Burbank Water and Power

2015 Integrated Resource Plan

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Chapter 1 - Executive Summary

Burbank Water and Power (BWP) is a vertically integrated, publicly owned municipal utility. Being vertically integrated means that BWP generates, transmits, and distributes power to Burbank customers. BWP is owned and operated by the City of Burbank and is governed by the Burbank City Council and an appointed board. BWP is not-for-profit, delivering service at cost.

BWP is committed to providing *reliable*, *affordable* and *sustainable* electricity service to Burbank. BWP is one of the most reliable electric utilities in the United States, maintaining electricity service to BWP's customers 99.999% of the time in 2014 and 2015. In terms of affordability, BWP's rates are near the lowest in the region, with annual rate increases consistent with the long-run rate of inflation. And BWP is committed to sustainability: in 2007, BWP was the first utility to plan for 33% renewable energy by 2020 and BWP actually reached 34% renewables in 2015, well ahead of BWP's 2020 target.

BWP incorporates these commitments as it plans for the future. However, this plan faces significant challenge and uncertainty, as the electric utility industry – and BWP's business – continues to transform.

MAJOR CHANGES SINCE BWP'S LAST IRP

BWP's last IRP was issued in 2006, just as major changes were taking place for BWP and the electric utility industry as a whole. Since 2006:

- Load growth expectations have declined. In 2006, BWP expected load growth of approximately 1% per year; BWP now expects flat or load reductions, as electricity conservation and energy efficiency now meets all of Burbank's projected growth in electricity demand;

- Due in part to California's policy to get off coal and the related "loading order" established in 2003 (and discussed in greater detail below), coal-fired generation now provides less than a third of Burbank's electricity supply, down from a majority in 2006;

- In 2007, Burbank established a plan for 33% renewable energy by 2020. Consistent with that goal, the loading order, and a subsequent state mandate, renewable energy now provides approximately 33% of Burbank's electricity supply, up from near zero in 2006. In so doing, renewables are a greater share of Burbank's electricity supply than coal for the first time in Burbank's history. By way of contrast, the 2006 IRP had coal at 45% of Burbank's energy supply;

- With greater energy efficiency and conservation, less coal-fired power, and more renewables, BWP began its journey towards significantly lower greenhouse gas (GHG) emissions, consistent with California's state goals, and;

- Despite these profound changes, BWP has been able to keep rate increases consistent with the long-run rate of inflation.

MAJOR CHALLENGES

As BWP plans for the future, the utility builds on past successes but its challenges are similar, both for BWP and the electric utility industry as a whole. These challenges are three-fold, discussed in greater detail below.

1. <u>SUPPLY AND DEMAND</u>: A transformation in annual demand for electricity in Burbank, from steady growth to no growth, expected for the foreseeable future while state renewable energy policy mandates the addition of new renewable power generation resources.

2. <u>INTERMITTENCY</u>: A transformation in power generation from controllable conventional power generation resources like coal and natural gas to difficult to control renewable power generation sources such as wind and solar.

3. DUCK CURVE: An increasing mismatch between consumption patterns during the day and evening and the conventional and renewable electricity generation available to meet that demand hour-by-hour. This frequently results in surplus electricity during sunny afternoons and an increasing challenge to cost-effectively maintain reliability as the sun sets. (This phenomenon is often referred to as the "Duck Curve" and is described in more detail below.)

Supply and Demand

As seen in Figure 1.1, Burbank's demand for electricity has stopped growing due to a lack of local development combined with aggressive energy efficiency and conservation efforts.

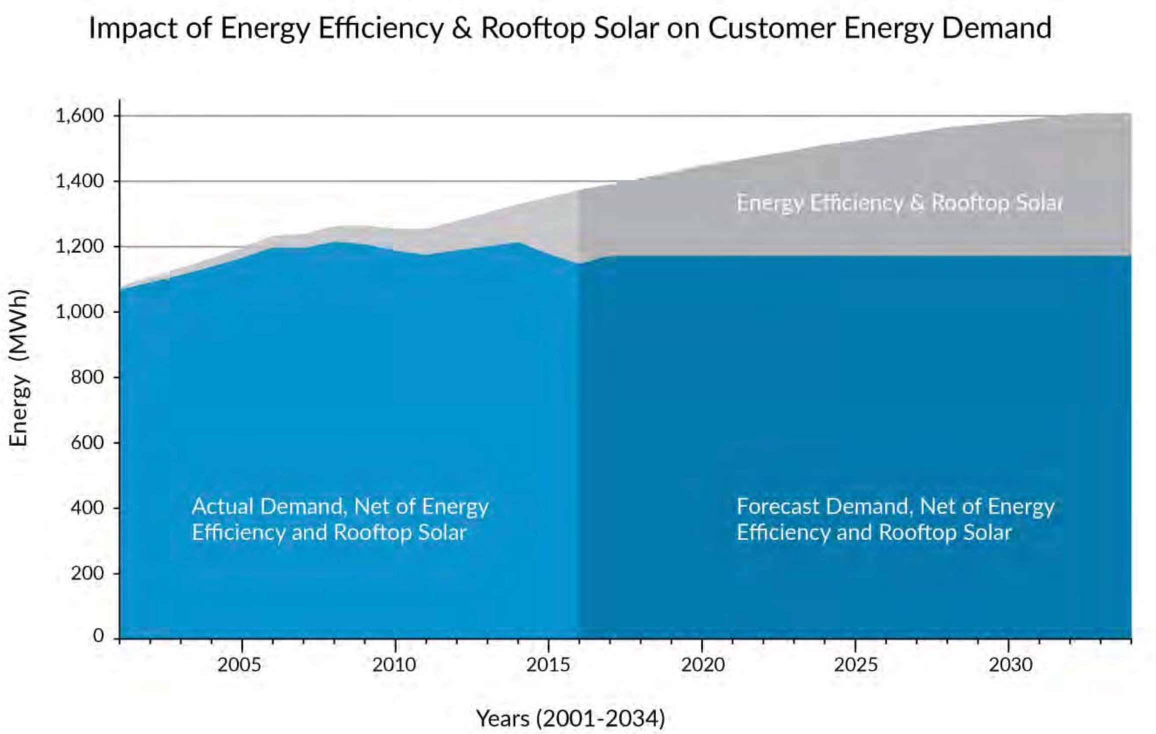

Figure 1.1 – Impact of Energy Efficiency and Rooftop Solar
Source: BWP

At the same time, BWP is compelled to purchase more and more renewable power to fulfill state mandates. BWP, like other California utilities, is now required to reach 50% renewables by 2030 with interim steps along the way. And BWP, like other California utilities, is subject to the "loading order" as established in the California's *2003 Energy Action Plan*. The loading order mandates that energy needs to be met first with energy efficiency, then with changes in rate design, and, if these are still insufficient, with renewable energy.

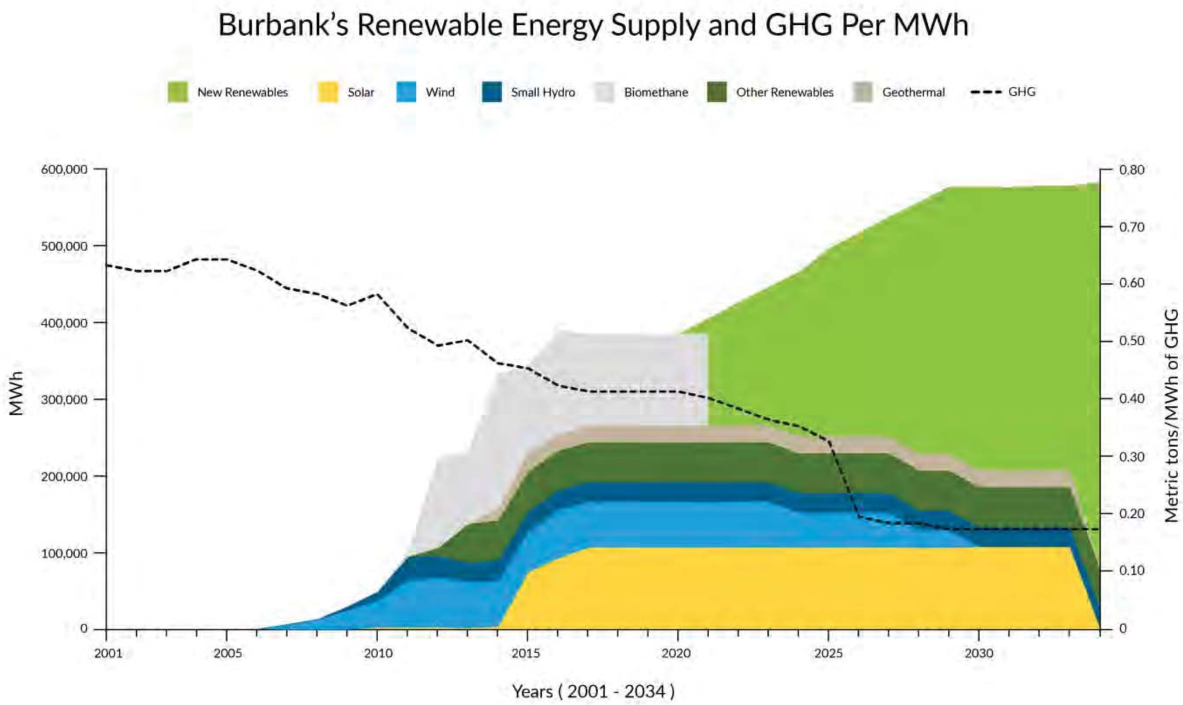

Figure 1.2 - Burbank's Renewable Energy Supply and GHG
Source: BWP

In accordance with the loading order, BWP meets load growth with energy efficiency and renewable energy. But BWP's historical, long-term commitments to purchase fossil-fueled power remain. Some of these long-term commitments, such as BWP's contracts with the coal-fired Intermountain Power Project (Intermountain) in Utah, come to an end in the mid-2020's, but not before BWP must add significant amounts of additional renewable energy, in addition to energy efficiency measures and local solar. As a result, while meeting its environmental *sustainability* goals, BWP has more power than Burbank needs. This oversupply, now common for California utilities, challenges BWP's commitment to *affordability*: BWP must increasingly sell excess power, often at less than the cost of production, into regional power markets.

The resulting power resource portfolio is shown for illustrative purposes below, with Burbank moving over time to a portfolio dominated by renewable and natural gas-fired electricity. As renewables increase, BWP's GHG profile decreases, consistent with California's policy goals. In this connection, it is also important to note BWP's "exit" from Intermountain is expected in 2025. A major component of BWP's reduction of GHG from electricity comes from elimination of BWP's coal supply and the continued growth of renewable energy.

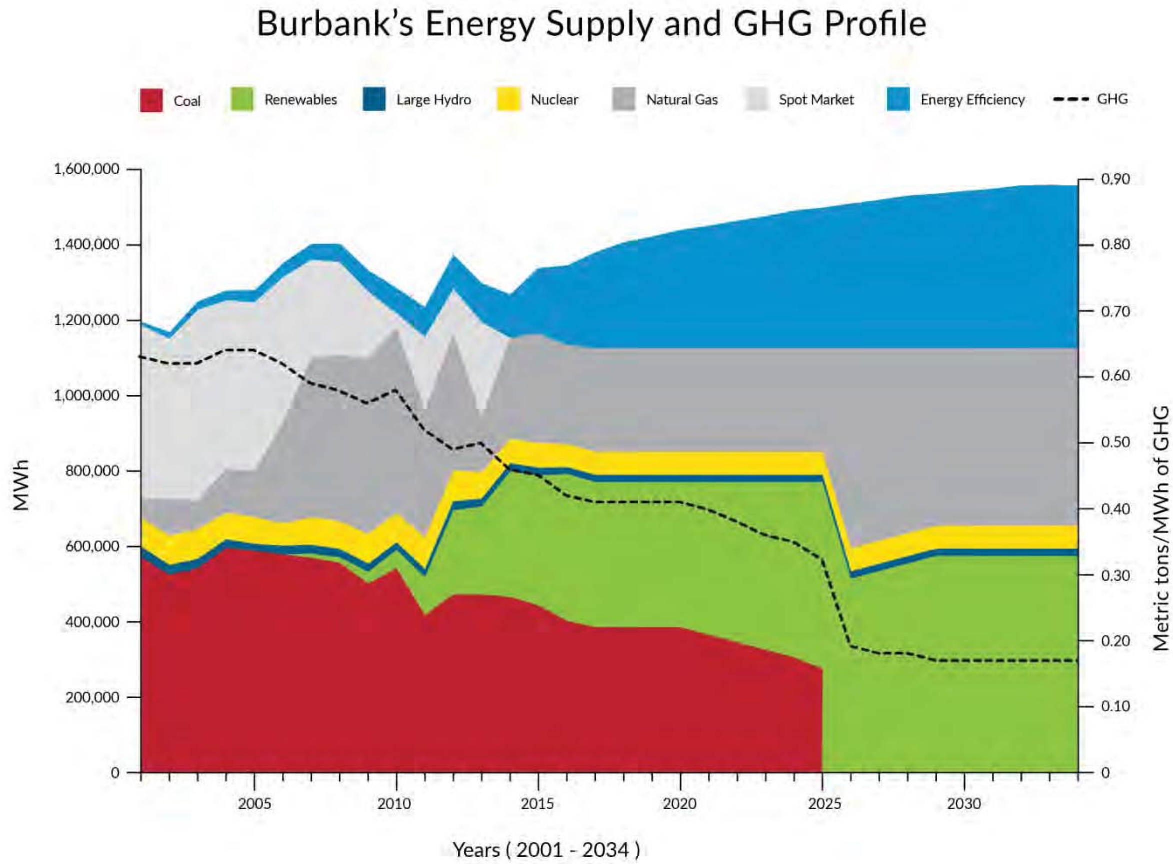

Figure 1.3 -- Impact of Changing Electricity Supply on GHG Profile
Source: BWP

Intermittency

The replacement of fossil-fueled power with renewable power creates another fundamental challenge: while fossil-fueled power is controllable, most renewable power (like wind and solar) is intermittent. In other words, wind and solar only generate when the wind blows and the sun shines, both of which can produce electricity in an erratic fashion, as shown below. *Reliability*, however, demands that the lights stay on regardless of wind and sun. BWP must have resources ready to operate to meet the demands of its customers.

