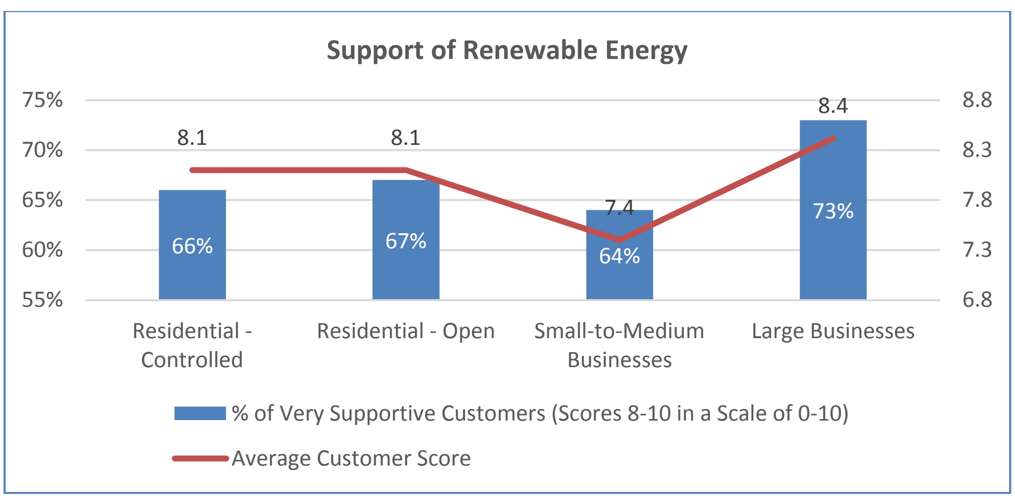


ENERGY SUSTAINABILITY

In this section, customers were asked about their thoughts on the use of renewable energy. Customers generally expressed their support of renewable energy such as wind, solar, biogas, and geothermal.

Large business customers expressed the highest level of support for renewable energy, followed by residential customers. Residential responses from the controlled and open surveys observed similar results. While the majority of small-to-medium businesses still expressed support of renewable energy, this group offered a moderately lower level of support.

Graph 78: Customer Survey – Support of Renewable Energy



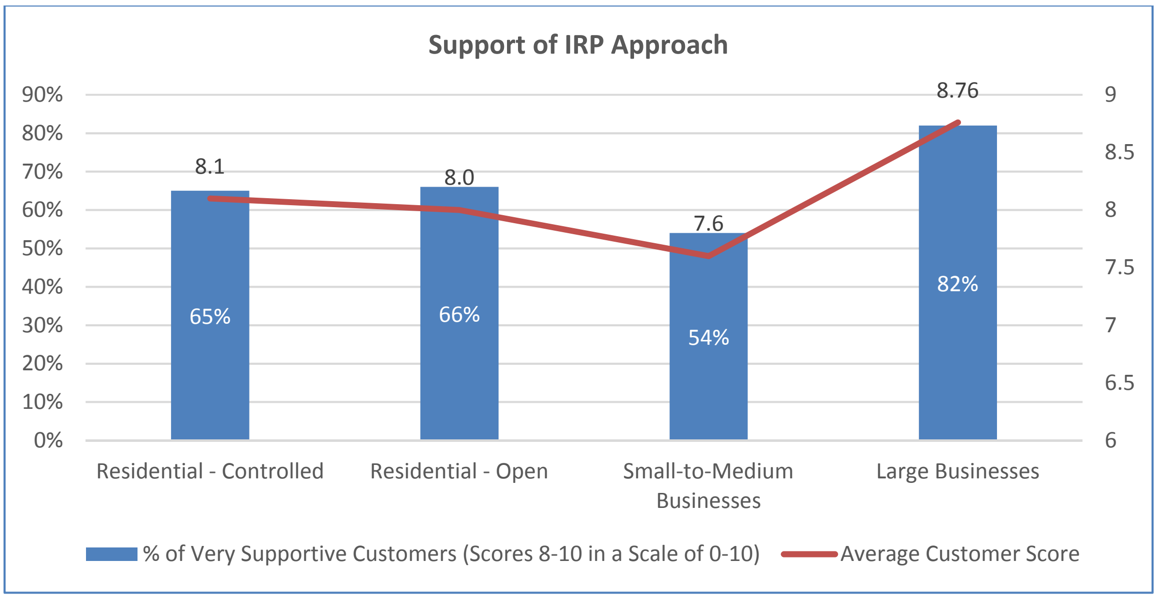
PLANNING FOR FUTURE ELECTRIC NEEDS

1. Support of the IRP Approach

This section touched on the center of the APU's IRP approach to further reduce carbon emission and increase the use of renewable energy resources. APU plans to increase renewable power to 50% by 2030, reduce coal power to zero as contracts expire, and doing this over a 10-year period to keep the impact on electric rates to a minimum. Customers were asked to rate how strongly they support or oppose this approach.

Similar to the previous section, the majority of the customers expressed support of such an IRP approach. The controlled and open residential survey observed similar responses. The customer group expressing the highest level of support were the large business customers.

Graph 79: Customer Survey – Support of IRP Approach

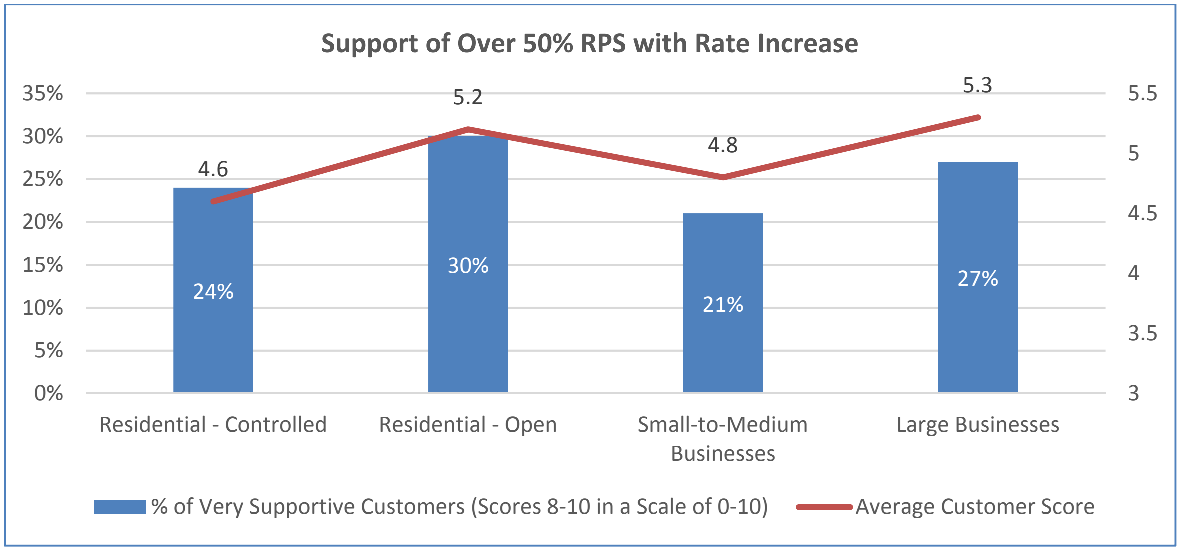


2. Support for Greater than 50% RPS

Moving beyond a 50% RPS will likely cause upward pressure on customer rates due to the costs associated with existing long-term contracts, owned generation assets, and the integration of renewable energy resources to the energy grid. All customers were asked how strongly they support or oppose going above a 50% RPS and any associated impact on rates.

Less than one third of customers in all customer categories expressed strong support of going above 50% renewable when facing rate increases, indicating most APU customers are sensitive to any potential rate increase associated with going beyond a 50% RPS.

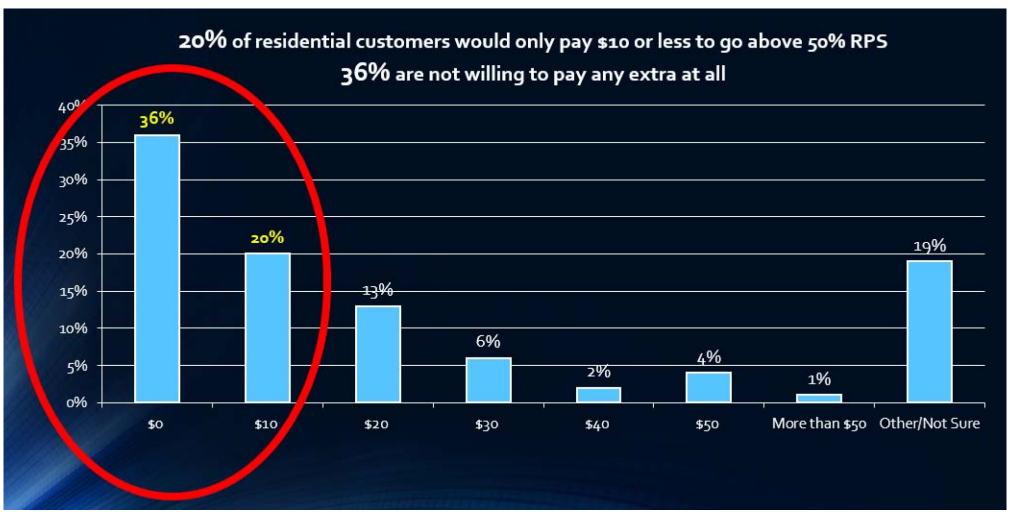
Graph 80: Customer Survey – Support of Over 50% RPS with Potential Rate Increase



3. Acceptable Rate Increase

Customers were also asked how much more they might be willing to pay to acquire renewables above and beyond the 50% RPS goal. From the *controlled residential* survey, 20% of customers would only pay $10 or less on a bimonthly bill to go above 50% renewable; 36% are not willing to pay any extra at all. (Graph below illustrates results of the controlled survey.)