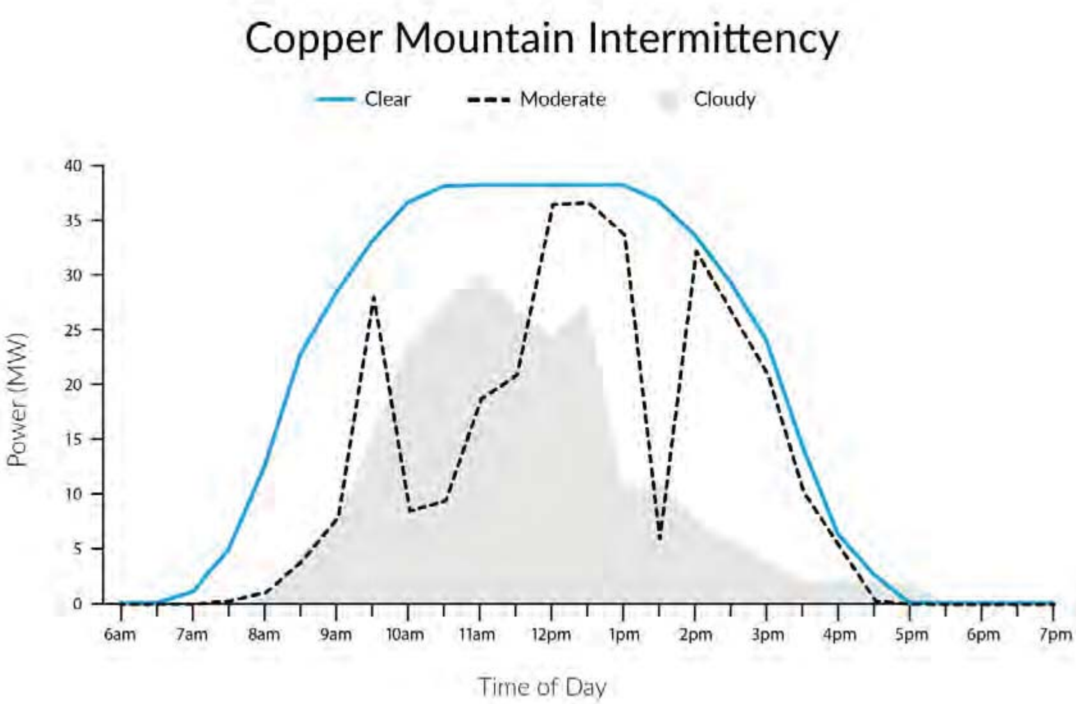

Figure 1.4 – Copper Mountain Solar 3 Intermittency
Source: BWP

Until utility-scale energy storage becomes cost-effective, BWP must use its fossil-fueled resources to "fill in the gaps" as winds wax and wane, as clouds and shadows from trees pass over solar panels, and when night falls. Filling in these gaps requires natural gas-fueled power plants like the Magnolia Power Plant (Magnolia) in Burbank. Plants like Magnolia are most efficient running in steady-state, to follow minute-to-minute changes in renewable output (even as it follows minute-to-minute changes in Burbank's demand). This "filling in the gaps" creates extra costs, challenging *affordability*.

The Duck Curve

As an increasing and unprecedented amount of solar generation comes onto the electric system, it causes an increasing mismatch between daily patterns of electricity demand and the conventional and renewable electricity generation available to meet that demand. The increasingly common result is a surplus of electricity during sunny afternoons and an increasing challenge to cost-effectively maintain reliability by quickly "ramping up" fossil generators as the sun sets and solar generation switches off.

The Duck Curve, endemic to California, is often referred to as the "Duck Curve" due to the shape of the resulting net demand curve over a 24-hour period. As seen in the chart below, 2012 was the last "pre-Duck" year for California as a whole; as more solar comes on-line each year, the "belly of the Duck" – mid-day over-supply and the late afternoon ramp – becomes more severe.

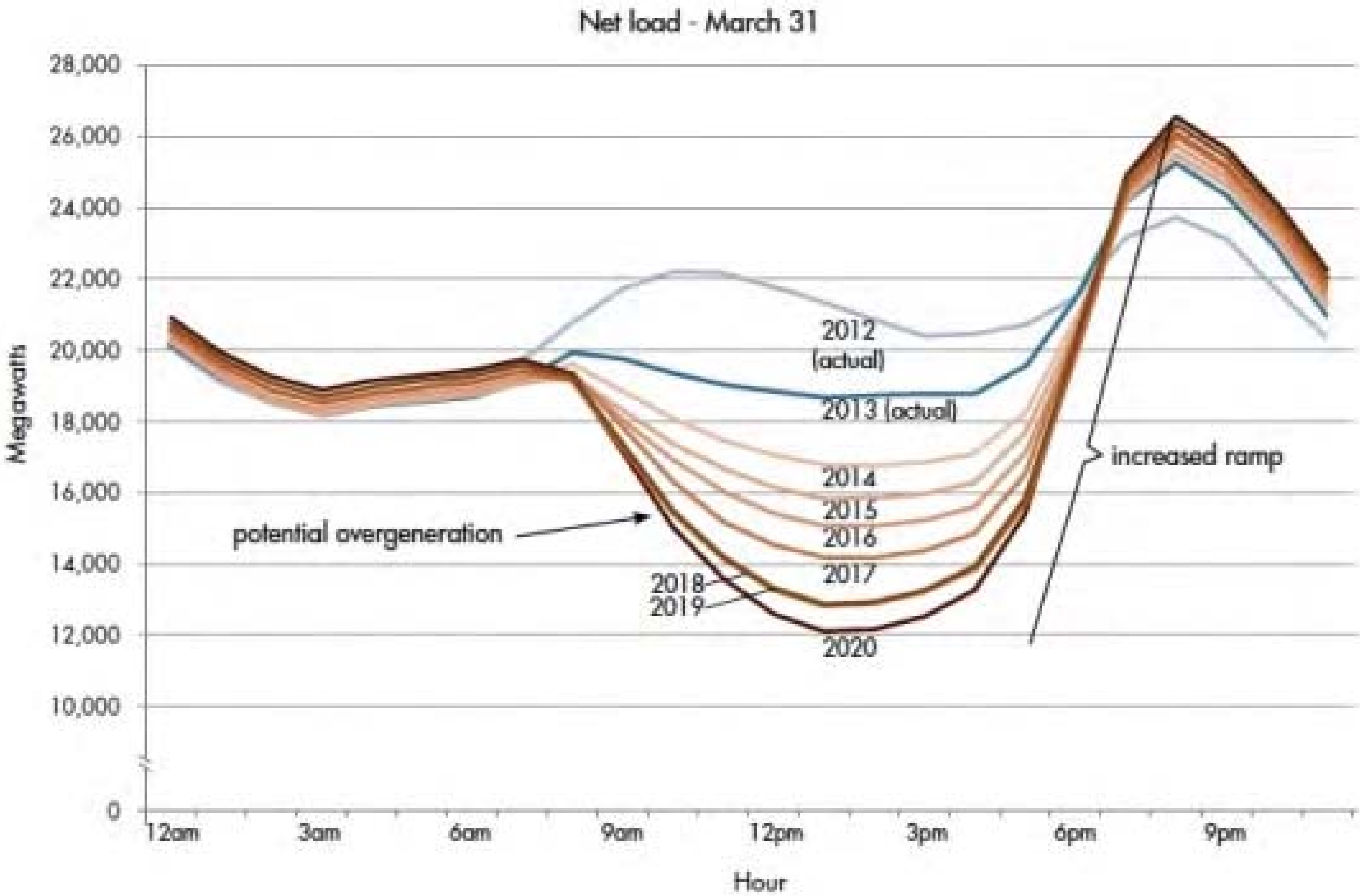

Figure 1.5 – CAISO's "Duck Curve"
Source: CAISO

This is an increasing challenge to *affordability* and *reliability*, but by addressing it early, BWP has an opportunity to address the challenge. Assisted with modern electric rate design like Time-of-Use rates (under which electricity rates change over the course of the day), energy storage development, technology tools like smart appliances and thermostats, and changing customer behavior to *encourage* midday consumption and *discourage* evening consumption, BWP through planning and execution will be positioned to maintain affordability and reliability while incorporating additional sustainable resources.

INTEGRATED RESOURCE PLANNING

In this exciting context, BWP presents this ***2015 Integrated Resource Plan*** (IRP) to its City Council, Board, customers, stakeholders, and other interested parties.

An IRP is a policy document created through a comprehensive, 20-year planning process by which a utility communicates the opportunities and challenges associated with meeting the community's projected energy demands.

As noted above, BWP is providing reliable, affordable, and sustainable electric service to Burbank and, over the last decade or so, has already made strategic decisions that will allow it to do so until at least 2020. In other words, BWP is on the right track for the foreseeable future and should stay on that track as BWP continues to plan for the future.

Because BWP can "stay the course," BWP can focus on long-term planning in a measured, thoughtful manner – the same way that the foundations for today's great performance were laid years before – to achieve that same great performance in the future, despite significant uncertainty. BWP has given itself "time to get it right" and, over the next few years, BWP will tirelessly position itself to continue reliable, affordable and sustainable electric service for Burbank for years and decades to come.

In this connection, BWP shaped its IRP process to meet Burbank's needs, with a significant emphasis on public and governing body outreach. BWP held public outreach meetings focused on helping the public understand BWP's business, the major issues it faces and, importantly, to seek feedback on those issues. BWP held similar study sessions with its Board and with the City Council. Outreach focused on three major questions:

- ***How Much Renewable Energy?*** In light of BWP's mandate of 33% by 2020 and the costs and benefits of renewable energy, BWP sought feedback on Burbank's appetite for renewable energy beyond 33%, even if it might increase BWP's rates.

  Burbank Answered: Consistent support for increased renewables as long as BWP maintained rate increases around the long-run rate of inflation, as it has in the past. This goal is consistent with BWP's planning as BWP prepares to meet California's new "50% by 2030" renewable energy mandate.

- ***Exit Coal 2020 or 2027?*** Should BWP get out of Intermountain and stop getting power from coal before BWP's contracts with the coal-fired plant expire in 2027, even if doing so might increase BWP's rates? In this connection, BWP discussed BWP's obligations to do so when those contracts expire, pursuant to California law.

  Burbank Answered: Responses to this question were across the spectrum, but the majority's message was clear: exit coal in due time but manage BWP's investment in Intermountain's reliable and affordable power in the meantime. At the same time, maximize the value of Intermountain's transmission assets no matter what happens at the Intermountain site post-coal.

- ***Subsidize Rooftop Solar?*** In light of current rate design, whereby a customer with rooftop solar effectively shifts certain of BWP's fixed costs to "non-solar" customers, BWP discussed the benefits of solar and asked whether Burbank wants rooftop solar to be subsidized this way.

  Burbank Answered: A clear majority stated that ongoing subsidies are not favored.

  Consistent with the sentiment of the majority, BWP engaged Leidos Engineering LLC (Leidos), a major power industry engineering and consulting firm, to assist in detailed, long-term scenario modeling. This IRP document is the result of the integration of that public feedback, those scenario modeling results, and other considerations into detailed planning observations and proposed policy conclusions.

PROPOSED POLICY GUIDELINES

BWP is committed to providing reliable, affordable, and sustainable electric service to Burbank. BWP does so in the context of state and federal regulatory mandates, local mandates, and under the direction of its Board and the Burbank City Council.

Burbank will continue to meet electricity demand growth from energy efficiency and conservation, then renewables. Burbank does not plan any new fossil-fueled power generation. In this connection, we assume that cost-effective energy storage will be available in the future to integrate renewable energy.

This IRP proposes a number of policy guidelines:

A. Optimize cost-effective energy efficiency and conservation programs.
B. Add renewable energy to the extent needed.
C. Plan to achieve greenhouse gas emissions reductions consistent with state goals.
D. Maintain low cost of service, including striving to maintain rate increases at or below the long-run rate of inflation.

ACTION ITEM HIGHLIGHTS

In turn, this Plan includes the following action items, consistent with the foregoing:

1. **Maintain the 33% Renewable Portfolio Standard through 2020 and achieve 50% by 2030** through maximizing BWP's flexibility on renewal of Intermountain; expanding BWP's access to regional electricity markets; continuing to investigate energy storage opportunities and other cost-effective renewable energy integration strategies, ideally with dispatchable resources; managing oversupply; making opportunistic cost-effective long-term purchases when warranted; and considering incremental transmission rights.

2. **Continue to complete Burbank's journey off coal as a resource**. Intermountain is a reliable and affordable part of BWP's power supply portfolio, despite its environmental challenges. BWP will continue to manage its long-term investment in Intermountain until Intermountain is retired, and look to maximize BWP's flexibility on its renewal. At the same time, BWP will work to mitigate the effects of electricity oversupply and seek renewable energy to meet unmet load.

3. **Redesign rates to mitigate subsidies for and facilitate cost-effective investment in rooftop solar**. At the same time, this effort must be phased-in so that sudden changes in customer electric bills are avoided.

4. **Pursue all cost-effective and operationally sound programs for energy efficiency and conservation in Burbank**, together with the development of effective customer-level program assessment tools. In a similar vein, reduce distribution losses to less than 3% by 2030, pursuant to the Distribution Master Plan, as lower losses mean less electricity generated in the first place.

5. **Improve the relationship between customer demand and a generation resource mix heavily dependent on renewable energy**. BWP is pursuing rate design improvements (including Time-of-Use rates across BWP's customer base), energy storage opportunities, and overall electrification (such as electric vehicles and electric heating and cooling) in Burbank**.**

6. **Derive value from innovation** through the continued proactive investigation and deployment of new technologies, including both utility-scale and small-scale energy storage technologies.

With this approach, reviewed and refined with the BWP Board and the Burbank City Council, BWP can position itself to provide *reliable*, *affordable*, and *sustainable* electric service to Burbank for decades to come.

Chapter 2 - IRP Overview

An IRP is a policy document created through a comprehensive, long-term planning process by which a utility communicates the opportunities and challenges associated with the community's projected energy demands, and the alternative power supply and conservation demand management resources, as well as the environmental issues related to reliability while meeting the demand for energy.

BWP shaped its IRP process to meet Burbank's needs with a significant emphasis on public outreach. BWP held public outreach focused on helping the public understand BWP's business and the major issues it faces and, most importantly, to seek feedback on those issues:

How Much Renewable Energy? In light of BWP's then-current mandate of 33% by 2020 and the costs and benefits of renewable energy, BWP sought feedback on Burbank's appetite for renewable energy beyond 33%, even if it might increase BWP's rates. The response was consistent: support for increased renewables as long as BWP maintained rate increases around the long-run rate of inflation, as it has in the past.

Exit Coal 2020 or 2027? Specifically, should BWP get out of Intermountain (and therefore stop getting power from coal) before BWP's contracts with Intermountain expire in 2027, even if doing so might increase BWP's rates? In this connection, BWP discussed BWP's obligations under California law to do so when those contracts expire. Public responses to this question were across the spectrum, but the majority's message was clear: exit coal in due time but manage BWP's investment in Intermountain. In the meantime, provide reliable and affordable power, while maximizing the value of the Intermountain transmission assets no matter what happens at the Intermountain site post-coal.

Subsidize Rooftop Solar? In light of current rate design, whereby a customer with rooftop solar effectively shifts certain BWP's fixed costs to "non-solar" customers, BWP discussed the benefits of solar and asked whether Burbank wants rooftop solar to be subsidized this way. In this case, a clear majority stated that ongoing subsidies are not favored.

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This document is the result of the integration of that public feedback, those modeling results, and other considerations that feed into this detailed planning observations and conclusions.

Chapter 3 - BWP 2015

3.1 What Is BWP

Burbank Water and Power

Burbank Water and Power is a vertically integrated, publicly owned municipal utility. Being vertically integrated means that BWP generates, transmits, and distributes power to Burbank customers. BWP is owned and operated by the City of Burbank and is governed by its Board and the Burbank City Council. BWP is not-for-profit, delivering service at cost.

BWP is committed to providing reliable, affordable and sustainable electricity service to Burbank. BWP's reliability is superb, maintaining electricity service to BWP's customers 99.999% of the time in 2014 and 2015. In terms of affordability, BWP's rates are near the lowest in the region, with annual rate increases at or below the long-run rate of inflation for the last decade. And BWP's commitment to sustainability is strong: In 2007, BWP was the first utility to commit to 33% renewables by 2020 and BWP actually reached that commitment during 2015, well ahead of its 2020 target.

BWP maintains this commitment to reliability, affordability and sustainability as BWP plans for the future. This will not be easy. BWP faces significant opportunities and challenges, as policies and regulations, market conditions, electricity demand, market access and other aspects of the utility business evolve. Therefore, BWP must stay ahead of the pack by constantly looking ahead, planning ahead and acting ahead so that BWP remains a leader in reliable, affordable and sustainable electric service for years to come.

Please see Exhibit D for a timeline of BWP's history, focused on power supply.

City of Burbank

Burbank is known as the *Media Capital of the World* and is home to two of the world's largest studios, Warner Bros. Entertainment and The Walt Disney Company. The city is also home to thousands of smaller businesses, many of whom moved to Burbank in the early 1990s after the aerospace industry contracted and real estate became more available. These businesses have come to expect cost-effective and reliable electric service, as well as additional services such as fiber optic networking.

Burbank also has a vibrant residential community, with a housing mix of about 18,500 single family homes that range from post-World War II bungalows to two story view homes. There are also about 27,000 multifamily homes. In total, BWP serves 45,071 residential, 5,534 small commercial, 1,051 medium commercial, 95 large commercial, and 41 extra-large customers.

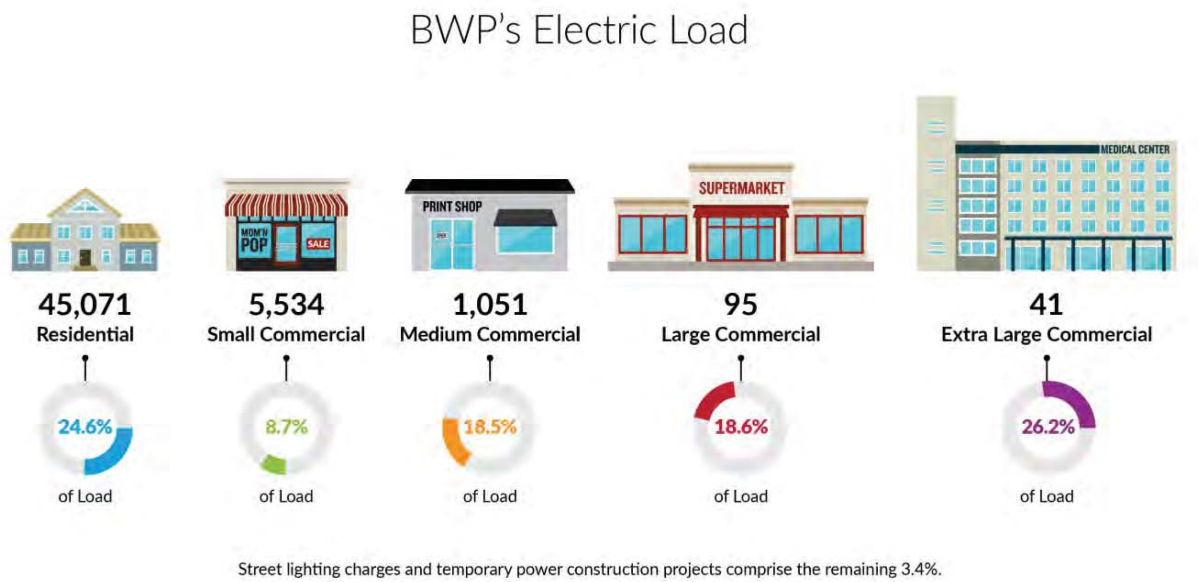


Figure 3.1 - BWP's Electric Load
Source: BWP

3.2 Load

BWP serves the electricity needs of Burbank. In utility terms, these needs are called "load." Managing and forecasting Burbank's load is necessary to ensure affordability and reliability. As BWP moves forward, there will be significant challenges to forecasting BWP's load due to changing customer use patterns brought on by energy efficiency, increasing rooftop solar, and legislative mandates to reduce GHG emissions which contribute to climate change. Therefore it is essential to understand load, load patterns, annual energy requirements, and the specific load change challenges BWP is preparing to meet.

Load is measured in watts and, for convenience, in multiples of watts, including kilowatts (kW or 1,000 watts) and megawatts (MW or 1,000,000 watts). A customer creates load when he or she turns on a light or an air conditioner, or starts a factory. That load then has duration – the amount of time the light is on or the factory is running – so a time element is added: 1 kW for 1 hour is 1 kilowatt hour (kWh), 1 kW for 2 hours is 2 kWh, and so on.

BWP serves this load by delivering electricity through the electrical system: the network of wires, transformers, switches, and other equipment that make up the electricity grid. BWP generates some of this electricity itself, buys some of it from power plants that it has rights to, and buys some from the electricity markets.

Electricity itself is a challenging thing, as it travels at the speed of light and must be consumed the instant that it is produced: the electric grid has limited ways to store it cost effectively in large quantities. So electricity generation in the system must always match closely to load to maintain safe operation and customers' lights (and other loads) on.

To maintain this crucial balance, BWP must accurately forecast its loads, both for the short-term and the long-term. Historically, Burbank's load has grown year-to-year but since 2009, load has remained flat or even decreased. The reductions have been the result of economic recession, combined with a lack of economic development in Burbank, energy efficiency and conservation efforts by BWP and its customers, and solar generation installed in the city.

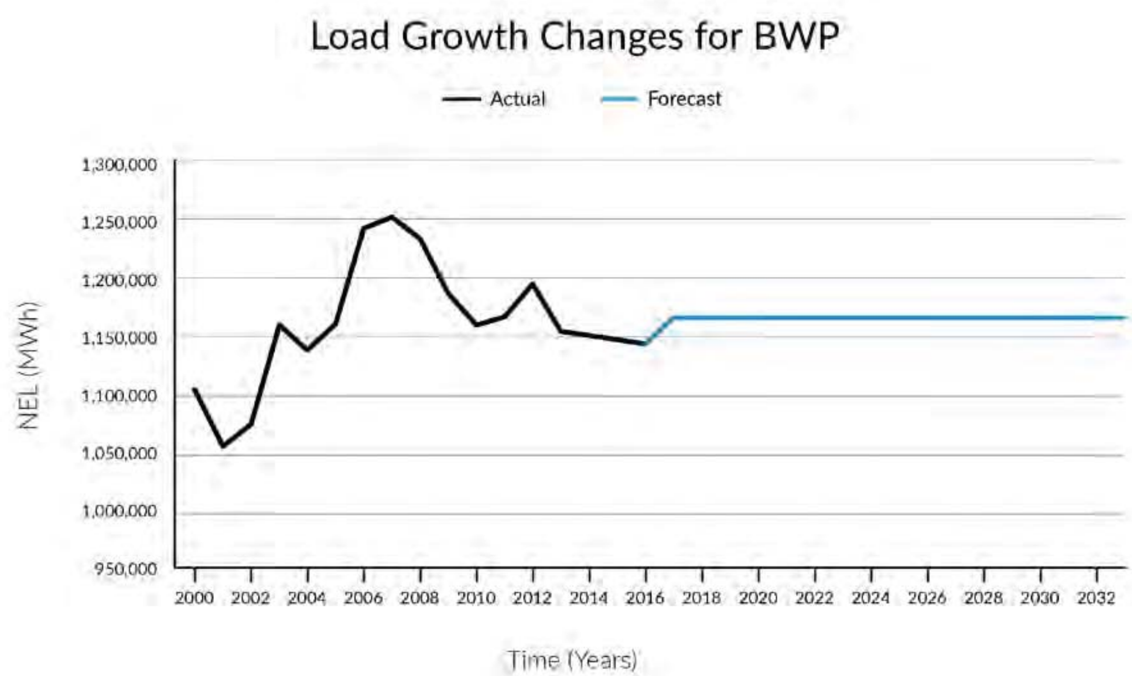


Figure 3.2 – Load Growth Changes for BWP
Source: BWP

BWP forecasts flat loads -- no load growth -- in the short and medium-term, with significant uncertainty over the long term. This long-term uncertainty, discussed in more detail elsewhere in this IRP, is due to uncertainties in economic growth and electrification (which would cause load to grow), additional installations of rooftop solar (causing loads to shrink), and other factors.

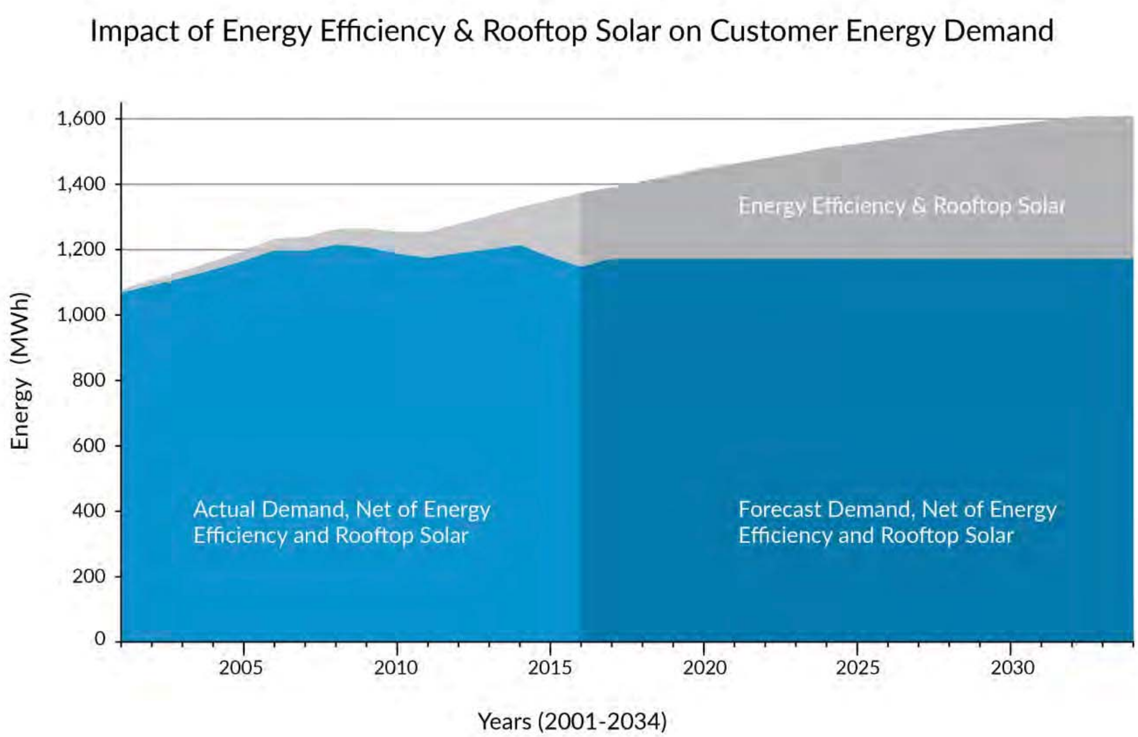


Figure 3.3 – Impact of Energy Efficiency and Rooftop Solar
Source: BWP

For BWP, aggregate peak demand is a single half hour or hourly period which represents the highest point of customer consumption of electricity. BWP's all-time peak demand was 321 MW in FY 2010-11. BWP's peak demand is forecast to remain flat at 314 MW for the next several years.

3.2.1 BWP is a Fully Resourced Utility

Burbank is currently adequately resourced to meet load and any growth or new requirements are expected to be met through energy efficiency and conservation, rate design, demand side management, and renewable energy. This approach, known as the "Loading Order," is consistent with both state and local policy direction and is reflected in BWP's prior IRP, dated 2006. The Loading Order is a progression of preferred generation options and reflects contemporary social and environmental policy.

3.2.2 Load Patterns

Loads are different – often very different – depending on the time of day, the day of the week, the season, and the prevailing weather.

For example, we tend to use less power at 4:00 a.m. than we do at 4:00 p.m. Even in our 24/7 world, most of us wake up in the morning and turn on an appliance such as a TV or coffee maker. We also crank up the air conditioning in mid-afternoon if we're hot, and turn on electric lights in the evening for a few hours before turning them off again when going to sleep. At night, loads are lower but power is still needed for refrigerators and cable TV boxes, streetlights and traffic lights, hospitals, police and fire stations and businesses with graveyard shifts, and we should not forget a trickle to charge our phones, laptops, and, increasingly, electric vehicles.

Because of air conditioning, loads tend to be much higher in the warmer months than in the cooler months. Since most businesses operate during the normal "9 to 5" work day from Monday to Friday, loads are higher during work days than on the weekends.

The electricity that is being used right now was actually planned for years ago but is generated at the instant that it is consumed. As part of BWP's obligation to serve its customers, BWP has to be ready to meet customer load demand at any time of the day or night.

3.2.3 Annual Energy Requirements

If one were to graph all the hourly energy requirements required to meet load over the course of a year and arrange them from the highest to lowest requirement, the result would be what utilities call a "load duration curve." The load duration curve shows the percentage of time that BWP's load is at or above a certain level. BWP's load duration curve for 2015 is shown in Figure 3.4.

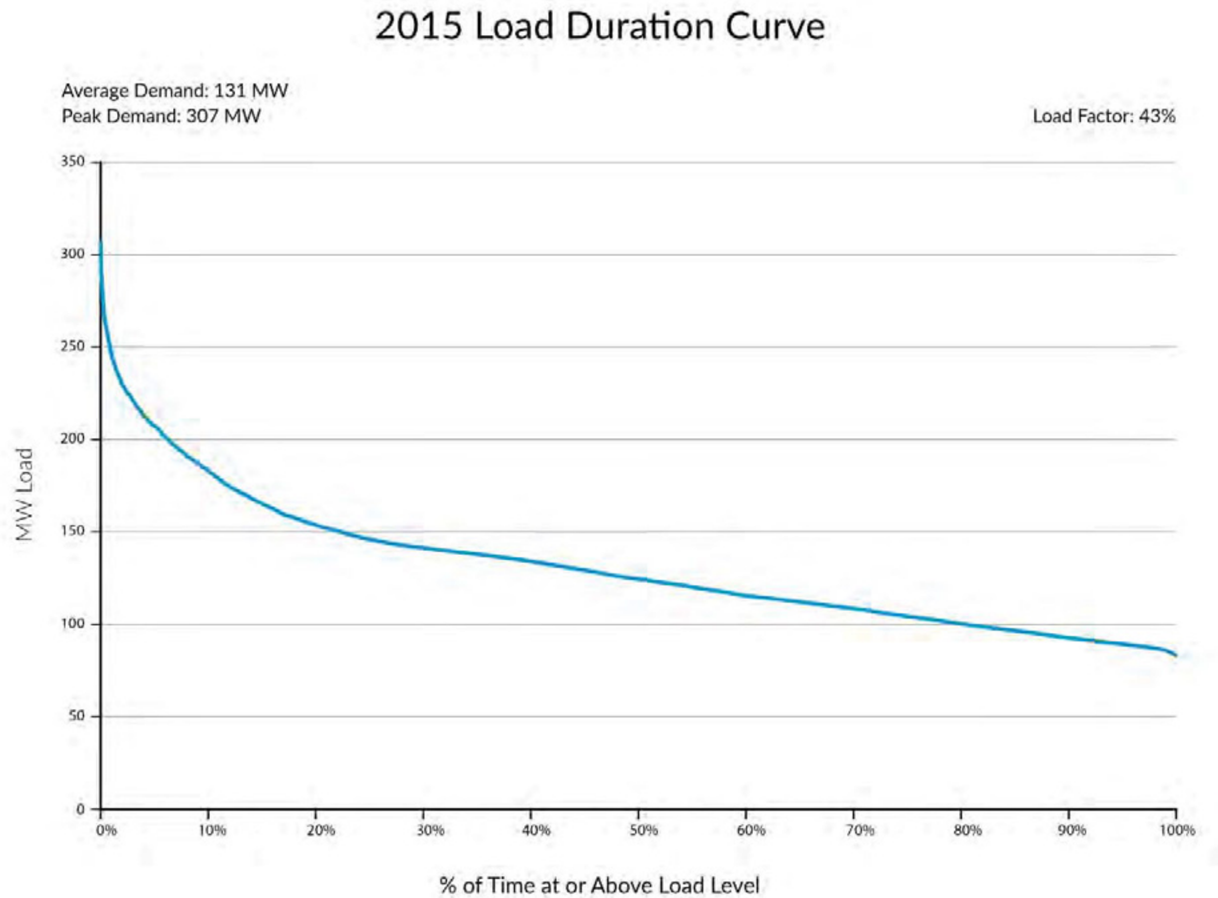


Figure 3.4 – 2015 Load Duration Curve
Source: BWP

The load duration curve shows how much generation capacity is needed to supply Burbank's load and how many hours of the year that capacity is utilized. The load duration curve above shows that Burbank's minimum load was 87 MW, meaning there was no time during the year in which BWP supplied less than 87 MW. The curve also shows how much capacity is needed to meet Burbank's maximum (or "peak") demand, which is a period representing the highest point of customer consumption of electricity.