Graph 81: Customer Survey – Residential Controlled Group on Potential Bill Increase Due To Over 50% RPS



The results from the *open residential and small-to-medium businesses* are available in the chart below. A noticeable percentage of customers were hesitant or unwilling to incur additional rate increases due to increased renewables.

Table 10: Customer Survey – Residential and Small-to-Med Businesses Open Group on Potential Bill Increase Due To Over 50% RPS

How much more are you willing to pay on a bill* to go above 50% renewables?	Residential (Open) %	Small-to-Med Businesses %
More than $50	2	2
$50	2	3
$40	3	3
$30	5	9
$20	13	8
$10	**19**	**16**
$0	**25**	**29**
Other	3	6
Not sure/it depends	**28**	**24**
Mean including 0	13.5	14.3

* Bimonthly for residential and monthly for business customers.

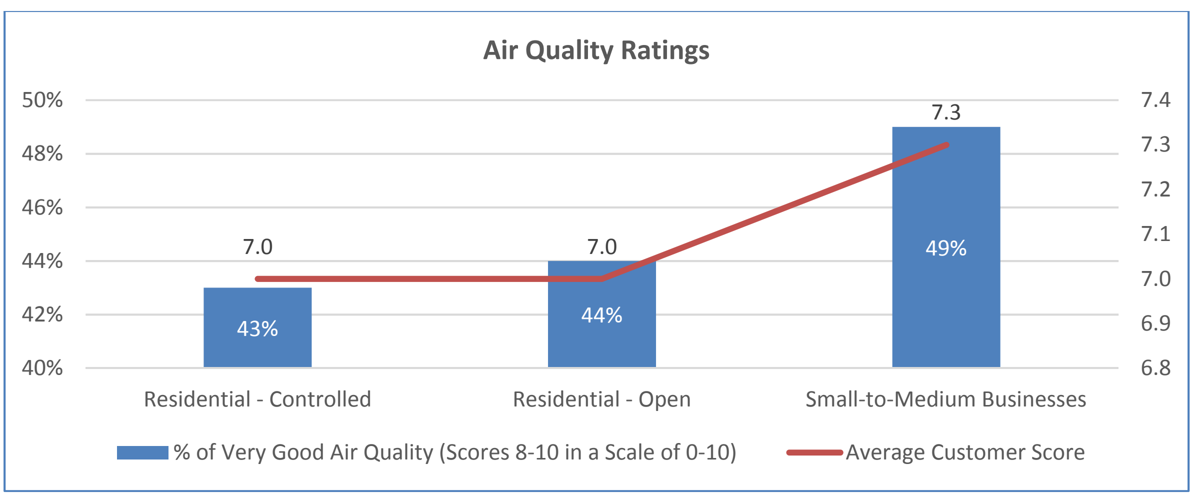
As of *large business customers*, 33% would pay 10% more; 13% would not pay any increase and 40% were unsure. The results show that APU customers have a low tolerance for bill increases associated with going beyond 50% RPS.

AIR QUALITY

These questions were intended to collect information regarding customers' thoughts about local air quality and their thoughts on what may be affecting local air quality. Quantitative responses as well as open-ended questions were both used to collect customer input. Responses were only sought from residential and small-to-medium business customers.

The survey results showed that 43% residential and 49% small-to-medium customers believe they experience excellent air quality (scored 8 to 10 on a scale of 0-10). On a scale of 0 to 10, the average score for all customers surveyed was 7 for residential and 7.3 for business customers.

Graph 82: Customer Survey – Air Quality Ratings



With the controlled residential survey, respondents were also asked if air quality has improved, stayed the same, or worsened. For those responding "improved" or "gotten worse", they were encouraged to share the contributing factors under an open-ended question.

Customers mostly contributed worsened air quality to the following factors (listed in the order of frequency):

- Cars/traffic/freeway
- High density housing/population explosion
- Manufacturers
- Fires/fireworks

To improve air quality, APU recognizes the importance of transportation electrification and supports it with a variety of programs. More details can be found in Section X. Transportation Electrification

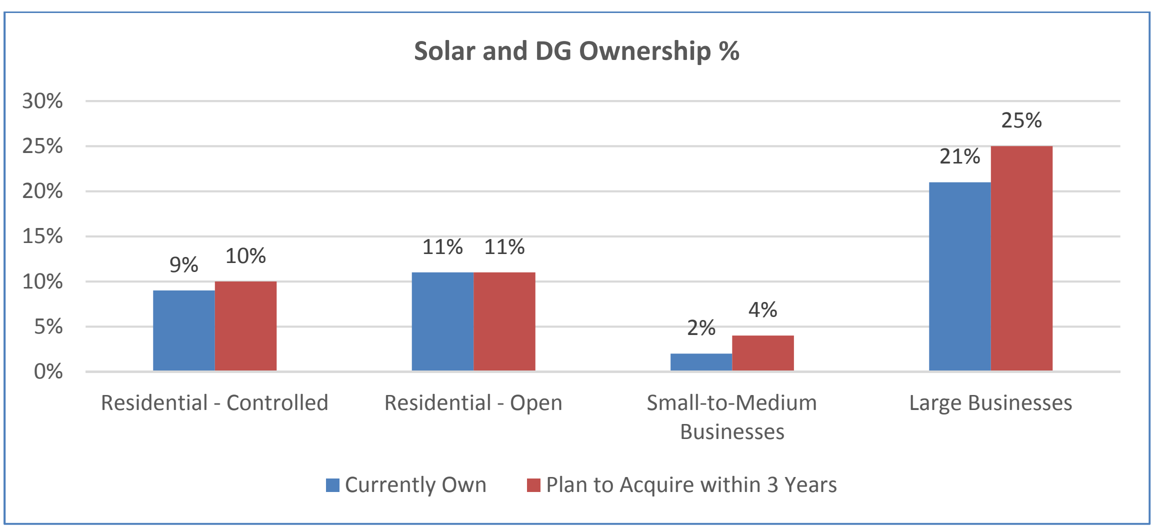
ROOFTOP SOLAR AND DISTRIBUTED GENERATION

This section asked all customers if they own solar panels, if they are satisfied with their solar panels, and how likely is it that they will acquire rooftop solar panels within the next three years. The large business customers were asked additional questions regarding their thoughts on onsite distributed generation including fuel cell and micro turbines.

The survey results indicated some growth potential for the next three years, with the largest growth opportunity in large businesses, followed by residential customers. The survey results were used in the demand forecast for solar growth. (See Section VI. Energy Demand and Peak Forecasts for discussions related to expected solar impact to APU energy demand and peak demand.)

Customers also expressed overall satisfaction with their existing solar or distributed generation systems. In addition, they are very likely to ask APU for advice, and believe APU would offer fair and balanced advice.

Graph 83: Customer Survey – Solar and Distributed Generation Ownership %

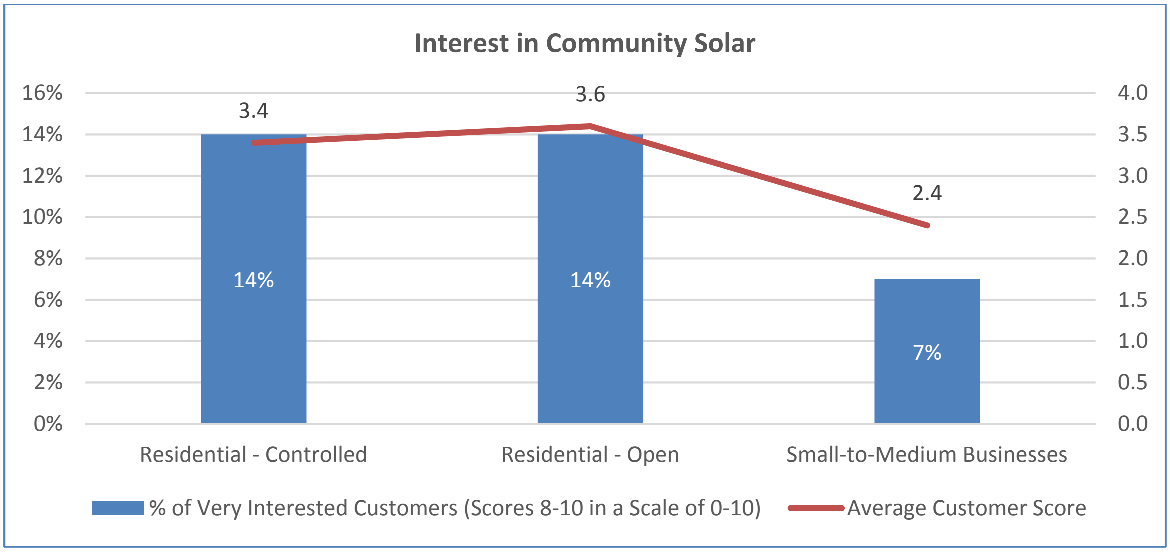


COMMUNITY SOLAR

Community Solar is a concept in which customers that are unable or unwilling to install solar panels at their home receive solar energy from a central solar facility owned and operated by APU. Participating customers receive the environmental benefits of solar power without the risks associated with ownership, but pay a premium price on their electric bill for the solar energy received.