The load duration curve reveals that BWP supplied more than 257 MW only 1% of the time, in other words there were 88 hours in the year when the total electric load on Burbank's system was greater than 257 MW. With a peak load of 321 MW, that means that 64 MW (321 minus 257) must be available in order to serve its peak needs for less than 88 hours every year.

These peak loads tend to occur during hot weather and so BWP's peak load of 321 MW only needs to be planned for during those anticipated periods. As a planning matter, however, 64 MW of generation (and transmission and distribution) capacity has to be maintained on standby just to operate for 1% of the year.

As indicated above, the utility must provide energy to serve load: the lights cannot go out, so to speak, no matter what the day brings. When resources are superimposed on the load duration curve, it is possible to show graphically how resources are allocated to meet load.

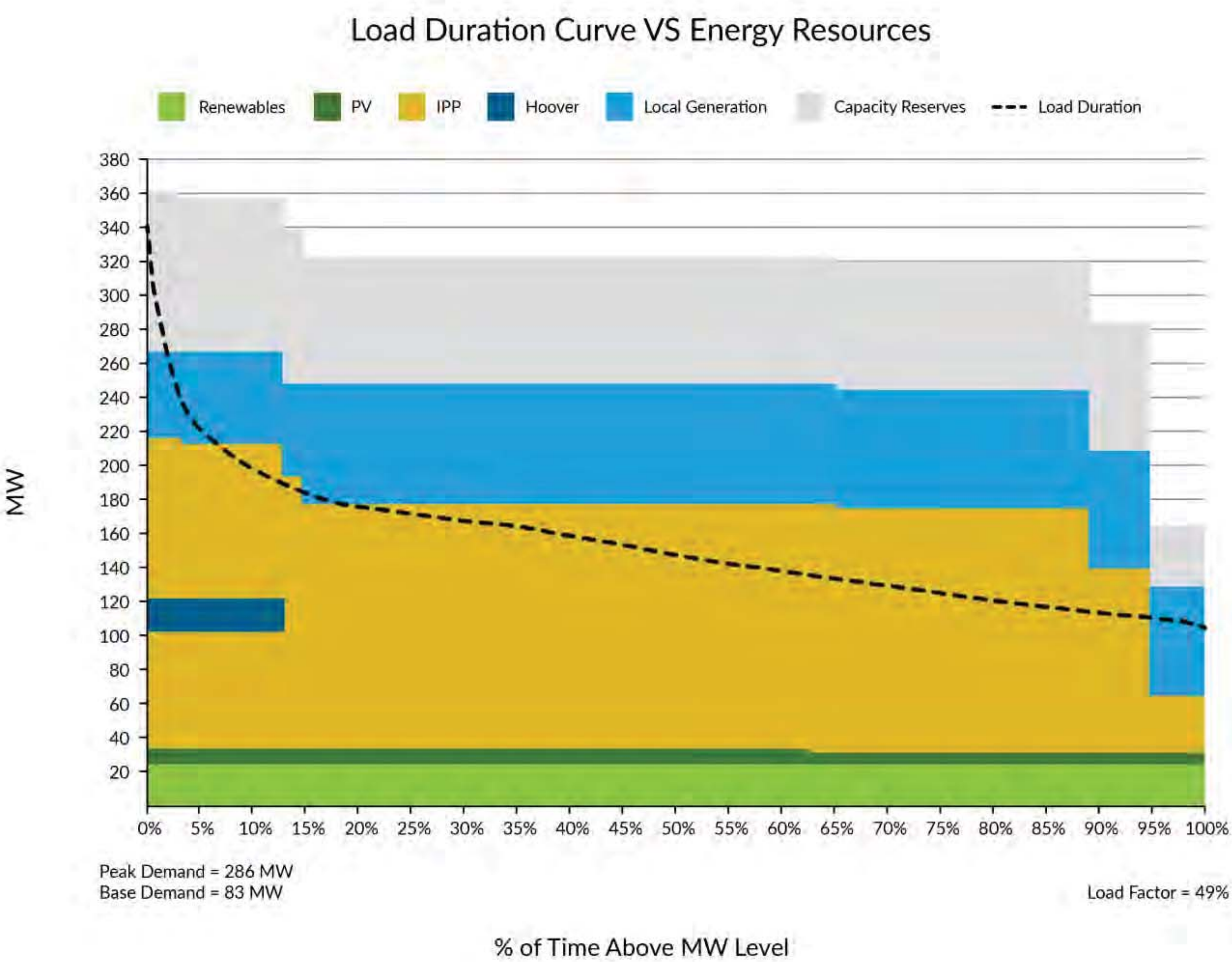


Figure 3.5 – Load Duration Curve vs. Energy Resources
Source: BWP

From the area under the load duration curve, it can be seen that the majority of the load is met from renewables, Palo Verde Nuclear Generating Station (Palo Verde), Intermountain, Hoover Hydroelectric Plant (Hoover), and Magnolia. During the summer, other resources are also used to meet Burbank's load requirements. From the shaded area above the load duration curve, it is possible to see how much additional energy is generated from existing resources: energy that BWP must manage, often by selling it into the market, to keep load and generation in balance.

At the same time, meeting the energy requirement does not eliminate the need to match generation and load in moment-to-moment: it is a dynamic process, especially with significant amounts of intermittent renewable resources. This intermittency – this unpredictability – means that, at any given moment the sun may be shining on solar panels, the wind may be blowing on wind turbines, or both, or neither. But reliability must be maintained.

Load Factor
"Load factor," in turn, is a measurement of a utility's system utilization relative to its peak, calculated as average load divided by peak load. On an annual basis, BWP's load factor is about 43.5%. This is not uncommon for a city like Burbank, with strong peaks during hot weather and during the work week but much lower loads at night and over the weekend. By way of contrast, a city like Vernon, California, which is almost entirely industrial, has an annual load factor of about 80%, reflecting the fact that its factories operate almost around-the-clock. Because air conditioning is a small component of a manufacturer's electricity use, Vernon's load is less sensitive to hot weather.

Load factor is important, as it describes how efficiently a utility is able to use its infrastructure. From a rate perspective, a higher load factor – more electricity flowing over the system – means that the fixed costs of that system can be recovered over a larger amount of electricity sales, which tends to lower the cost of each kilowatt sold. As described elsewhere in this IRP, BWP is developing a number of strategies to raise its load factor.

3.2.4 The Duck Curve

The California Independent System Operator (CAISO) is the entity that operates most of California's electric grid. BWP is not part of the CAISO but its challenges are similar. The CAISO published a graph of what its net load looks like today, and what it could look like in the future as California adds more and more intermittent renewable generation (primarily solar) to the grid. This chart is called the "Duck Curve" because it resembles a duck floating in the water.

In Figure 3.6 below, the blue lines at the top are what the net load looked like in 2012 and 2013, based on real data from the grid. The brown lines are future projections of what the net load might look like, culminating with 2020.

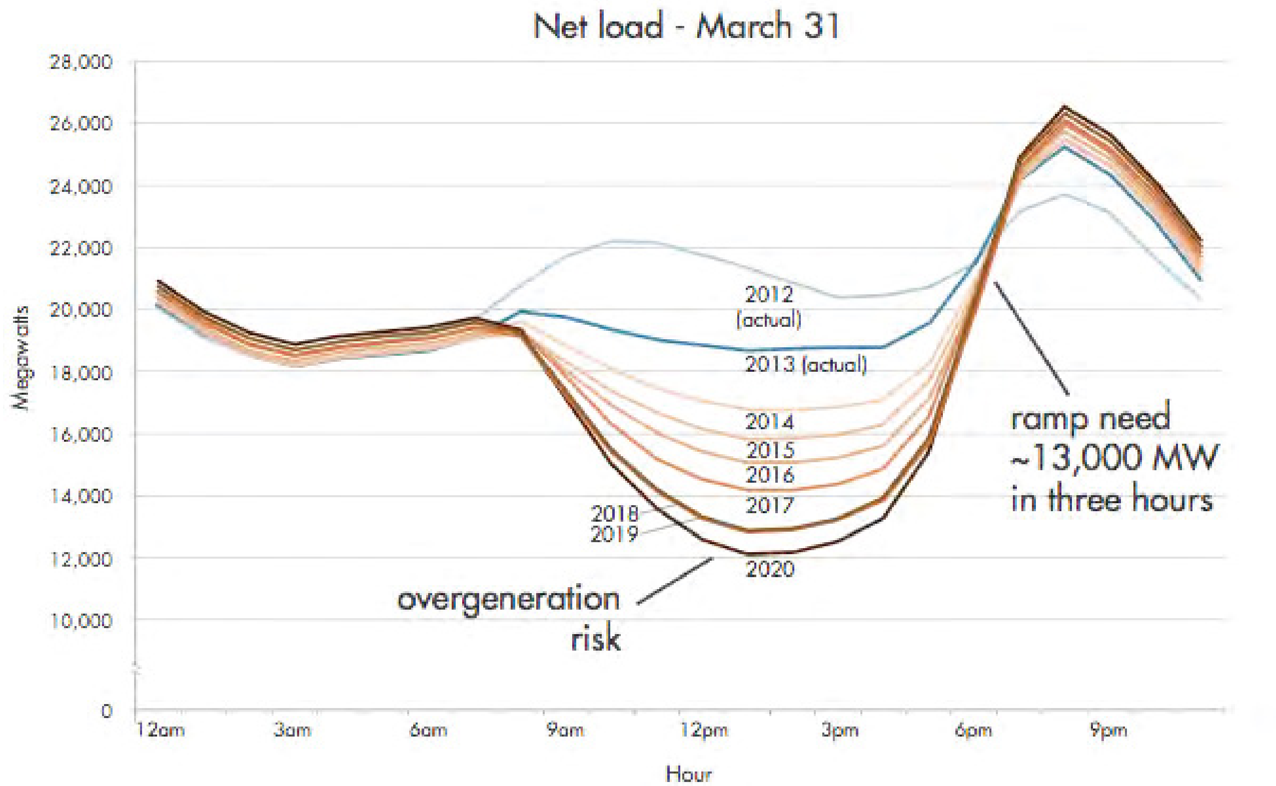


Figure 3.6 – CAISO's "Duck Curve"
Source: CAISO

There is a slight pick-up in the morning (before much sunlight) as people wake up and start to use electricity. This is the duck's tail. Later, as the sun comes up, load increases from those TVs and coffee makers but solar power generation picks up even faster, dropping into the belly of the duck. As a result, what used to be the system peak (the middle of the day) increasingly looks like a trough. In fact, power plants (both conventional and renewable) produce more energy than we can consume. In the evening, when everyone goes home from work and turns on air conditioners and televisions, the sun goes down, solar power stops generating, and the curve begins to ramp into the duck's head. Suddenly, generation needs to increase by a large amount -- and very quickly.

And there is more than just one single duck. There are actually hundreds of ducks: a different duck for every day of the year. And the duck changes over time – it gets fatter, so to speak -- as more solar power is added to the mix.

The Duck creates two major challenges to California utilities. The first is that variable power sources like solar cannot produce power all the time: solar is dependent on daylight. Along with the rising and setting sun, passing clouds and shade from trees cause solar generation to stop and start (and stop and start) during the day. The diagram shows these effects at BWP's primary solar energy source, Copper Mountain Solar 3 (Copper Mountain).

BWP is challenged to manage the variation in output from intermittent renewable resources.

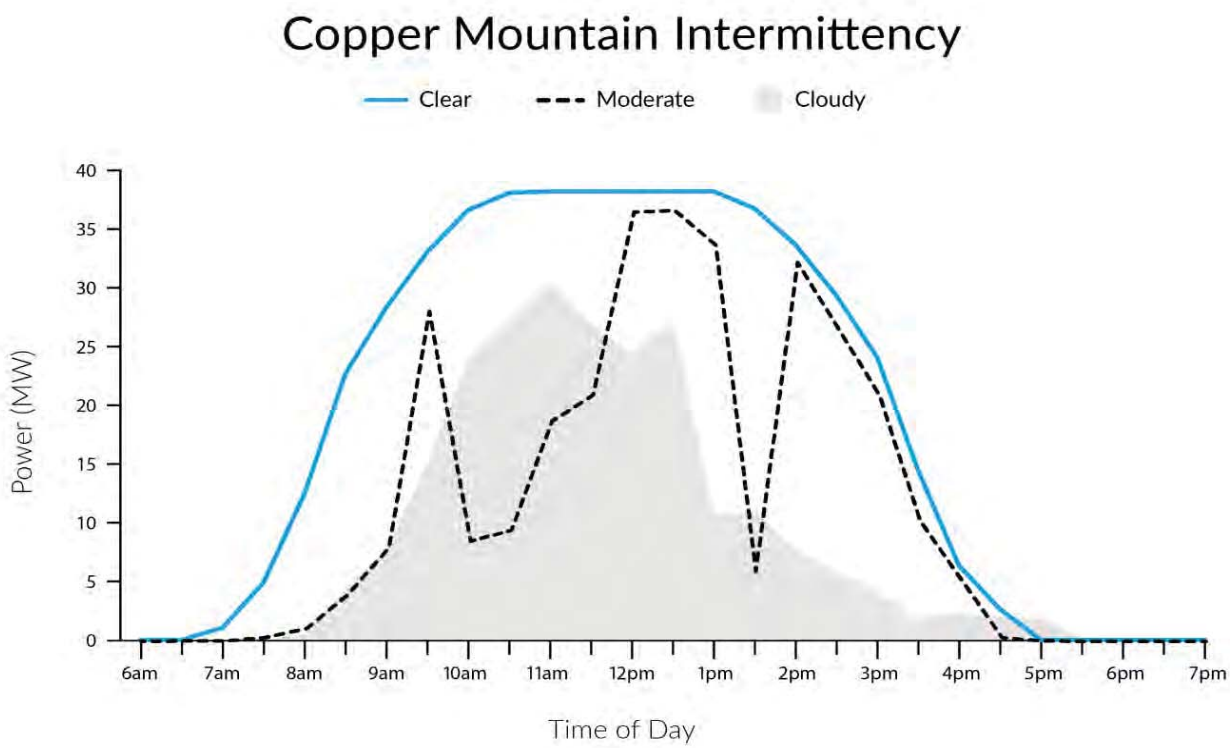


Figure 3.7 – Copper Mountain Solar 3 Intermittency
Source: BWP

The second challenge occurs towards the end of the day, when the sunlight diminishes. The conventional base-load power sources are limited in their ability to ramp up to meet the sudden demand of customers as they come home from work and start using electricity.

These challenges affect utilities and system planners all over California. They will become increasingly difficult to manage as more intermittent renewable generation (primarily solar) is added to the grid. These two challenges both have imperfect solutions. The first can be met by minimizing over-generation midday by shutting either renewables or other plants down or by increasing midday loads, both by shifting loads to midday and with energy storage. The afternoon ramp issue requires the dispatchable power plants on the system to ramp up production at a rapid rate to maintain load-generation balance. This can be mitigated by increasing midday loads (thus decreasing the size of the afternoon ramp), by adding storage that can supplement power supplies at that time, by adding non-solar, dispatchable, fast-ramping generating resources, and by decreasing loads in the late afternoon and evening. Below is a complete CAISO snapshot of these challenges over the longer term.

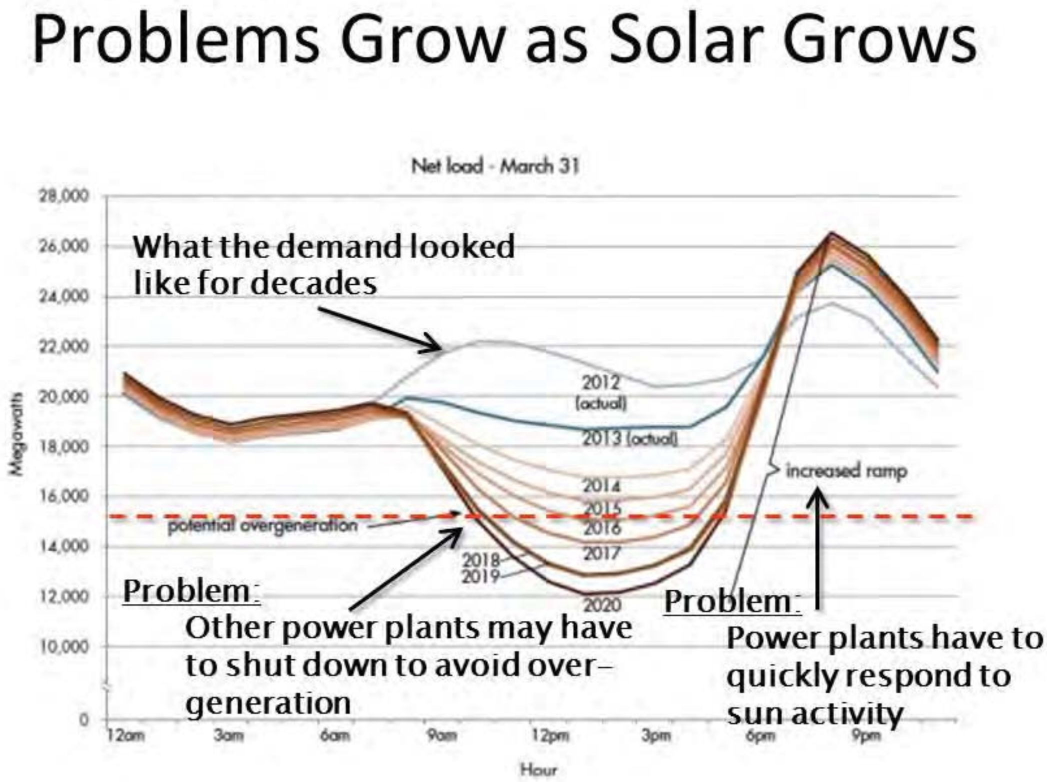


Figure 3.8 – Problems Grow as Solar Grows
Source: CAISO

3.2.5 Over-Generation

The Figure 3.9 represents a typical day in Burbank during spring 2015.

"BWP's Power Supply" in lime green is the minimum amount of power supply BWP has available through power supply contracts with other sources or from local generation at BWP facilities to make sure that BWP's customers have the power they need throughout the day. These sources can be ramped up or power can be purchased in the market if load increases. "Customer Demand" is the black line representing the actual amount of energy BWP customers used on that day to meet all their energy needs, which was between 90 MW to 140 MW. The "Non Solar Power Supply" is the blue line representing the amount of non-solar power supply resources used to meet the needs of BWP customers, which is typically between 85 and 140 MW per day.

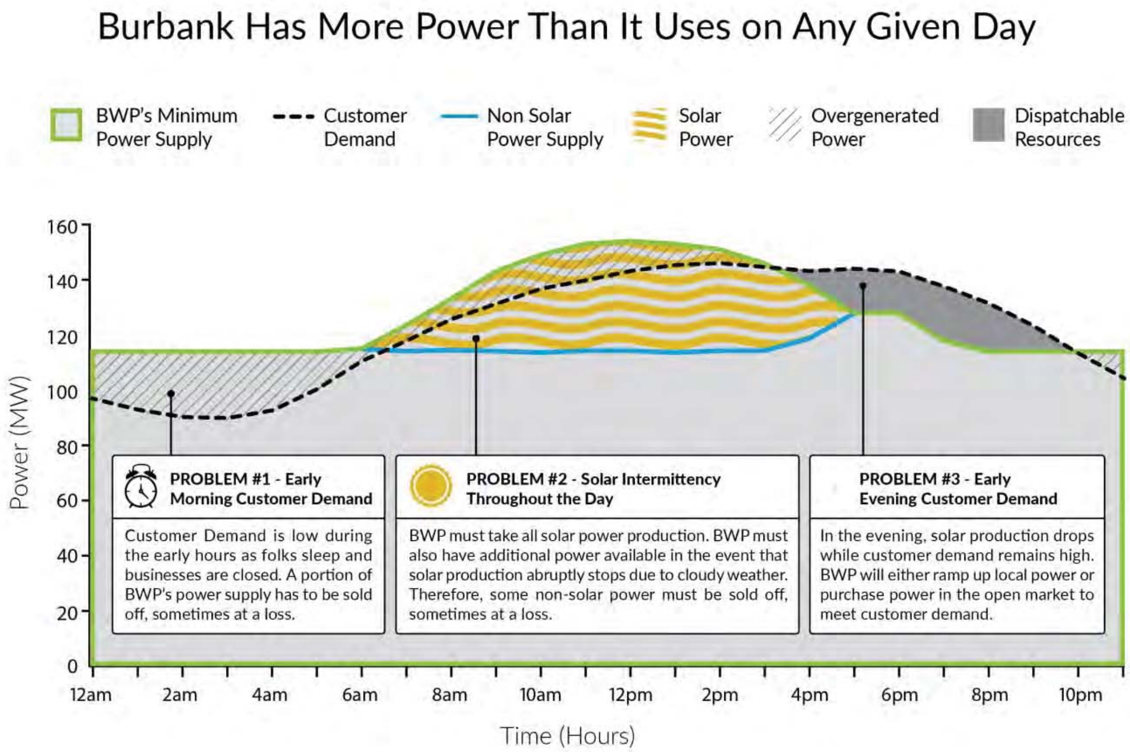


Figure 3.9 – Burbank has More Power than it Uses on Any Given Day
Source: BWP

Due to the uncertainty of solar production, BWP must always have reserves that can be ramped up if clouds or trees cast shadows over BWP's solar generation. The uncertainty of solar creates pressure on BWP costs and eventually customer rates, especially with more rooftop solar. The impacts of increased rooftop solar are discussed later in this IRP.

The wavy lime green with gray slanted area represents BWP's share of Copper Mountain. Its output can go away at any time, depending on cloud coverage. During the middle of the day, Copper Mountain produces up to 40 MW for BWP. If its production suddenly drops, BWP needs to ramp up power supply at another facility or purchase power on the open market to make up for the 40 MW to avoid financial penalties and/or even suffer a power outage.

"Over-generated power" is the grey slanted lines between the "BWP's Power Supply" and the "Customer Demand," representing the amount of power over generation that must be sold in the market. In this example, it accounts for as much as 30 MW. This type of over-generation is now normal in the utility business. Over-generation is a function of being fully resourced *before* BWP began adding renewable energy to its portfolio.

3.3 Generation

How is Power Produced?

A reliable power system does not depend on a single power generation resource or a single method of producing power. Rather, a reliable power system uses diversity of resources, technologies, fuels, and power plant characteristics to maintain reliable electric service at all times.

Conventional methods of power generation use coal, natural gas, nuclear, or water (i.e., hydroelectric power plants) to produce electricity. Power can also be produced from renewable sources, including wind, solar, geothermal, and landfill gas.

Both groups are important and BWP does not rely on just one group, or even one source within a group. Instead, BWP relies upon a mix of both conventional and renewable generation. Each type has its own role in BWP's supply portfolio.

For example, take solar generation. Once a solar plant is built, the energy produced has no fuel costs and no emissions. But if there's cloud cover or at nighttime, no solar power is generating. No sun means no solar power generation. That's why conventional sources are still important, as they can generate power anytime.

3.3.1 Base-Load, Peaking and Load-Following Power Resources

Some plants, like coal-fired, nuclear and geothermal, run continuously day and night. Such 24 hour per day, 365 day per year power is called *base-load* power. Conventional power plants, usually fueled with natural gas, can adjust their output as loads change throughout the day. These are called *load-following*. Magnolia provides both base-load and load-following power. *Peaking plants* also primary use natural gas but are quick starting, quick ramping power plants that supply power when loads exceed the output of the base-load and load-following plants. Peaking plants are also called upon to help integrate intermittent renewable energy (discussed below).

Base-load Resources

Base-load resources help serve the steady load that BWP must serve at all times. As such, a base-load resource runs for months on end without interruption. When operated this way, base-load resources produce reliable, cost-effective power. Base-load resources can be natural gas, coal, nuclear, hydroelectric, or geothermal.

Base-load resources are slower to "ramp" – accelerate or decelerate, increasing or decreasing power output, respectively – and often can't ramp very fast. In this way, base-load resources are the freight locomotives of power generation: the best option for long, steady hauls.

Load-Following Resources

While base-load resources chug steadily along, load often does not: as people and businesses go about their days, load increases and decreases minute-by-minute, hour-by-hour. Load-following resources increase and decrease output with it. Load-following resources are usually fueled with natural gas – like many base-load resources – but are designed to ramp faster, usually at some cost to efficiency. As such, load-following resources can be thought of as the 18-wheelers of the power supply: not as efficient as base-load resources but able to drive in the heavy traffic (so to speak) of changing loads.

Hydroelectric resources can also play a load-following role in the power system, as they can start, stop, and ramp relatively quickly.

Peaking Resources

Peaking resources are the sprinters of the group: a power plant that can be switched on and ramped up when power is needed, usually within minutes.

Peaking power plants are usually fueled by natural gas. Peaking plants, usually based on jet engines, are designed for maximum flexibility at the cost of efficiency. In contrast, base-load plants are designed for efficiency at the cost of flexibility.

Hydroelectric resources can also play a peaking role in the power system, as they can start, stop, and ramp relatively quickly.

Intermittent Resources

Base-load, load-following and peaking resources, despite their differences, are all dispatchable to one degree or another: operators can change their output by controlling the supply of fuel into the power plant itself. Intermittent resources, on the other side, have no such control: for example, solar power plants, by virtue of using the sun as fuel, only produce power when the sun is shining but not when clouds pass over or at nighttime. In the same way, wind power plants only produce power when the wind is strong enough to move the wind turbine blades. Wind and sun can only be predicted within a short time frame. Therefore, intermittent resources challenge efforts to balance generation and load in real-time.

The challenges associated with intermittent resources are discussed in more detail elsewhere in this IRP.

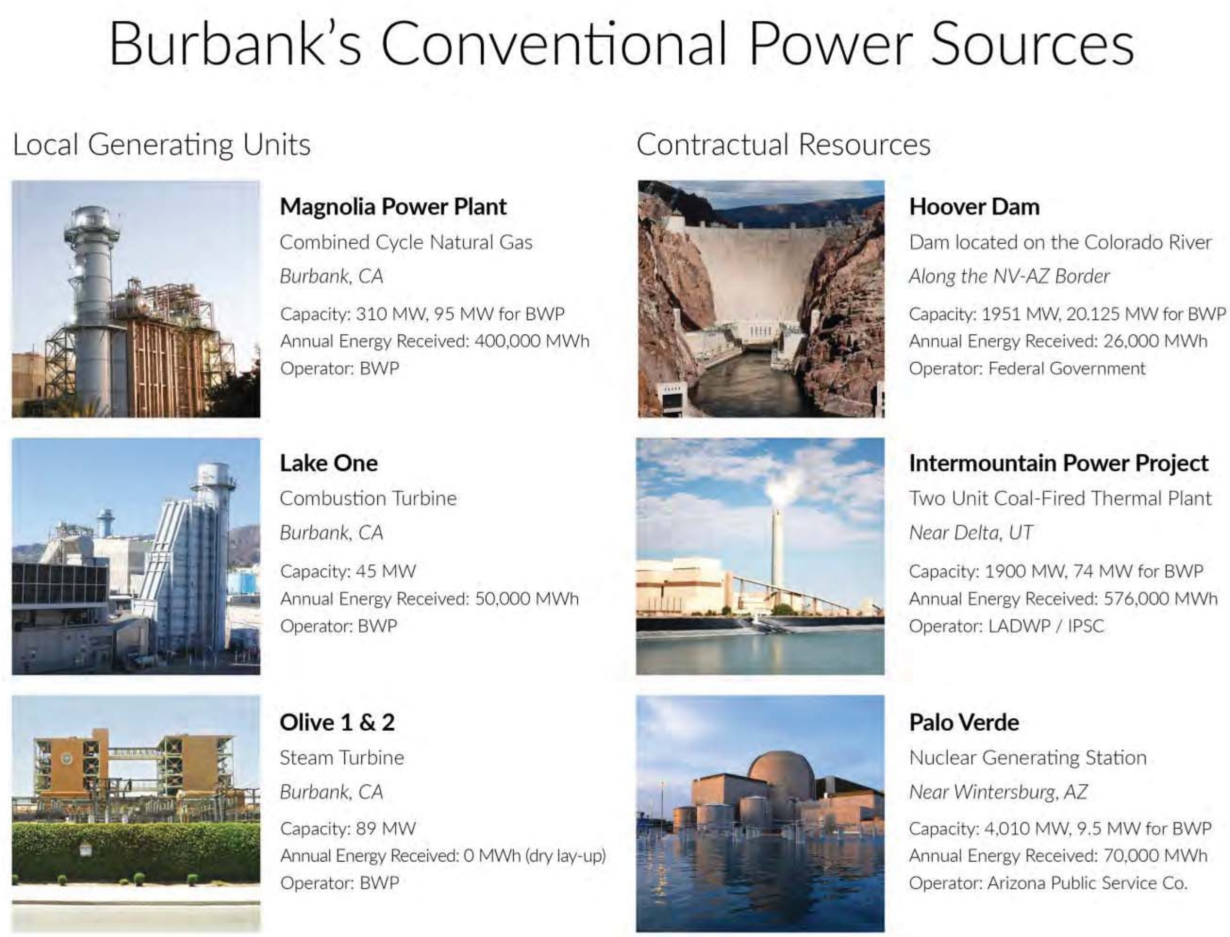


Figure 3.10 – BWP's Conventional Power Sources
Source: BWP

3.3.2 Renewable Resources

In 2007, Burbank became the first city to commit to a 33% renewable power supply portfolio standard. Since then, BWP has undertaken several initiatives to bring renewable resources into its power supply portfolio. As of 2015, 34% of Burbank's power supply came from renewable resources, five years ahead of schedule.

Like conventional generation resources, different types of renewable resources have different characteristics. Solar and wind are intermittent, only generating when the sun shines or the wind blows, respectively. Geothermal and small hydroelectric are base-load and can operate around-the-clock.