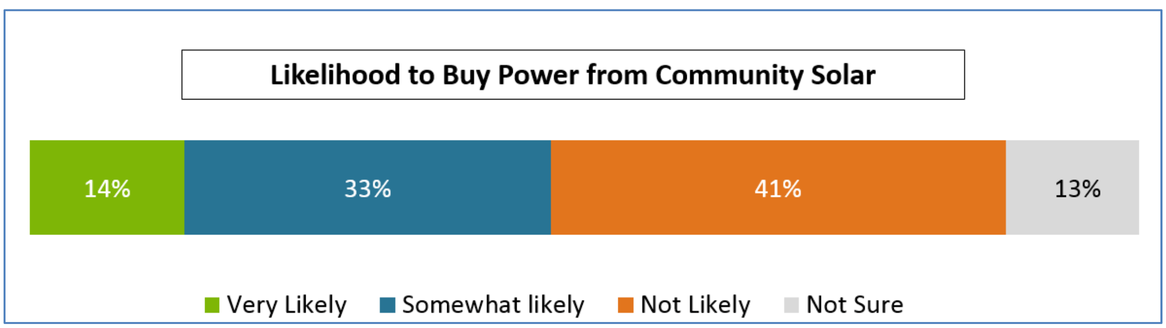
Residential and small-to-medium businesses were asked about their interest in community solar. A small percentage of customers expressed interest in paying a premium price for community solar.

Graph 84: Customer Survey – Residential and Small-to-Medium Businesses Interest in Community Solar



From the controlled residential survey, 41% would not consider community solar and 13% are not sure.

Graph 85: Customer Survey – Residential Interest in Community Solar Breakdown



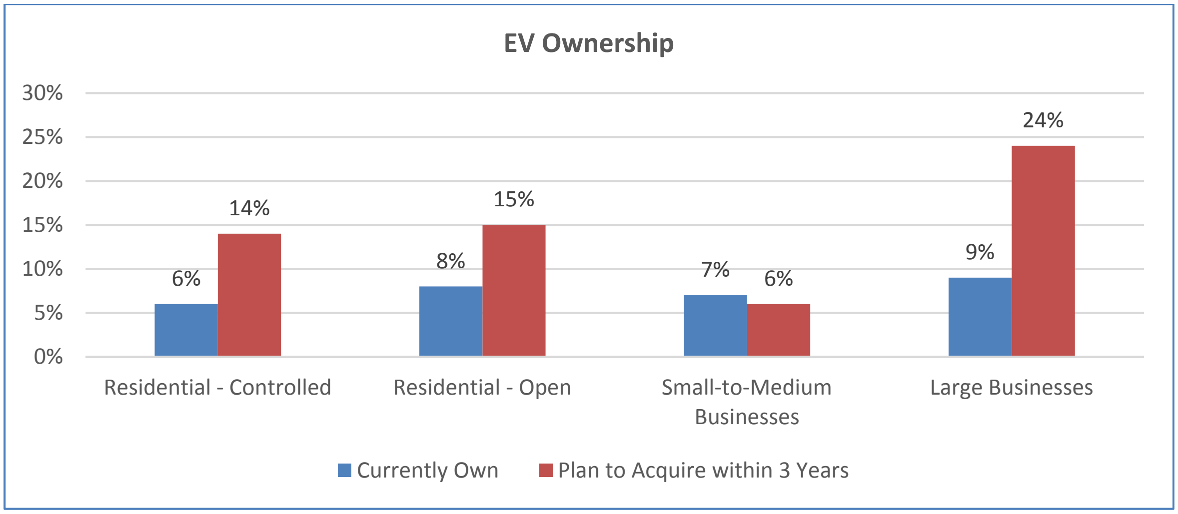
The survey results were incorporated into the design of APU's Solar for Schools and Solar Power Program, as detailed in Section XI. Solar and Other Distributed Generation

ELECTRIC CARS

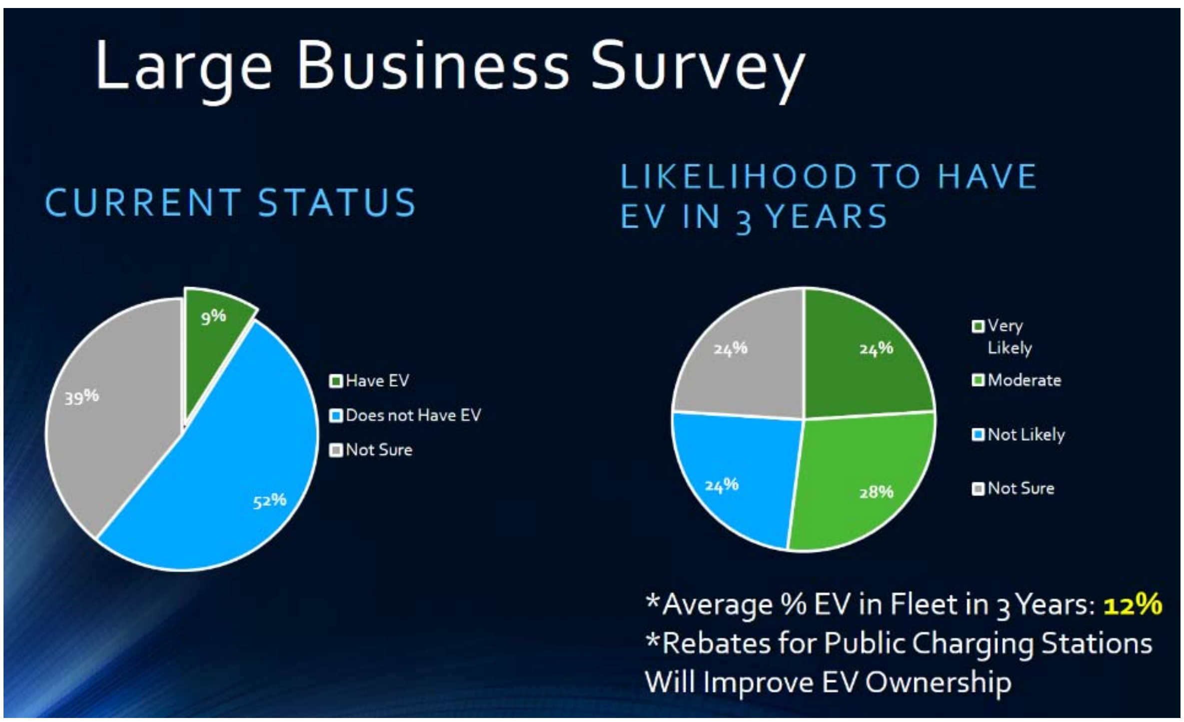
The questions in this section sought customer input on whether or not they currently own EVs, and whether or not they plan to acquire EVs within the next three years. Additional questions sought input on customer knowledge of APU rebate programs and whether or not EV charger rebates or more public access EV chargers would increase the likelihood of EV ownership.

The survey results indicated some EV growth potential for the next three years, with the largest growth opportunity in large businesses, followed by residential customers.

Graph 86: Customer Survey – Current and Planned EV Ownership

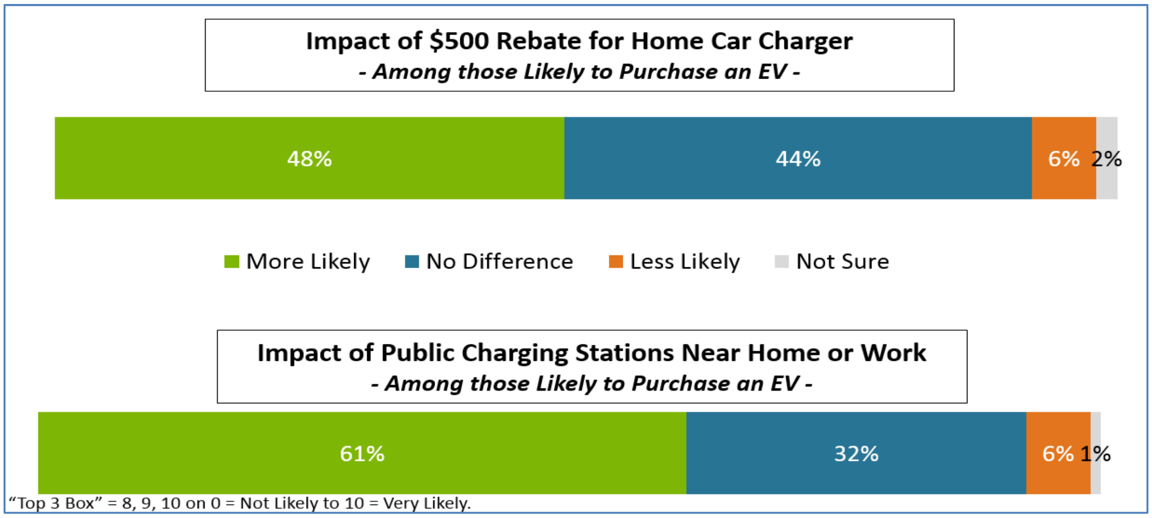


Graph 87: Customer Survey – Large Business Current and Planned EV Ownership Breakdown



For residential customers, the survey results also revealed that rebates in EV charging stations and access to public charging stations would increase the likelihood of EV ownership. Notably, access to public charging stations would more favorably impact the decision to purchase an EV than EV charger rebates will.

Graph 88: Customer Survey – Residential Controlled Group on Impact of Rebate vs. Public Charging Accessibility on EV Ownership



For large business customers, 36% indicated that a $5,000 rebate toward a public charging station would make them more likely to buy or lease an(other) EV within the next three years.

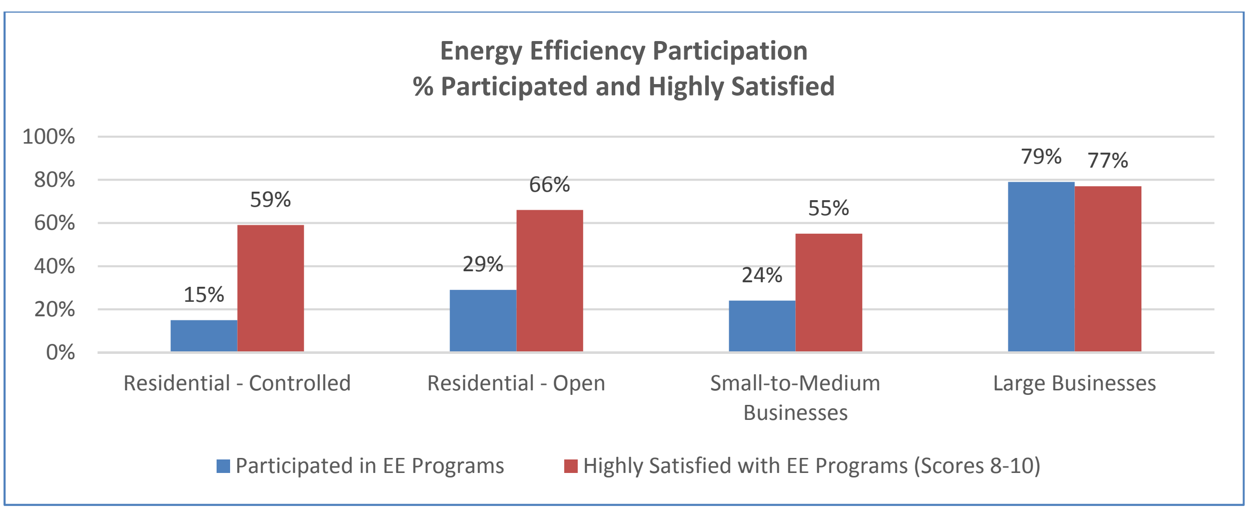
The survey results were incorporated into the design of programs and incentives to promote transportation electrification, as detailed in Section X. Transportation Electrification.

ENERGY EFFICIENCY

In this section, customers were asked if they have participated in one or more of APU's energy efficiency programs; and if yes, how satisfied they were with the results or benefits. Customers were also asked about what motivated them to use energy more efficiently.

Large business customers have the highest energy efficiency participation rate amongst all customer groups. 79% of large business customers have participated in EE programs. The controlled residential respondents had the lowest participation rate of 15%. Similarly, large businesses have the highest satisfaction ratings, followed by residential and small-to-medium commercial customers.

Graph 89: Customer Survey – Energy Efficiency Participation and Satisfaction Rating



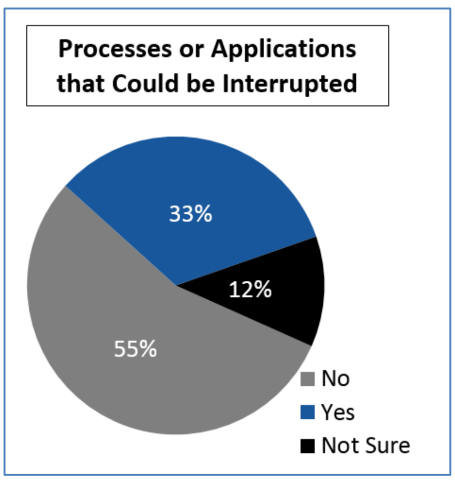
All customer groups are motivated to use energy more efficiently both because of the benefit to the environment, and savings they would receive on their electric bills.

The survey results were incorporated in APU's energy efficiency program design. More details may be found in Section XII. Energy Efficiency and Demand Response Programs and Section XIII. Programs for the Low Income and Disadvantaged Communities

DEMAND RESPONSE

APU's large business customers were asked whether or not they have interruptible processes, and if so, what was their interest in receiving compensation for APU's right to interrupt their electric service during an electrical event. One third of customers surveyed have interruptible processes, and among them the interruptible processes represent 62% of their power usage; 36% are interested in receiving compensation for APU's right to interrupt electric services.

Graph 90: Customer Survey – Large Business Customers Demand Response Potential



E. RESIDENTIAL ANALYSIS BY INCOME LEVEL

The controlled residential survey was further analyzed by respondents' income levels to evaluate the effectiveness of APU programs and services offered that reach the low income and disadvantaged communities (LI-DACs). APU provides many programs that are available to, or specifically designed for, customers in LI-DACs. The survey results are viewed as a growth opportunity to perform targeted outreach, extend inter-departmental collaboration, and develop new programs specifically designed for residents located in LI-DACs. Details of such efforts can be found in Section XIII. Programs for the Low Income and Disadvantaged Communities.

Survey results by homeownership showed disparate responses in the topics of air quality and participation in efficiency programs. Homeowners were more likely to report excellent air quality, improved air quality, and participation in energy efficiency programs.

Note that survey respondents generally attributed the improved air quality to reduced vehicle emissions, and worsened air quality in more traffic and cars. As such, APU focuses on transportation electrification to improve air quality throughout the service area, with early emphasis on LI-DACs. For details, see Section X. Transportation Electrification.

APU also recognizes challenges in reaching renters and developing renter-specific energy efficiency programs. Discussions on how to address such barriers can be found in Section XIII. Programs for the Low Income and Disadvantaged Communities.

Table 11: Customer Survey – Air Quality Rating by Renters vs. Homeowners

Survey Topics	Renters	Homeowners
Excellent Air Quality	38%	49%
Air Quality Improved	6%	14%
Participated in Efficiency Programs	8%	23%

Where survey results indicated disparity in response by income levels, the results are summarized in the table below. Note that some result samples were insufficient to draw conclusion and therefore omitted from the table.

Table 12: Customer Survey – Residential Controlled Group Survey Results by Income Categories

Survey Topics	<$50K	$50K - <$100K	$100K+
Customer Satisfaction	72%	72%	85%
Satisfaction Improved	16%	9%	7%
Excellent Value for Price Paid	50%	50%	70%
Strongly Support Renewable Energy	78%	67%	64%
Strongly Support IRP Approach	72%	65%	68%
Strongly Support 50%+ Renewables, with Potential Rate Increase	33%	20%	34%
Average acceptable rate increase per bimonthly bill (for those who are willing to pay more)	$19	$20	$24
Excellent Air Quality	39%	42%	49%
Air Quality Improved	10%	10%	12%
Anticipate An(other) EV	16%	24%	27%

Higher income customers were more likely to report higher satisfaction and excellent value of price paid. They were more likely to report excellent and improved air quality, and were more likely to acquire an(other) EV. APU believes that higher income customers have the means to be the early adopters of technology innovation such as solar panels, EVs and energy efficient appliances. As such, they are more likely to utilize APU's rebates and other efficiency programs, therefore resulting in higher customer satisfaction.

Lower income customers were more likely to report improved customer satisfaction, and stronger support of renewables and the IRP plan, even when facing the possibility of potential rate increase. They were also more likely to support renewables with a relatively larger percentage of their income.

Lower income customers are the strong proponents of the sustainable future. Through various strategies and programs, APU ensures that investments are made in the City's most vulnerable communities. More details can be found under Section X. Transportation Electrification and Section XIII. Programs for the Low Income and Disadvantaged Communities.