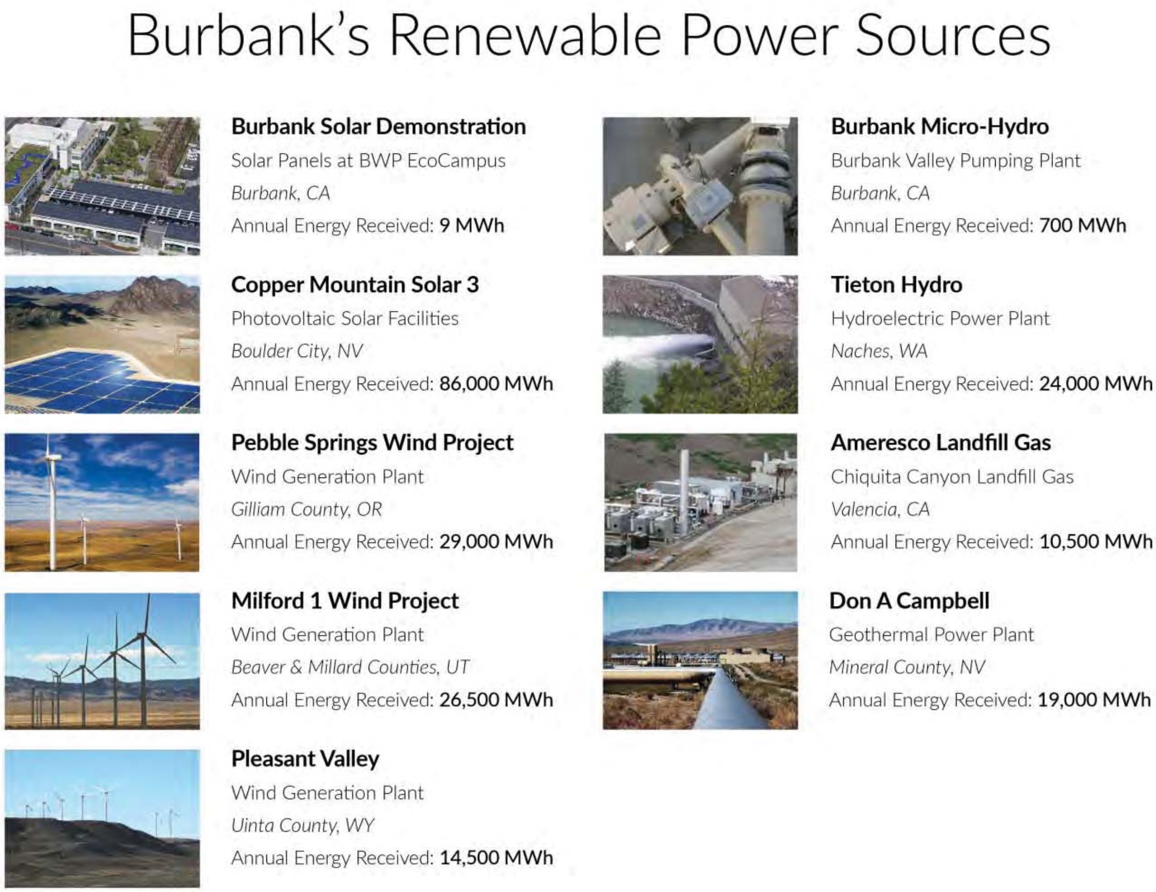


Figure 3.11 – BWP's Renewable Power Sources
Source: BWP

Since Burbank made its commitment to renewable energy in 2007, the "33% by 2020" mandate has been codified in California law and regulation as the Renewable Portfolio Standard (RPS). In particular, CEC adopted detailed rules for RPS compliance to which BWP (and all California utilities) must comply. Under the RPS program, renewable energy is measured in Renewable Energy Credits (RECs). One REC represents one MWh of renewable energy.

The RPS rules divide renewable resources into three Portfolio Content Categories (colloquially known as "buckets"), each with its own requirements:

- Portfolio Content Category 1 (PCC1) – A renewable energy generator directly connected to or delivering to a California Balancing Authority, such as the LADWP Balancing Authority, without substituting electricity from another source.

  For example, BWP's share in Copper Mountain is PCC1 because it is delivered to the LADWP Balancing Authority at the Marketplace Substation.

- Portfolio Content Category 2 (PCC2) – Allows energy and RECs not delivered to a California Balancing Authority. This includes energy received as a swap for previously generated energy into a California Balancing Authority within the same calendar year as the RPS-eligible generator.

  For example, the Morgan Stanley Exchange is PCC2 as BWP delivers energy to Morgan Stanley year-round, while Morgan Stanley delivers RPS-eligible energy to BWP from March to October.

- Portfolio Content Category 3 (PCC3) - RECs only, without energy.

  In addition, pursuant to its mandate, BWP procured renewable energy supplies before the Portfolio Content Category system was enacted. This energy is referred to as "grandfathered" or "PCC0" renewable energy.

  The RPS program requires a certain amount of compliance in a given year and also sets limits on how much of each Portfolio Content Category may be counted against a utility's RPS requirements in a given year.

RPS Compliance Portfolio Categories

COMPLIANCE PERIODS	RPS PERCENTAGE	PORTFOLIO CONTENT CATEGORY
Compliance Period 1 (2011-2013)	-20%	Min PCC1 = 50% Max PCC3 = 25%
Compliance Period 2 (2014-2016)	- 2014 - 21.7% + - 2015 - 23.3% + - 2016 - 25.0%	Min PCC1 = 65% Max PCC3 = 15%
Compliance Period 3 (2017-2020)	- 2017 - 27.0% + - 2018 - 29.0% + - 2019 - 31.0% + - 2020 - 33.0%	Min PCC1 = 75% Max PCC3 = 10%

Figure 3.12 – California Renewable Portfolio Standard
Source: CEC

3.3.3 Generation Diversity and Positive Impact on Rates

Integration of different fuels and technologies produces the least-cost, highest reliability power production mix. Power production costs change because the input fuel costs - including natural gas, oil, coal, and uranium - change over time. The uncertainty of the future cost of these fuels translates into uncertainty for the production cost of electricity. This is known as production cost risk.

A diversified portfolio is the most cost-effective tool available to manage production cost risk. In addition, a diverse power generation technology mix is essential to cost-effectively integrate intermittent renewable power resources into the power supply mix.

3.4 Transmission Resources

Power transmission is the delivery of energy from its place of generation, purchase, or sale to load. Burbank has ownership in or contractual entitlements to numerous regional transmission facilities. Transmission lines bring electric energy to load and BWP uses its contractual and ownership rights to deliver electricity generated, and purchased, to Burbank.

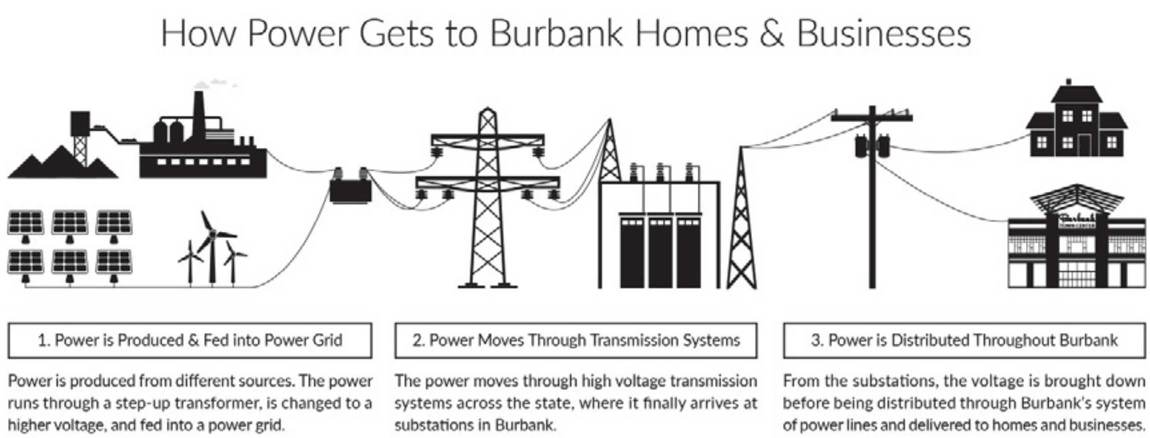


Figure 3.13 – How Power Gets to Burbank Homes and Businesses
Source: BWP

History of BWP's Transmission Rights
The utility business has changed tremendously over the years. Historically, BWP has engaged in new transmission contracts in times of rising natural gas prices. BWP also worked with Southern California Public Power Authority (SCPPA) to participate in major new transmission projects so that BWP can move power from power generation sources or other entities throughout the Western United States.

Over time, BWP has focused on engaging in new transmission contracts and on finding advantageous power resources or supplies that help keep electric rates low. SCPPA was formed in 1980 to help finance these projects for municipal utilities with economies of scale to keep costs low. BWP worked with other participants through SCPPA to jointly build major transmission lines, such as Mead-Phoenix and Mead-Adelanto, which are described in Appendix 2. BWP helped build these projects and has rights to schedule and move power over these transmission lines.

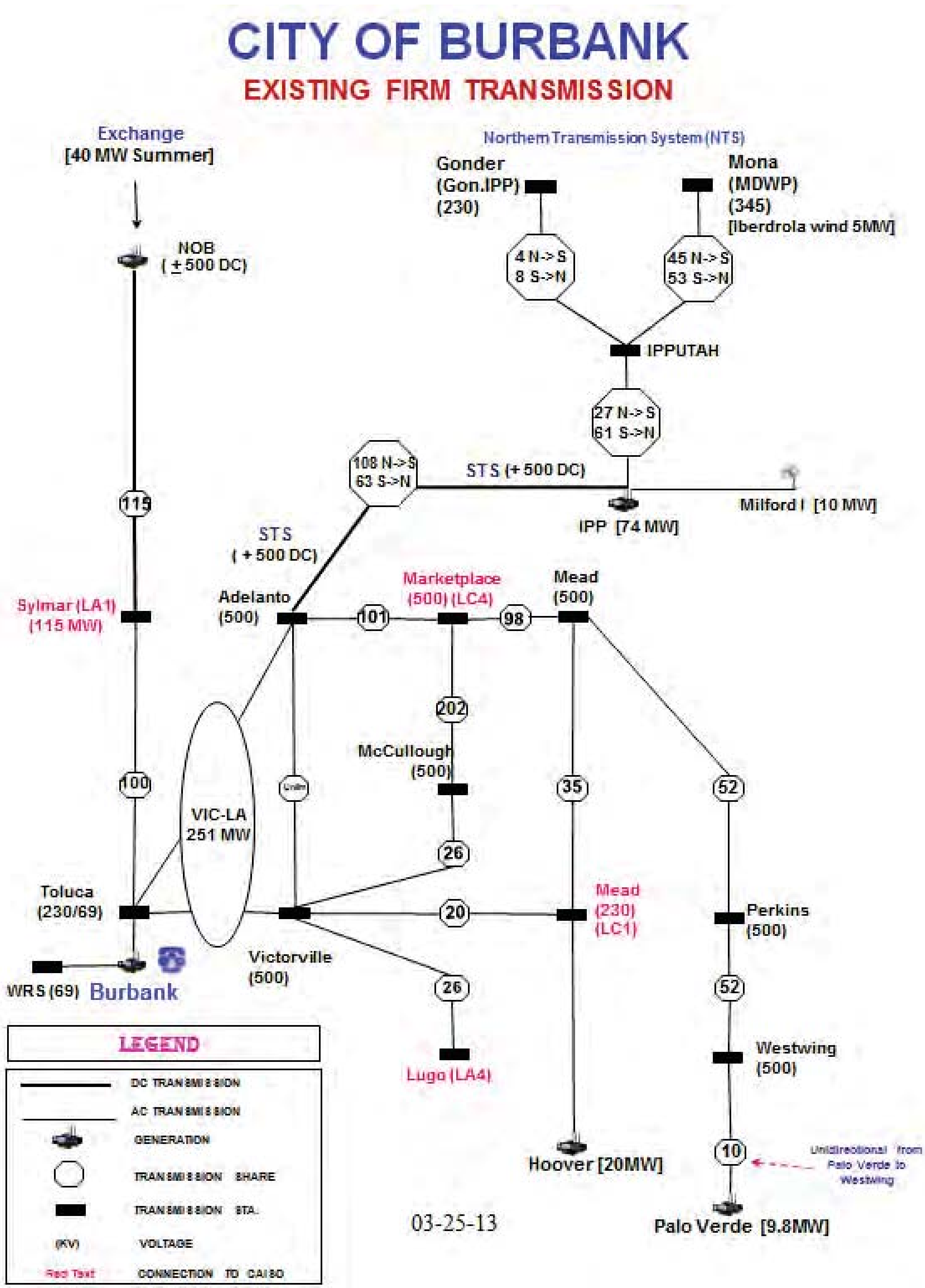


Figure 3.14 – BWP's Transmission Rights
Source: BWP

Details of BWP's transmission rights are in Appendix 2.

These transmission rights (illustrated above and described in Appendix 2) are adequate to service BWP's current needs. They also enable BWP to participate in the wholesale power market. However, as more renewable energy is added and/or replaced, it may be necessary to acquire additional transmission service or participate in the development of new transmission facilities.

BWP can also enter into swap and other agreements to use a third party's transmission assets. In this case, BWP might purchase renewable energy from a distant power plant and swap it to a third party, which would then deliver substitute energy to BWP closer to Burbank. In this sort of arrangement, a third party also absorbs the intermittency of that renewable energy source if any. Arrangements like these are just another method of acquiring resources in the most cost-effective manner.

3.5 Distribution

BWP provides Burbank with electrical service through a distribution network which includes electric stations, transmission lines, distribution lines, and transformers. An electric power distribution system is the final stage in the delivery of electric power that carries electricity to individual consumers.

A large portion of Burbank's electric infrastructure was constructed from the 1940s through the 1960s to serve the typical loads of that era, with 4 kV service. The infrastructure has since been expanded and updated over the years.

Commercial developers supported and assisted in funding the expansion of the BWP system, beginning the transition from a 4 kV system to the more reliable 12 kV service and from large air-insulated electric substations to smaller, more modern, gas-insulated substations. Updating the distribution lines from 4 kV to 12 kV allowed BWP to deliver three times as much electricity, reducing power losses in the system and improving reliability.

With the investment in more reliable 12 kV substation capacity, including the San Jose, Golden State, Keystone, Hollywood Way, and Burbank Substations, BWP has been steadily transferring customers from the 4 kV service to the more reliable and efficient 12 kV service.

The 12 kV substations are primarily served from the 34.5 kV systems. Future substations will be served from the 69 kV systems where possible, allowing BWP to realize additional efficiency and reliability. While BWP has made significant progress in the last 15 years, several 4 kV substations and associated distribution systems remain.