F. OTHER SURVEY RESULTS

HIGH SCHOOL STUDENTS

Compared to adult respondents, high school students are more supportive of renewables and would be willing to pay more to obtain higher renewable penetration. Similarly, high school students showed overwhelming support toward solar panels and higher support of electric vehicles than adult survey respondents.

The only area where adults had a higher response rate was in the participation of energy efficiency programs. High school students did not seem to have overall awareness of the energy efficiency programs available, and were not certain which programs their families might have participated in.

Many students also asked, "Why are renewables more expensive?" In future education outreach events, APU may introduce students to energy efficiency programs available and to various components of the power supply and renewable integration costs as appropriate.

LATINO UTILITIES COALITION

Consistent with other survey types, the Latino Utilities Coalition (LUC) expressed overall support of renewable energy and the IRP plan. APU specifically asked LUC representatives regarding their thoughts about the Solar for Schools program. Respondents were highly supportive of this program.

APPENDIX C – PORTFOLIO EVALUATION DETAILS

A. RPS AND GHG COMPLIANCE

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
RPS and GHG Compliance	3	1	2

Objective:

Two Compliance objectives must be met, RPS compliance and GHG compliance.

Higher compliance -> higher grade

RPS COMPLIANCE GRADING MATRIX													Grade:
1) Identify each portfolio's RPS plan and ensure each portfolio meets compliance requirements ***2) Identify the differences between each portfolio's retirement plan***													
TOTAL PLANNED REC RETIREMENT													
Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Retail sales	2,324	2,322	2,319	2,315	2,312	2,309	2,306	2,306	2,306	2,306	2,306	2,306	
Compliance %	31%	33%	34%	36%	38%	40%	41%	42%	45%	46%	48%	50%	
RPS Mandate	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
REC Retirement	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Retail sales	2,324	2,322	2,319	2,315	2,312	2,309	2,306	2,306	2,306	2,306	2,306	2,306	
Compliance %	31%	33%	34%	36%	38%	40%	41%	42%	45%	46%	48%	50%	
RPS Mandate	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
REC Retirement	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Retail sales	2,324	2,322	2,319	2,315	2,312	2,309	2,306	2,306	2,306	2,306	2,306	2,306	
Compliance %	31%	33%	34%	36%	38%	40%	41%	42%	45%	46%	48%	50%	
RPS Mandate	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
REC Retirement	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3
REC RETIREMENT DIFFERENCE BETWEEN PORTFOLIOS													
Variable Portfolio Total	721	766	788	833	878	924	945	968	1,038	1,061	1,107	1,153	3

Mixed Difference	-	-	-	-	-	-	-	-	-	-	-	-	3
Baseload Difference	-	-	-	-	-	-	-	-	-	-	-	-	3

Conclusion: 1) Each portfolio meets RPS Compliance
2) There is no difference of REC retirement between portfolios

Grade: Higher grade is awarded to portfolios with higher amount of RECs. Because each portfolio is equal, they are weighed equally

GHG COMPLIANCE GRADING MATRIX

1) Identify each portfolio's GHG emissions (MTCO2e) and ensure portfolio meets compliance
2) Identify the differences between each portfolio's GHG emissions (MTCO2e)
Note: The calculation includes generation for both the retail energy demand and for energy sales into the wholesale market

TOTAL PORTFOLIO EMISSIONS (MTCO2e)

Variable Model	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Emissions by Power Source													
CTG	25,282	23,244	21,165	21,518	20,284	20,046	3,592	0	0	0	0	0	
Canyon	60,720	57,587	52,938	57,043	55,905	54,022	56,726	53,860	46,582	47,065	47,732	45,340	
Intermountain Power Project	1,045,470	988,253	1,008,139	1,015,359	979,111	989,279	1,004,464	999,610	413,983	0	0	0	
Magnolia	275,895	276,387	247,135	275,877	275,727	277,299	247,454	275,338	275,827	276,844	247,124	276,421	
Non-Firm Purchases	107,241	122,232	129,983	116,832	126,290	125,382	141,518	140,098	326,266	467,388	482,756	437,019	
Total Emissions	1,514,607	1,467,703	1,459,361	1,486,629	1,457,317	1,466,028	1,453,754	1,468,906	1,062,658	791,297	777,612	758,780	
GHG TARGET 40% reduction 2030	2,276,183	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,380,000	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3

Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Emissions by Power Source													
CTG	25,282	23,244	21,165	21,518	20,284	20,046	3,592	0	0	0	0	0	
Canyon	60,720	57,587	52,938	57,043	55,905	54,022	56,726	53,860	46,582	47,065	47,732	45,340	
Intermountain Power Project	1,045,470	988,253	1,008,139	1,015,359	979,111	989,279	1,004,464	999,610	413,983	0	0	0	
Magnolia	275,895	276,387	247,135	275,877	275,727	277,299	247,454	275,338	275,827	276,844	247,124	276,421	
Non-Firm Purchases	107,241	122,232	129,983	116,832	126,290	125,382	141,518	140,098	323,501	464,902	477,827	447,169	
Total Emissions	1,514,607	1,467,703	1,459,361	1,486,629	1,457,317	1,466,028	1,453,754	1,468,906	1,059,892	788,811	772,683	768,930	
GHG TARGET 40% reduction 2030	2,276,183	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,380,000	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3

Baseload Model	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Emissions by Power Source												

CTG	25,282	23,244	21,165	21,518	20,284	20,046	3,592	0	0	0	0	0	
Canyon	60,720	57,587	52,938	57,043	55,905	54,022	56,726	53,860	46,582	47,065	47,732	45,340	
Intermountain Power Project	1,045,470	988,253	1,008,139	1,015,359	979,111	989,279	1,004,464	999,610	413,983	0	0	0	
Magnolia	275,895	276,387	247,135	275,877	275,727	277,299	247,454	275,338	275,827	276,844	247,124	276,421	
Non-Firm Purchases	107,241	122,232	129,983	116,832	126,290	125,382	141,518	140,098	323,501	464,902	487,898	439,680	
Total Emissions	1,514,607	1,467,703	1,459,361	1,486,629	1,457,317	1,466,028	1,453,754	1,468,906	1,059,892	788,811	782,754	761,441	
GHG TARGET 40% reduction 2030	2,276,183	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,822,664	1,380,000	
Meets Compliance?	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	3

EMISSIONS DIFFERENCE BETWEEN PORTFOLIOS (MTCO2e)													
Variable Portfolio Total	1,514,607	1,467,703	1,459,361	1,486,629	1,457,317	1,466,028	1,453,754	1,468,906	1,062,658	791,297	777,612	758,780	3
Mixed Difference	0	0	0	0	0	0	0	0	-2,766	-2,486	-4,929	10,150	1
Baseload Difference	0	0	0	0	0	0	0	0	-2,766	-2,486	5,142	2,661	2

Conclusion:	1) Each portfolio meets Emissions Compliance. 2) All planned portfolio resources are online in 2030, therefore 2030 is determined to have the highest weight. Although the Variable and Mixed portfolios are nearly equal over 2019 - 2030, the Variable Portfolio has the least amount emissions in 2030, which is expected to continue in later years.
Grade:	Higher grade is awarded to portfolios with lower emissions. Using 2030 as the grade mark, Variable Portfolio is graded the highest, followed by Baseload and Mixed Portfolios.

B. REGULATORY RISK

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Regulatory Risk	3	2	1

Objective:

To minimize risk associated with new regulations, the portfolio should have high flexibility to absorb additional renewable resources beyond the current 50% target and should have low emissions.

A portfolio is considered lower risk and more flexible if it 1) has funding available to cover additional purchases needed to meet new regulations and 2) is diverse, which lowers restrictions for the type of resources that may be added to the portfolio.

Lower expected portfolio cost -> greater flexibility -> higher grade. Higher portfolio diversification -> greater flexibility -> higher grade.

(Please see the Expected Cost Matrix and the Portfolio Diversification Matrix for more detail.)

REGULATORY RISK GRADING MATRIX

1) Identify the total net cost of each portfolio (see "Expected Cost" Matrix)
2) Identify the diversification of each portfolio (see "Portfolio Diversification" Matrix)

TOTAL NET POWER SUPPLY COST

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Grade:
Variable Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$275,711,044	$277,634,502	$290,453,339	$294,981,115	3
Mixed Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$277,971,963	$280,156,766	$295,460,224	$300,242,683	2
Baseload Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$277,971,963	$280,156,766	$295,446,776	$302,609,577	1

TOTAL PORTFOLIO DIVERSIFICATION

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Grade:
Variable Portfolio													
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	25%	24%	29%	32%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	75%	76%	71%	68%	3
Mixed Portfolio													
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	19%	19%	19%	19%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	81%	81%	81%	81%	2
Baseload Portfolio													
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	19%	19%	16%	15%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	81%	81%	84%	85%	1

Conclusion:	1) The Variable Portfolio has the lowest net power supply cost, followed by the Mixed and Baseload. 1) The Variable Portfolio has the highest diversification, followed by the Mixed and Baseload.
Grade:	Higher grade is awarded to portfolios with lower costs and higher diversification. Because the Variable Portfolio is the least costly and most diverse, it is graded the highest, followed by the Mixed and Baseload Portfolios.