BWP's distribution system consists of the following:

- Service area of approximately 17 square miles
- Approximately 32 miles of 69 kV transmission
- Approximately 40 miles of 34.5 kV sub-transmission
- Twelve distribution substations, two customer substations, and four switching stations
- Approximately 210 miles of 4 kV distribution
- Approximately 122 miles of 12 kV distribution

- Approximately 12,000 poles
- Approximately 6,000 distribution transformers
- Approximately 52,500 customer electric meters

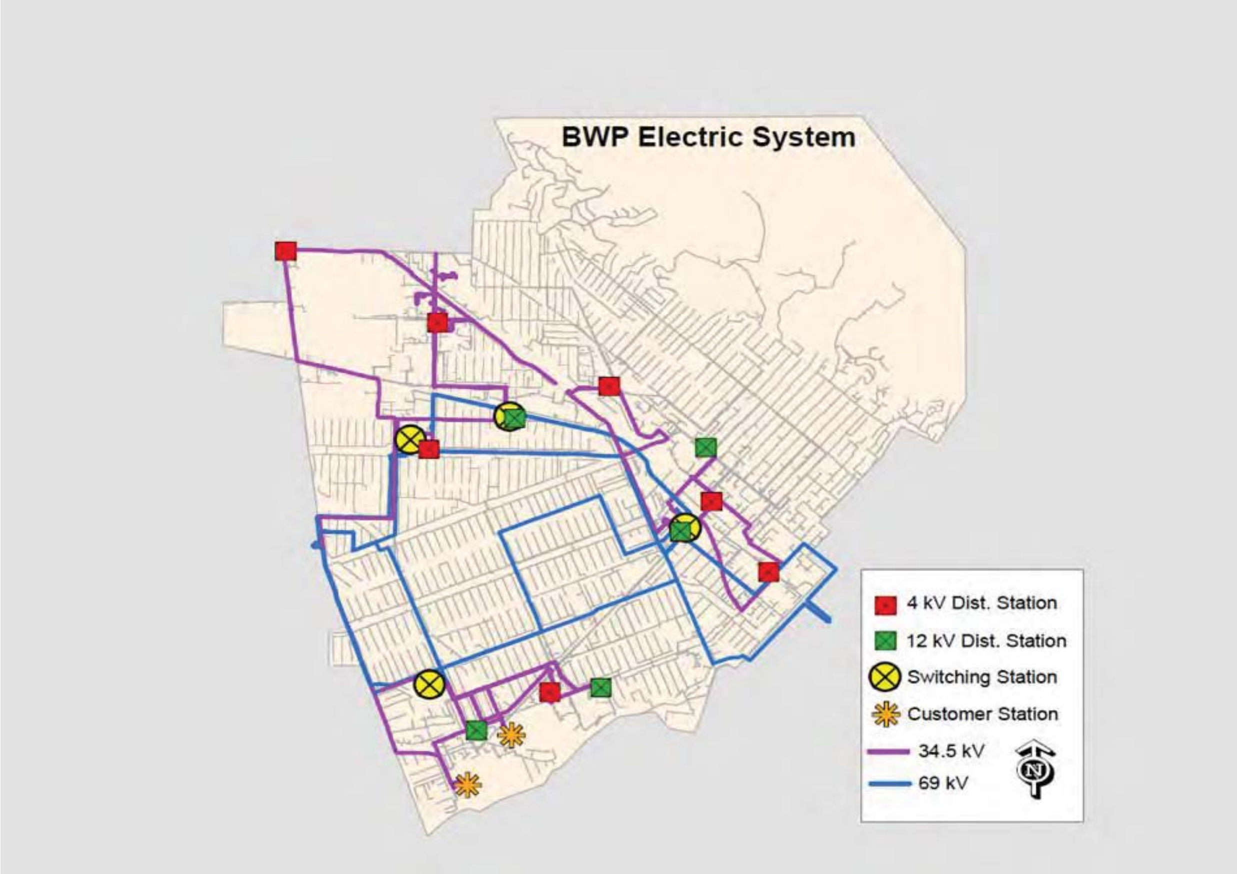


Figure 3.15 – BWP's Electric Distribution System
Source: BWP

Over the decades, the residential and small commercial load has grown, primarily driven by increasing population, increasing air conditioning installations, larger homes, electronic devices and appliances that provide our modern conveniences and creature comforts. (As discussed in this IRP, Burbank's loads are no longer expected to grow and may in fact be shrinking.)

Reducing losses on the power distribution systems has beneficial impacts on rates and the environment by reducing fuel consumption, stretching the lifespans of transmission and generating facilities, and reducing air pollution and carbon dioxide (CO_2) emissions. These efforts are consistent with BWP's goals of reliability, affordability, and sustainability.

In this connection, BWP has taken significant steps to reduce losses among all its major distribution system elements. In fact, BWP has met approximately 22% of its customer peak demand increase since 1980 simply by improving its distribution system.

Overall, BWP has reduced system losses by 37% since 1999.

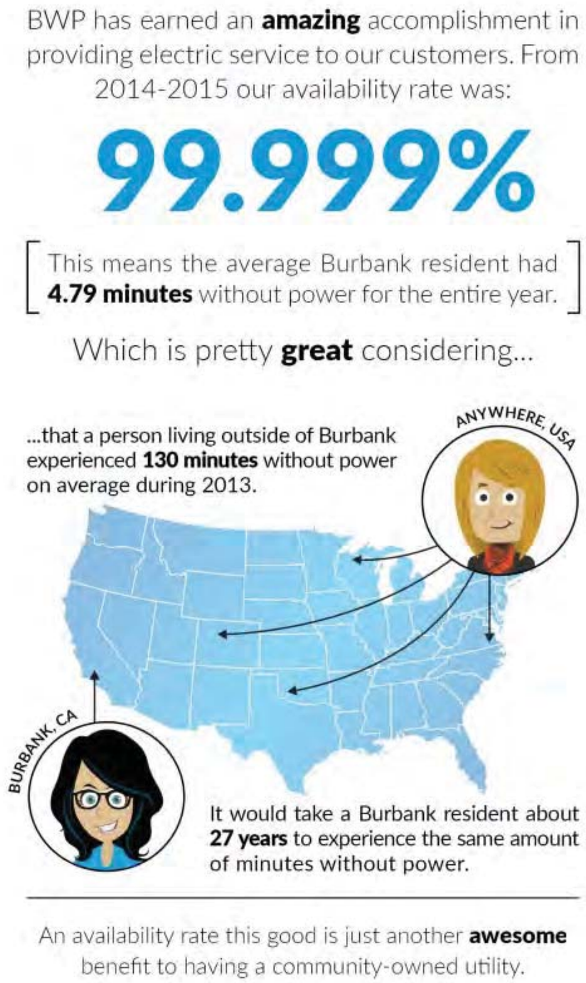


Figure 3.16 – BWP's Reliability Comparison
Source: BWP

BWP has an Electrical Distribution Master Plan to ensure improvements are optimizing distribution system reliability and reducing distribution system losses. BWP has an all-time record high in service availability of 99.999% in 2014 and 2015. This means that the average Burbank resident spent only 4.79 minutes without power for the entire year. In comparison, the average North American experienced 130 minutes without power on average during 2013, about 27 times more often than in Burbank. In other words, it would take about 27 years for a Burbank resident to experience the same duration of outages experienced by people in North America serviced by the average utility.

3.6 Grid Modernization

BWP's grid modernization seeks to enhance Burbank's distribution system with advanced technology including digital meters, smart appliances, storage, renewable energy sources and other future technologies.

The new meters, devices and appliances allow for sending and receiving meter data or device status to the utility without any manual intervention such as meter reading, having customers calling in meter reads or physically inspecting electrical equipment. BWP uses this enhanced data to provide numerous benefits to customers, and for operations and energy efficiency.

Grid modernization has improved service to BWP's customers and promoted efficiency. The primary technical components of this grid modernization include:

- A fiber optic Ethernet switched services network and a citywide secure WiFi mesh network serve as the primary networks that allow for two-way data flow between BWP and digital meters.
- Advanced Metering Infrastructure (AMI). BWP implemented three essential systems to transmit and maintain meter read data:
- Digital water and electric meters
- Water and electric wireless meter reading systems with two-way secure mesh radio communication, and
- Meter Data Management System (MDMS) to store and manage meter data

These systems work together to gather and store meter data which is used for data analytics and billing.

3.6.1 Grid Modernization Benefits

This data, in turn, can be used to make targeted improvements in BWP's distribution system to the benefit of BWP's customers. By applying state-of-the-art analytic tools, BWP can analyze and better understand load growth, overloaded circuits, and power quality. Engineers can analyze the incoming meter data and develop strategies to improve system performance and operational characteristics. System operators can manage system demand, outages, and optimize system performance. This data has helped with right sizing of transformers and with making system improvements to improve reliability during high load periods.

At the same time, the data allows BWP's customers to become more informed about their energy consumption and empowers them to adjust their consumption. BWP has recently begun delivering a periodic, personalized report to its customers on their energy consumption compared to their neighbors. The result has been an estimated reduction in overall energy use of 2%.

Grid modernization also aids in providing interval meter data so customers are able to take advantage of Time-of-Use (TOU) rates. TOU rates offer cost savings by encouraging customers to shift energy usage from high to low demand times, optimizing system offerings and reducing operating costs. In a similar vein, AMI also lends itself to demand side programs.

3.6.2 Grid Modernization Helps Promote Transportation Electrification

Plug-In electric vehicles (PEVs) are an essential piece of BWP's transportation electrification (TE) strategy to reduce GHG emissions. TE aims to use clean electric energy to fuel transportation, reducing the use of petroleum-based fuels such as gasoline, diesel, and natural gas. Grid modernization allows BWP to offer TOU rates, which incentivizes PEV drivers. Customers can charge their vehicles during lower cost hours at work or at home.

TE aims to electrify not just personal automobiles, but many forms of transportation:

- Plug-in electric vehicles
- Forklifts
- Transport refrigeration units
- Shore power for ship visits
- Port cargo handling equipment
- Airport ground service equipment
- High speed rail
- Light and heavy passenger rail
- Commuter rail
- Medium-duty vehicles, such as trucks and buses
- Heavy-duty vehicles, such as trucks
- Heavy-duty vehicles, such as construction and farming equipment
- Lawn and garden equipment
- Sweepers and scrubbers
- Tow tractors and industrial tugs
- Golf carts

BWP is becoming more active in promoting and using TE as a load resource to help achieve new environmental goals and maintain grid reliability. BWP benefits from TE through better grid utilization by incentivizing PEV charging to lower cost hours when energy usage is typically low; mitigating the effects of rooftop solar generation by managing PEV load during the day, and potential load growth opportunities.

3.6.3 Grid Modernization Reduces Power Outages, Improves Power Quality

Grid modernization also improves the reliability of BWP's distribution system. For example, by reducing the duration and frequency of outages caused by Mylar balloons, palm fronds, birds and rodents with digital relays and automatic reclosing on feeder circuit breakers, BWP was able to reduce customer outage minutes by over 1 million minutes per year between 2010 and 2013.

This figure has continued to improve and in 2015 the number of customer outage minutes fell by more than 2 million minutes.

With a fully deployed AMI network, BWP is in a position to do what most utilities only dream of doing: to evaluate the electrical stress on the distribution system at any moment without the installation of any additional measurement devices. BWP can easily view loading conditions on its distribution system and identify transformers that risk failure due to overloading. In addition, BWP can identify transformers that are substantially under loaded. This provides opportunities to reduce losses by choosing the most economically sized transformer based on historic loading conditions. This creates a more reliable system with fewer transformer failures, reduced transformer inventory space costs, fewer service crew call outs, and fewer and shorter customer outages.

Prior to AMI deployment, BWP could respond only when a customer called to complain about their electric service. Now, staff is able to see voltage conditions throughout the system. BWP has identified a substantial number of locations with low voltage and has since corrected low voltage issues at over 2,000 locations without a single phone call made to BWP. Such proactive corrections to service, further reduces system losses and provides a better quality power service to the customers.

In summary, BWP is reducing costs through predictive analytics and anticipating transformer failures before they occur. BWP is also proactively improving power quality by fixing voltage issues. Ultimately, BWP engineers are increasing their productivity and responding to customer needs more quickly through the use of its data.

3.7 Energy Efficiency

BWP's long-standing commitment to energy efficiency is an extension of fundamental principles dedicated to social and environmental responsibility, ensuring reliability, and keeping rates low for Burbank. In 1998, California Assembly Bill 1890 (Brulte, 1996) created massive electrical restructuring in the state. One of the provisions of AB 1890 was to create a Public Benefits Charge, now equal to 2.85% of electric rate revenues. These funds were mandated to be collected and spent on four electric 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 for low-income electricity customers.

Since AB1890, and when the Public Benefits Charge went into effect, BWP has provided the citizens and businesses of Burbank with award-winning Public Benefits programs and initiatives, including:

- Renewable Energy Programs: BWP offers its Solar Support Rebate program to both residential and commercial customers. In FY 2014-15, the rebate given to residential customers was $0.96 per watt installed, and to commercial customers was $0.73 per watt installed. Due to falling solar equipment prices, BWP's Solar Support program continues to be very popular and has been fully subscribed. At the same time, more than two-thirds of new residential solar photovoltaic (PV) systems are being installed without a rebate, which demonstrates the increasing cost-effectiveness of solar PV systems. Now, BWP only provides rebates to solar PV systems that are westerly-facing, in order to minimize the effects of the "Duck Curve."

- Low-Income Programs: BWP offers a Lifeline rate to about 2,000 income-qualified customers, which is a discount to the standard residential rate and among the most generous in the state. BWP also developed the Refrigerator Exchange program for Lifeline customers to replace customers' existing primary, and often less energy-efficient, refrigerators with an ENERGY STAR model at no cost to them. Lifeline customers in single family homes are required to participate in BWP's free Home Improvement program to further reduce their electric, water, and natural gas bills.

- Research, Development and Demonstration: BWP operates a demonstration program of 34 Ice Bear units installed at City-owned buildings and large businesses. The Ice Bear is a peak-shifting thermal energy storage unit that works with air conditioners. It is just a tank containing water that is frozen during off-peak hours; the ice is then used to provide cooling, in substitution of the air conditioner's compressor, during peak hours. In FY 2014-15, the units provided about 217 kW of peak demand capacity reduction.

In FY 2014-15, BWP implemented demonstration centers of efficient technologies and operations pilot program targeting not-for-profit facilities. The goal of the program was to upgrade less energy-efficient facilities in cash-strapped sectors. Three facilities received comprehensive audits followed by lighting retrofits with added controls, including occupancy sensors, and dimming capabilities; replacement of older HVAC units; and, in one case, replacement of an old and inefficient commercial refrigeration unit.

California Senate Bill 1037 (Kehoe, 2005) established several important policies regarding energy efficiency, including a statewide commitment to cost-effective, reliable, and feasible energy efficiency, with the expectation that all utilities should consider energy efficiency before investing in other resources to meet growing demand. Assembly Bill 2021 (Levine, 2006) added to these policies by requiring the establishment of 10-year energy savings targets on a triennial basis. Assembly Bill 2227 (Bradford, 2012) amended the requirement to a quadrennial basis.

BWP supports these policies and aggressively pursues all cost-effective energy efficiency opportunities.

These legislative changes led to the development of energy efficiency programs which provide savings to customers and helped reduce GHG emissions. With new energy efficiency measures, BWP strategically utilizes Public Benefit funds to expand energy efficiency program offerings and to meet legislative targets. For example, when a customer replaces a single pane window with an energy-efficient one, the new window prevents heat from escaping in the winter, the customer uses less energy to heat the home while still staying comfortable. In the summer, efficient windows keep the heat out and the air conditioner does not need to run as often, saving electricity.

When a customer replaces an appliance, such as a refrigerator or washing machine, or office equipment, such as a computer or printer, with a more energy-efficient model, the new equipment provides the same service, but uses less energy. This saves the customer money on their energy bill and reduces the amount of greenhouse gases going into the atmosphere.

BWP has collaboratively worked with the California Municipal Utilities Association (CMUA), Northern California Power Agency (NCPA), and SCPPA, since 2005, to measure the effectiveness of energy efficiency programs and to report savings in a consistent and comprehensive manner. In December 2006, the first joint report on energy efficiency was submitted to the California Energy Commission (CEC). Since then, BWP has participated in this reporting effort annually.