C. RESOURCE ADEQUACY

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Resource Adequacy	1	2	3

Objective:

Calculate the amount of System, Local and Flexible capacity available.

Calculate the amount of System, Local and Flexible capacity purchases needed to meet resource adequacy requirements.

Higher excess capacity -> higher grade. Lower amount of purchases -> higher grade.

SYSTEM CAPACITY GRADING MATRIX — Grade:

1) Identify each portfolio's total System Capacity available
2) Identify the amount of purchases needed to meet System Capacity Requirements
3) Identify the difference in capacity purchases between portfolios

SYSTEM CAPACITY GRADING MATRIX													Total	Grade
Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
System Capacity Requirement	646	645	645	644	643	643	642	641	641	641	641	641		
Available Capacity	709	705	701	702	700	690	654	647	415	415	421	424		
over/short	(62)	(60)	(56)	(58)	(57)	(47)	(12)	(7)	226	226	220	216	887	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$9,893,188	$10,140,518	$10,135,965	$10,219,318	$40,388,989	1
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
System Capacity Requirement	646	645	645	644	643	643	642	641	641	641	641	641		
Available Capacity	709	705	701	702	700	690	654	647	416	416	423	423		
over/short	(62)	(60)	(56)	(58)	(57)	(47)	(12)	(7)	224	224	218	218	884	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$9,842,746	$10,088,815	$10,029,974	$10,280,724	$40,242,259	2
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
System Capacity Requirement	646	645	645	644	643	643	642	641	641	641	641	641		
Available Capacity	709	705	701	702	700	690	654	647	416	416	421	425		
over/short	(62)	(60)	(56)	(58)	(57)	(47)	(12)	(7)	224	224	220	215	884	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$9,842,746	$10,088,815	$10,140,574	$10,169,721	$40,241,856	3
DIFFERENCE IN CAPACITY PURCHASES BETWEEN PORTFOLIOS														
Variable Portfolio Total MW	709	705	701	702	700	690	654	647	415	415	421	424	7,182	2
Mixed Difference MW	0	0	0	0	0	0	0	0	1	1	2	(1)	3	3
Baseload Difference MW	0	0	0	0	0	0	0	0	1	1	(0)	1	3	3

Variable Portfolio Total $	$0	$0	$0	$0	$0	$0	$0	$0	$9,893,188	$10,140,518	$10,135,965	$10,219,318	$40,388,989	1
Mixed Difference $	$0	$0	$0	$0	$0	$0	$0	$0	-$50,442	-$51,703	-$105,991	$61,406	($146,730)	2
Baseload Difference $	$0	$0	$0	$0	$0	$0	$0	$0	-$50,442	-$51,703	$4,608	-$49,597	($147,133)	3

Conclusion:	1) Each portfolio requires capacity purchases to meet system capacity requirements 2) The Variable Portfolio requires the most amount of purchases over the study period, followed by the Mixed and Baseload Portfolios
Grade:	Higher grade is awarded to portfolios with lower required purchases amounts. Even though the Baseload and Mixed require the same amount of capacity purchases, the cost is slightly higher in the Mixed Portfolio (due to timing and escalation rate of purchase price). Therefore, the Baseload Portfolio is graded the highest, followed by the Mixed and Variable Portfolios.

LOCAL CAPACITY GRADING MATRIX — **Grade:**

1) Identify each portfolio's total Local Capacity available
2) Identify the amount of purchases needed to meet Local Capacity Requirements
3) Identify the difference in capacity purchases between portfolios

LOCAL CAPACITY GRADING MATRIX

Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Grade
Local Capacity Requirement	230	230	230	230	230	230	230	230	230	230	230	230		
Available Capacity	294	294	294	294	294	294	289	284	242	242	242	242		
over/short	64	64	64	64	64	64	59	54	12	12	12	12		
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Local Capacity Requirement	230	230	230	230	230	230	230	230	230	230	230	230		
Available Capacity	294	294	294	294	294	294	289	284	242	242	242	242		
over/short	64	64	64	64	64	64	59	54	12	12	12	12		
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Local Capacity Requirement	230	230	230	230	230	230	230	230	230	230	230	230		
Available Capacity	294	294	294	294	294	294	289	284	242	242	242	242		
over/short	64	64	64	64	64	64	59	54	12	12	12	12		
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3

DIFFERENCE IN CAPACITY PURCHASES BETWEEN PORTFOLIOS

Variable Portfolio Total MW	294	294	294	294	294	294	289	284	242	242	242	242	3,307	3
Mixed Difference MW	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Baseload Difference MW	0	0	0	0	0	0	0	0	0	0	0	0	0	3

Variable Portfolio Total $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Mixed Difference $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Baseload Difference $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3

Conclusion: 1) Each portfolio meets Local Capacity Requirements
2) No portfolio requires Local Capacity Purchases

Grade: Higher grade is awarded to portfolios with least amount of required capacity purchases. Because each portfolio is equal, they are weighed equally

FLEXIBLE CAPACITY GRADING MATRIX — **Grade:**

1) Identify each portfolio's total Flexible Capacity available
2) Identify the amount of purchases needed to meet Flexible Capacity Requirements
3) Identify the difference in capacity purchases between portfolios

FLEXIBLE CAPACITY GRADING MATRIX													Total	Grade
Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Flexible Capacity Requirement	78	78	78	78	78	78	78	78	83	83	88	93		
Available Capacity	195	195	195	195	195	195	195	195	195	195	195	195		
over/short	117	117	117	117	117	117	117	117	112	112	107	102	1,369	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Flexible Capacity Requirement	78	78	78	78	78	78	78	78	83	83	83	83		
Available Capacity	195	195	195	195	195	195	195	195	195	195	195	195		
over/short	117	117	117	117	117	117	117	117	112	112	112	112	1,384	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Flexible Capacity Requirement	78	78	78	78	78	78	78	78	78	78	78	78		
Available Capacity	195	195	195	195	195	195	195	195	195	195	195	195		
over/short	117	117	117	117	117	117	117	117	117	117	117	117	1,404	
Capacity Purchase ($)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3

DIFFERENCE IN CAPACITY PURCHASES BETWEEN PORTFOLIOS														
Variable Portfolio Total MW	195	195	195	195	195	195	195	195	195	195	195	195	2,340	3
Mixed Difference MW	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Baseload Difference MW	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Variable Portfolio Total $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3

Mixed Difference $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Baseload Difference $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	3
Conclusion:	1) Each portfolio meets Flexible Capacity Requirements, although the Baseload Portfolio has the highest excess capacity, followed by the Mixed and Variable Portfolios. 2) No portfolio requires Flexible Capacity Purchases.													
Grade:	Higher grade is awarded to portfolios with least amount of required capacity purchases. Because each portfolio is equal, they are weighed equally.													

D. PORTFOLIO DIVERSIFICATION

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Portfolio Diversification	3	2	1

Objective:

To limit risk, it is important to have a balanced and diverse portfolio. Therefore, portfolios with higher diversification are awarded a higher grade.

PORTFOLIO DIVERSIFICATION GRADING MATRIX															Grade:
1) Calculate the % of generation from intermittent and baseload resources for each portfolio ***2) Identify which portfolio is the most diverse***															
Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Max	Average	
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	25%	24%	29%	32%	32%	27%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	75%	76%	71%	68%	76%	73%	3
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030			
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	19%	19%	19%	19%	19%	19%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	81%	81%	81%	81%	81%	81%	2
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030			
Intermittent %	25%	26%	35%	35%	31%	28%	25%	20%	19%	19%	16%	15%	19%	18%	
Baseload %	75%	74%	65%	65%	69%	72%	75%	80%	81%	81%	84%	85%	85%	82%	1

Conclusion: All three portfolios have a high share of baseload resources, however the Variable Portfolio has the most intermittent resources, followed by the Mixed and Baseload.

Grade: Higher grade is awarded to the portfolio with the highest % of diversification. The Variable Portfolio is much more diverse than the Mixed and Baseload, so it is awarded the highest grade.

E. EXPECTED COST

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Expected Cost	3	2	1

Objective:

To minimize impact to customer bills, a portfolio with lowest cost is preferred.

Lower expected portfolio cost -> higher grade.

EXPECTED COST GRADING MATRIX

1) Identify net power supply cost for each portfolio
2) Identify the differences between each portfolio's net power supply cost.

TOTAL NET POWER SUPPLY COST

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Grade:
Variable Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$275,711,044	$277,634,502	$290,453,339	$294,981,115	$3,192,091,379	**3**
Mixed Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$277,971,963	$280,156,766	$295,460,224	$300,242,683	$3,207,143,015	**2**
Baseload Portfolio	$256,857,783	$262,214,613	$255,207,091	$255,083,084	$249,250,092	$252,028,753	$259,534,681	$263,135,282	$277,971,963	$280,156,766	$295,446,776	$302,609,577	$3,209,496,460	**1**

NET POWER SUPPLY COST DIFFERENCE BETWEEN PORTFOLIOS

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total	Grade
Variabe Portfolio Total	256,857,783	262,214,613	255,207,091	255,083,084	249,250,092	252,028,753	259,534,681	263,135,282	275,711,044	277,634,502	290,453,339	294,981,115		**3**
Mixed Difference	0	0	0	0	0	0	0	0	2,260,919	2,522,263	5,006,885	5,261,569	$15,051,636	**2**
Baseload Difference	0	0	0	0	0	0	0	0	2,260,919	2,522,263	4,993,437	7,628,462	$17,405,081	**1**

Conclusion: The Variable Portfolio has the lowest net power supply cost, followed by the Mixed and Baseloaded.

Grade: Higher grade is awarded to portfolios lower costs. Because the Variable Portfolio is the least costly, it is graded the highest, followed by the Mixed and Baseload Portfolios.

F. MANAGED MARKET RISK

PERFORMANCE MEASURE	VARIABLE	MIXED	BASELOAD
Managed Market Risks	3	1	2

Objective:

To minimize market volatility risk, portfolios that require lower financial exposure are preferred.

Lower financial exposure -> higher grade.

MANAGED MARKET RISK GRADING MATRIX

1) Identify the financial exposure for each portfolio using the % of wholesale energy purchases and system load
2) Identify the differences between each portfolio's financial exposure

TOTAL NET POWER SUPPLY COST

Variable Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Grade:
Market Purchases $	$9,015,645	$10,060,054	$11,113,005	$10,544,388	$11,952,570	$12,637,576	$14,885,447	$16,594,602	$42,305,480	$60,297,293	$64,895,038	$62,868,660	3
Market Purchases GWh	250.56	285.59	303.70	272.97	295.07	292.95	330.65	327.33	762.30	1,092.03	1,127.93	1,021.07	
Purchase % of Load	10%	12%	12%	11%	12%	12%	14%	13%	31%	45%	46%	42.04%	3
Mixed Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Market Purchases $	$9,015,645	$10,060,054	$11,113,005	$10,544,388	$11,952,570	$12,637,576	$14,885,447	$16,594,602	$41,955,653	$59,958,644	$64,201,819	$63,987,154	1
Market Purchases GWh	250.56	285.59	303.70	272.97	295.07	292.95	330.65	327.33	755.84	1,086.22	1,116.42	1,044.79	
Purchase % of Load	10%	12%	12%	11%	12%	12%	14%	13%	31%	45%	46%	43.01%	1
Baseload Portfolio	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Market Purchases $	$9,015,645	$10,060,054	$11,113,005	$10,544,388	$11,952,570	$12,637,576	$14,885,447	$16,594,602	$41,955,653	$59,958,644	$65,380,671	$63,007,261	2
Market Purchases GWh	250.56	285.59	303.70	272.97	295.07	292.95	330.65	327.33	755.84	1,086.22	1,139.95	1,027.29	
Purchase % of Load	10%	12%	12%	11%	12%	12%	14%	13%	31%	45%	47%	42.29%	2

NET POWER SUPPLY COST DIFFERENCE BETWEEN PORTFOLIOS

Variable Portfolio Total	$9,015,645	$10,060,054	$11,113,005	$10,544,388	$11,952,570	$12,637,576	$14,885,447	$16,594,602	$42,305,480	$60,297,293	$64,895,038	$62,868,660	3
Mixed Difference	$0	$0	$0	$0	$0	$0	$0	$0	($349,827)	($338,648)	($693,218)	$1,118,494	1
Baseload Difference	$0	$0	$0	$0	$0	$0	$0	$0	($349,827)	($338,648)	$485,634	$138,601	2

Conclusion: 2) All planned portfolio resources are not online until 2030, therefore 2030 is determined to have the highest weight.
Although the portfolios are nearly equal over 2019 - 2030, the Variable Portfolio has the least amount cost in 2030, which is expected to continue in later years.

Grade:	Higher grade is awarded to portfolios with lower financial exposure. Because the Variable Portfolio has the least amount of financial exposure (specifically in 2030 and beyond), it is graded the highest, followed by the Baseload Portfolio and Mixed Portfolios.

APPENDIX D – ACRONYMS AND DEFINITIONS

Acronym	Definition
AB	Assembly Bill: Legislation that is either originated or modified in the California State Assembly.
AAEE	Additional Achievable Energy Efficiency: Defined by the CEC as incremental savings from the future market potential identified in utility potential studies not included in the baseline demand forecast, but reasonably expected to occur, including future updates of building codes, appliance regulations, and new or expanded investor-owned utility or publicly owned utility efficiency programs.
AAPV	Additional Achievable Photovoltaic: Defined by the CEC as estimated additional solar photovoltaic installations above the photovoltaic adoptions in the baseline demand forecast.
AMI	Advanced Metering Infrastructure: Refers to systems that measure, collect and analyze energy usage from advanced electric meters through various communication media on request or on a pre-defined schedule.
APPA	American Public Power Association: National service organization representing the nation's more than 2,000 publicly owned electric utilities.
APU	Anaheim Public Utilities: The City of Anaheim Public Utilities Department.
AQMD	Air Quality Management District: State agency established to achieve and maintain healthful air quality. The agency's air quality goal is accomplished through a comprehensive program of planning, regulation, compliance assistance.
BA	Balancing Authority: The responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within the area, and supports interconnection frequency in real time.
CAISO	California Independent System Operator: A non-profit independent system operator which oversees the operation of California's bulk electric power system, transmission lines, and electricity market generated and transmitted by its participants.
Cal-Adapt	Cal-Adapt: A not-for-profit organization providing data and information produced by State of California's scientific and research community, and offers a view of how climate change might affect California at the local level. Cal-Adapt's development is a key recommendation of the 2009 California Climate Adaptation Strategy.
CalEnviroScreen	California Communities Environmental Health Screening Tool: A web-based tool developed by the Office of Environmental Health Hazard Assessment to identify communities in California most burdened by pollution from multiples sources and most vulnerable to its effects, taking into account socioeconomic characteristics and

	underlying health status.
CalEPA	California Environmental Protection Agency: State agency created by the Governor's Executive Order in 1991 which develops, implements and enforces the State's environmental laws that regulate air, water and soil quality, pesticide use and waste recycling and reduction.
CalETC	California Electric Transportation Coalition: A non-profit association committed to the successful introduction and large-scale deployment of all forms of electric transportation including plug-in electric vehicles of all weight classes, transit buses, port electrification, off-road electric vehicles and equipment, and rail.
CARB	California Air Resources Board: California's clean air agency. Responsible for promoting and protecting public health, welfare and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the State.
CEC	California Energy Commission: The State's primary energy policy and energy planning agency. Responsible for ensuring publicly owned utilities' compliance with the State's Renewables Portfolio Standard and Title 20 data reporting requirements.
CDBG	Community Development Block Grant: As defined by the Department of Housing and Urban Development, the Community Development Block Grant funds activities that benefit low- and moderate-income persons, the prevention or elimination of slums or blight, or other community development activities that address an urgent threat to health or safety.
City Council	City Council of the City of Anaheim: The governing body of the City of Anaheim, which includes Anaheim Public Utilities.
CMUA	California Municipal Utilities Association: An association incorporated in 1933 to represent the interests of California's publicly owned electric utilities before the California Legislature and other regulatory bodies.
CO2	Carbon Dioxide: A colorless, odorless gas found in the atmosphere that is associated with global warming. It is released into the atmosphere through the burning of fossil fuels like coal, oil and natural gas.
CO2e	Carbon Dioxide Equivalent: A standard unit for measuring carbon footprints. The idea is to express the impact of each different greenhouse gas in terms of the amount of CO2 that would create the same amount of warming.
CAIDI	Customer Average Interruption Duration Index: Electric reliability index that measures how long it takes to restore service once a customer is interrupted.
CP	Compliance Period: The six compliance periods under the Renewables Portfolio

	Standard are defined in Public Utilities Code section 399.30 (c): (1) Compliance Period 1: January 1, 2011, to December 31, 2013, inclusive. (2) Compliance Period 2: January 1, 2014, to December 31, 2016, inclusive. (3) Compliance Period 3: January 1, 2017, to December 31, 2020, inclusive. (4) Compliance Period 4: January 1, 2021, to December 31, 2024, inclusive. (5) Compliance Period 5: January 1, 2025, to December 31, 2027, inclusive. (6) Compliance Period 6: January 1, 2028, to December 31, 2030, inclusive.
CPUC	California Public Utilities Commission: Regulates California's investor-owned electric utilities, telecommunications, natural gas, water and passenger transportation companies, in addition to household goods movers and the safety of rail transit.
CTG	Combustion Turbine Generator: Electric generator that is commonly powered by a natural gas burning turbine. The CTG burns natural gas to produce hot combustion gases that pass directly through the turbine, spinning the blades of the turbine to generate electricity. APU uses natural gas to run its CTG (also referred to as Kraemer Power Plant), which produces 48 MW of electricity for the city.
DAC	Disadvantaged Communities: Disadvantaged communities are designated by CalEPA, pursuant to Senate Bill 535 (De León), using the California Communities Environmental Health Screening Tool ("CalEnviroScreen"). Disadvantaged communities are identified by census tract and are those that scored at or above the 75th percentile.
DER	Distributed Energy Resource: Any resource on the distribution system that produces electricity. It may include technologies such as, rooftop solar, fuel cells or energy storage.
DOE	Department of Energy: A cabinet-level department of the United States government responsible for the federal energy policies.
DSM	Demand-Side Management: The management of mechanisms and technologies such as efficiency measures and load-management practices that reduce or manage end-user demand.
EE	Energy Efficiency: Practices or programs designed to reduce the amount of energy required to provide the same service and level/quality of output. Some examples include: switching to LED lightbulbs, installing efficient appliances, installing new windows and re-insulating homes to use less energy for heating and cooling, including smart thermostats, etc.
EIA	Energy Information Administration: Statistical agency of the DOE created by Congress in 1977 that provides policy-independent data, forecasts and analyses to promote sound policy making, efficient markets and public understanding regarding energy, and its interaction with the economy and the environment.
EMA	Environmental Mitigation Adjustment: APU's automatic upward or downward rate adjustment mechanism that recovers fluctuations in environmental mitigation costs

	related to the procurement, generation, transmission, or distribution of electricity.
EPA	Environmental Protection Agency: Federal agency that develops rules and regulations concerning environmental protection, and monitors utilities and other industries.
ES	Energy Storage: A system that stores energy and uses the stored energy at a later time. Energy storage is recognized as an increasingly important element in the electricity system, being able to modulate demand and act as flexible generation when needed.
FERC	Federal Energy Regulatory Commission: An independent regulatory agency within the Department of Energy that regulates the transmission and sale of natural gas for resale in interstate commerce; regulates the transmission of oil by pipeline in interstate commerce; regulates the transmission and wholesale sale of electricity in interstate commerce; licenses and inspects private, municipal and state hydroelectric projects; oversees environmental matters related to natural gas, oil, electricity and hydroelectric projects; administers accounting and financial reporting regulations and conduct of jurisdictional companies; and approves site choices as well as abandonment of interstate pipeline facilities.
EV	Electric vehicle. A vehicle which uses one or more electric motors for propulsion.
GHG	Greenhouse gas. A gas that contributes to the greenhouse effect by absorbing infrared radiation (e.g., carbon dioxide and methane).
IEPR	Integrated Energy Policy Report. A report adopted by the California Energy Commission and transmitted to the Governor and Legislature every two years. It includes trends and issues concerning electricity and natural gas, transportation, energy efficiency, renewables, and public interest energy research.
IPP	Intermountain Power Project: A coal-fired baseload power plant in Utah. APU executed a power sales agreement in the early 1980s for 13.225% of the energy output from this power plant. Thirty-six utilities serving California and Utah receive capacity and energy from this project.
IR	Integrated Resources: A work group under the Power Supply Division of Anaheim Public Utilities. It is responsible for long-term resource planning, regulatory compliance and renewable procurement.
IRP	Integrated Resource Plan: A long-term comprehensive plan that balances the mix of demand and supply resources over a long-term planning horizon to meet specified policy goals.
ISO	Independent System Operator: An agency created to operate, control and ensure the integrity of the integrated transmission grid independently of any generation, wholesale or retail market.

LADWP	Los Angeles Department of Water and Power: A publicly owned utility that supplies electric and water to residents and businesses in Los Angeles and surrounding communities.
LCR	Local Capacity Requirement: The minimum resource capacity required by the CAISO in each local area to meet established reliability criteria. CAISO performs annual studies to identify the local capacity requirement for the following calendar year.
LEED	Leadership in Energy and Environmental Design: One of the most popular green building certification programs used worldwide. Developed by the non-profit Green Building Council, it includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods that aims to help building owners and operators be environmentally responsible and use resources efficiently.
LI-DAC	Low Income and Disadvantaged Communities: Disadvantaged communities are designated by CalEPA using the California Communities Environmental Health Screening Tool. Low income communities are defined by the Department of Housing and Urban Development as Community Development Block Grant areas. Combined, these two areas are designated by APU as low income and disadvantaged communities.
LIHEAP	Low Income Home Energy Assistance Program: APU program that provides monetary assistance to low income households for the payment of utility bills and creation of payment plans for customers that have past-due account balances.
LSE	Load Serving Entities: An entity that serves end users within the CAISO area and has been granted authority or has an obligation pursuant to state or local law, regulation, or franchise to sell electric energy to end users.
LUC	The Latino Utilities Coalition: An outreach and advocacy group established by APU to help solicit input and feedback on utility matters pertaining to the Latino community. Members are comprised of community leaders, city policy makers, school administrators, concerned citizens, and members of the business community.
MTCO2e	Metric Tons of Carbon Dioxide Equivalent: A metric measure used to compare the emissions from different greenhouse gases based upon their global warming potential. It can also be converted to KGCO2e (=MTCOT2*1,000) or MMTCO2e (=MTCOT2/1,000).
NCPA	Northern California Power Agency: A not-for-profit Joint Powers Agency, whose members are publicly owned utilities located in Northern California.
NEM	Net energy metering: A special billing arrangement that provides credit to customers with eligible renewable electric generation facility (e.g., solar photovoltaic systems) for the electricity the system adds to the electric grid.

NERC	North American Electric Reliability Council: A not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the bulk power system through system awareness; and educates, trains, and certifies industry personnel.
PCC	Portfolio Content Category: It refers to one of three categories of electricity products procured from an eligible renewable energy resource, as specified in Section 3203 of CEC's Enforcement Procedures for the Renewable Portfolio Standard for Local Publicly Owned Electric Utilities[22].
PG&E	Pacific Gas & Electric: An investor-owned utility that provides natural gas and electric services to Northern and Central California.
PV	Photovoltaics: Commonly seen on rooftop solar panels, the technology covers the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect.
RA	Resource adequacy. The CAISO requirements that ensures sufficient capacity exists for grid-wide reliability, including system capacity, local and flexible capacity requirements.
PCA	Power Cost Adjustment: APU's automatic upward or downward rate adjustment mechanism that recovers the fluctuations in power supply costs and other relevant operational costs.
PEV	Plug-in Electric Vehicle: A vehicle that draws electricity from a battery and is capable of being charged from an external source.
POU	Publicly Owned Utilities: Not-for-profit utilities that are owned by customers and subject to local public control and regulation.
PUB	Public Utilities Board: APU's advisory board comprised of seven Anaheim residents that makes recommendations to the City Council on major APU issues.
RP3	Reliable Public Power Provider: The RP3 designation lasts three years and recognizes utilities that demonstrate high proficiency in reliability, safety, work force development, and system improvement. In 2017, the American Public Power Association recognized APU once again as a (RP3). Of the 2,000 public power utilities nation-wide, only 235 hold the RP3 designation.

[22] http://www.energy.ca.gov/portfolio/

RPS	Renewable Portfolio Standard: A State program that by law requires utilities in California to increase the production and procurement of energy from renewable energy resources, such as wind, solar, biomass, and geothermal.
RSA	Rate Stabilization Adjustment: Automatic upward or downward rate adjustment mechanism that recovers the cost of fluctuating power supply costs. It contains two components (1) a Power Cost Adjustment (PCA) to recover fluctuations in power supply costs and other relevant operational costs, and (2) an Environmental Mitigation Adjustment (EMA) to recover fluctuations in environmental mitigation costs related to the procurement, generation, transmission, or distribution of electricity.
SAIDI	System Average Interruption Duration Index: Electric reliability index that measures how long the average customer is interrupted.
SAIFI	System Average Interruption Frequency Index: Electric reliability index measured by recording how many times service is interrupted.
SB	Senate Bill: Legislation that is either originated or modified in the California State Senate.
SCADA	Supervisory Control and Data Acquisition: Information systems used in industry to monitor and control plant status and provide logging facilities.
SCAQMD	South Coast Air Quality Management District: An air pollution control agency responsible for regulating sources of air pollution in the South Coast Air Basin in Southern California.
SCE	Southern California Edison (Company): The largest investor-owned electric utilities serving Central and Southern California.
SCPPA	Southern California Public Power Authority: A joint powers agency comprised of eleven publicly owned utilities and one irrigation district located Southern California.
SP-15	South of Path 15: South of California transmission Path 15, a CAISO pricing zone covering Southern California.
TOU	Time of Use: Billing rate structure that allows customers to reduce electricity costs by shifting energy use to off-peak hours during which they are charged a lower rate.
ZEV	Zero-emission vehicles: A vehicle that emits no exhaust gas from its source of power, such as plug-in electric vehicles and hydrogen electric vehicles.