3.7.1 Energy Efficiency Portfolio Results

The following, reported to the CEC in March 2016, provides a snapshot of the efficacy of BWP's efficiency programs. These numbers reflect FY 2014-2015 program activity:

- **Significant Investment:** BWP spent $4.3 million on energy efficiency programs and overhead.
- **Peak Demand Reduction:** BWP programs reduced peak demand by 3 MW.
- **Energy Savings:** Gross annual savings totaled 14 million kWh.
- **Lifecycle Savings:** Gross lifecycle savings accruing from BWP's efficiency portfolio reached nearly 130 million kWh.
- **Retail Sales:** Burbank has 43,000 residential and 6,500 commercial service connections, serving a total population of 105,000 residents and more than 3,300 businesses. During FY 2014-15, a total of 1,109 million kWh were sold, 25% to residents and 75% to Burbank's commercial customers.
- **GHG Reductions:** The net lifecycle greenhouse gas reductions are 77,649 tons.
- **Cost-Effectiveness:** Applying the Total Resource Cost (TRC) test, the principal measure used in the industry to determine program cost-effectiveness, BWP's Portfolio TRC was 2.64, meaning that every dollar

invested in energy efficiency yielded $2.64 in benefits. The average TRC for publicly owned utilities like BWP is 2.02, so BWP is ahead of the curve.

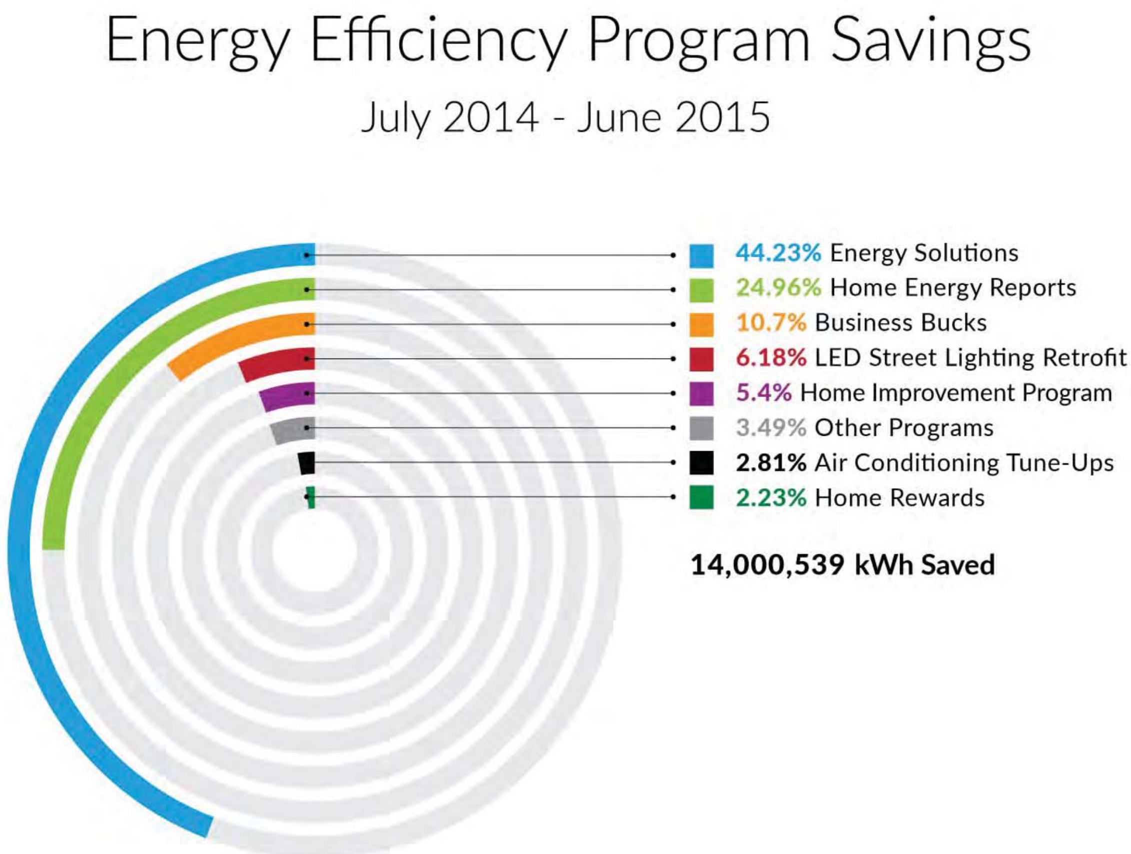


Figure 3.17 – BWP's Energy Efficiency Program Savings
Source: BWP

3.7.2 Current Portfolio Strategy

As a result of nearly 20 years of energy efficiency efforts, increasingly stringent building codes, and a community ethos of sustainability, the average Burbank household uses less than 500 kWh per month. The efficiency baseline makes it a challenge to design more programs that can squeeze more energy efficiency "juice" out of a smaller and smaller "lemon."

BWP's energy efficiency portfolio has been designed to reflect the organizational goal of continuing to provide sustainable, affordable, and reliable electric service to all of Burbank's residents and businesses.

3.7.3 Long-Term Impact of Efficiency Efforts

Early and ongoing active management efforts in efficiency and conservation pay big dividends. BWP has a growing efficiency portfolio, where each initiative gains more and more traction with customers over time and reaps significant rewards. Burbank's load growth has abated over time and is estimated to level out even further to a possible negative load growth scenario. BWP's long-standing goal, established with the 1998 Public Benefits requirement, has been to offset energy use by 1% annually. What appears to be a modest goal is, in fact, both challenging and impactful. The graph that follows highlights the dramatic impact of the successful efficiency and conservation efforts.

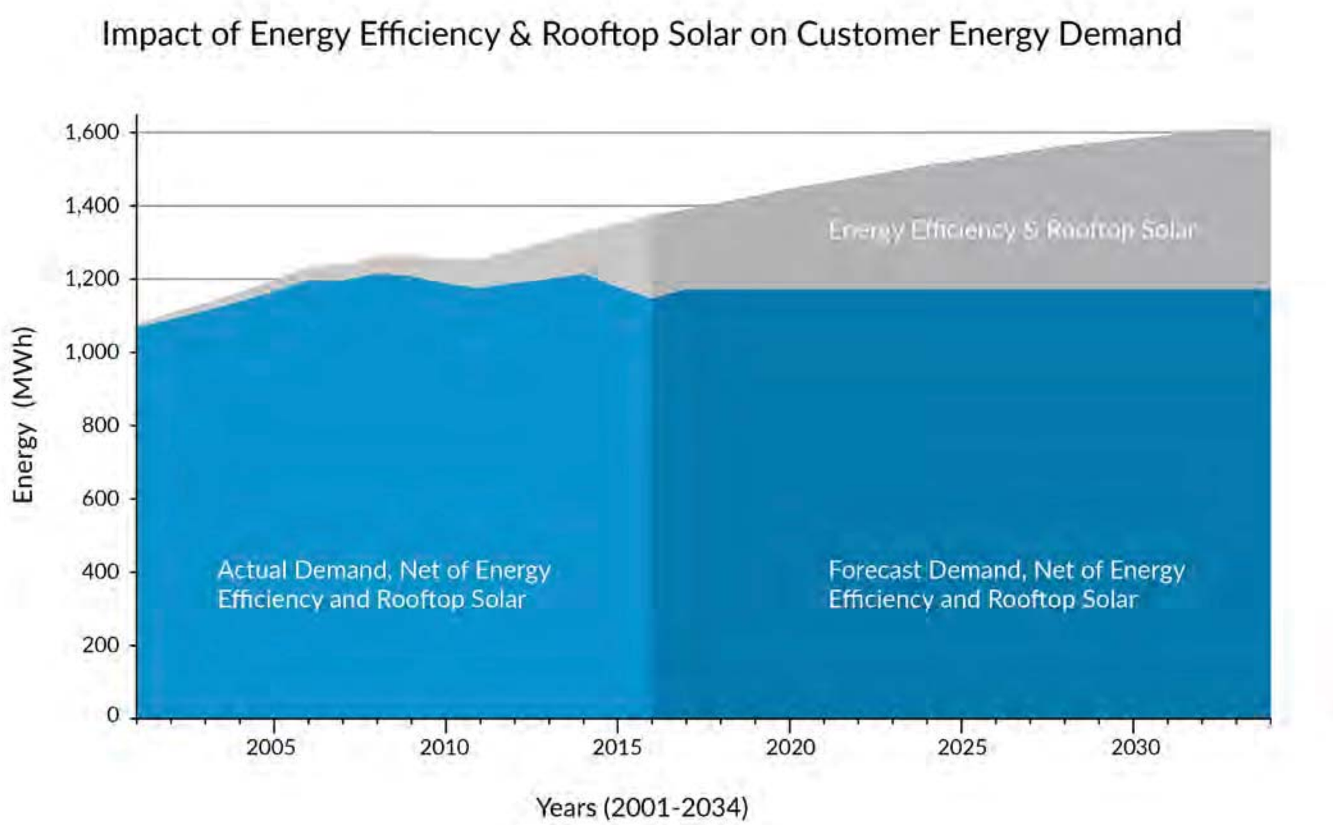


Figure 3.18 – Impact of Energy Efficiency and Rooftop Solar
Source: BWP

3.7.4 Ongoing Responsiveness to the Community

BWP regularly evaluates each program and reviews market conditions in order to improve services to residents and businesses. Research has shown that energy efficiency program success is a three-legged stool, with the three legs represented by:

- financial attractiveness
- installation availability
- awareness

As a result, most programs are free for customers to participate in and have a direct installation component. Awareness is addressed through print flyers and digital communications to customers emphasizing BWP's role as a community utility.

Innovative communication methods can be incorporated into traditional energy efficiency programs to increase energy savings and customer engagement. For example, in FY 2014-15, BWP completed its fourth year of mailing out paper *Home Energy Reports* to residents that spur behavioral change and energy savings. The program saved nearly 3.5 million kWh and is BWP's largest and most cost-effective residential energy efficiency program. Households can also view their reports online via a customer web portal, MyBWP, to view daily and hourly energy use and which also has a library of efficiency tips.

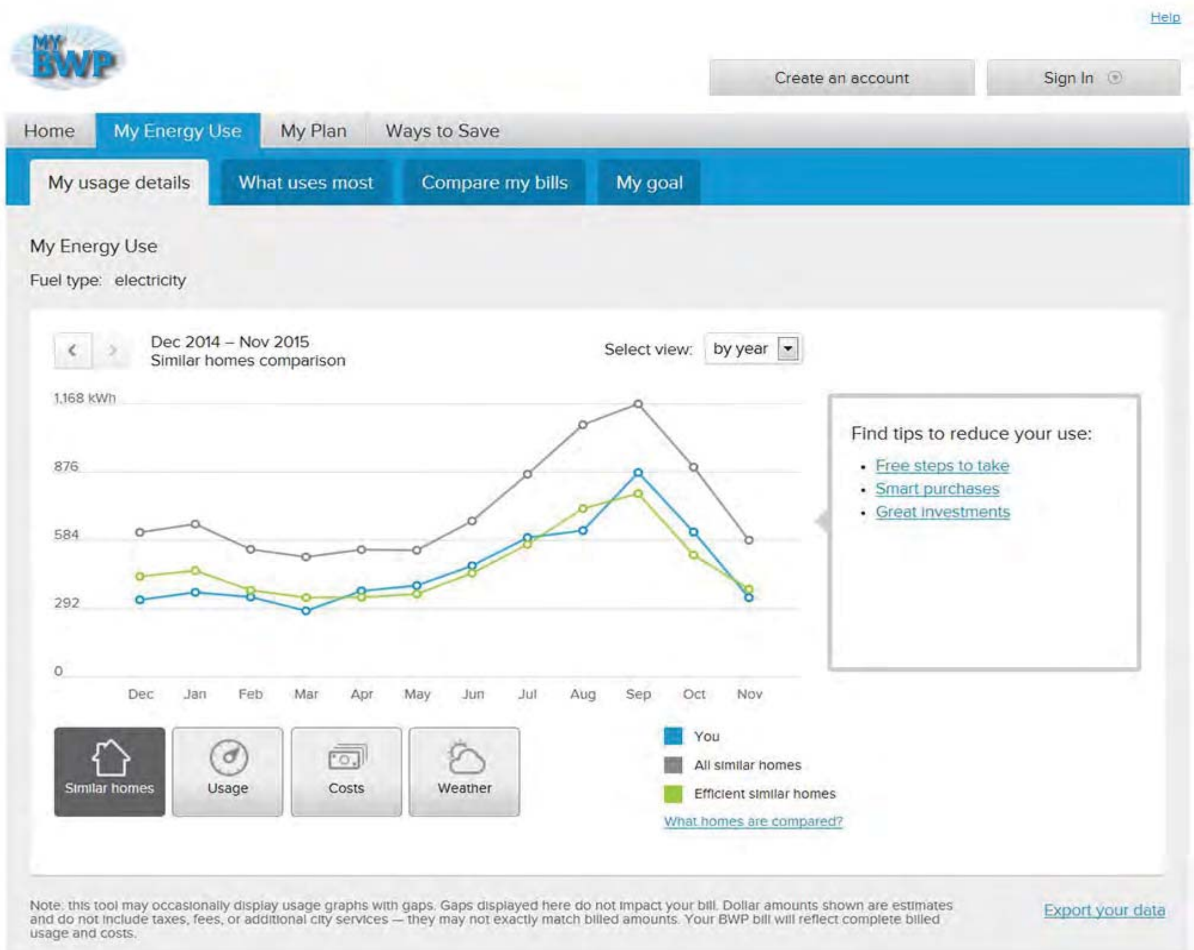


Figure 3.19 – Sample of BWP's Web Page on Customer Energy Use

Source: BWP

City of Burbank Water and Power Since 1913
Always There for You!

Home Energy Report

Account number: 0000A-00000
Report period: 03/15/12–05/14/12

We are pleased to provide this personalized report to help you save energy.

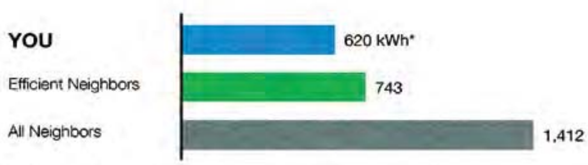
The purpose of the report is to:

- **Provide information**
- **Help you track your progress**
- **Share energy efficiency tips**

This information and more is available at
BurbankWaterAndPower.com/EnergyReports

***********AUTO**5-DIGIT 91501
JOHN Q. PUBLIC
1234 ANYSTREET
BURBANK CA 91504

Last 2 Months Neighbor Comparison | You used **17% LESS** electricity than your efficient neighbors.



How you're doing:

▶ **GREAT** ☺☺
Good
More than average

* kWh: A 100-Watt bulb burning for 10 hours uses 1 kilowatt-hour.

Who are your Neighbors?

All Neighbors: Approximately 100 occupied, nearby homes that are similar in size to yours (avg 1,967 sq ft)

Efficient Neighbors: The most efficient 20 percent from the "All Neighbors" group

Your Personal Commitment

Your goal: to use 5% less electricity than last year.

Your goal progress so far:

From Feb - Apr, you used **6% less** than your target.
Goal runs through May 2012

Great job. You're on track to beat your goal.

* kWh: A 100-Watt bulb burning for 10 hours uses 1 kilowatt-hour.

Looking for ways to meet your goal?
BurbankWaterAndPower.com/EnergyReports

Turn over for savings ⟶

152230-BWP-20120624-32-[BWP_0004_BWP_NUM_10_B_STD]-[GEN_0000_NO_INSERT]-STANDARD-1-1-2110

Figure 3.20 – Copy of Sample Customer Home Energy Report
Source: BWP

Some of the ongoing programs include:

- **Energy Solutions –** Currently open to any business customer, this program provides rebates for any type of energy efficiency project. In FY 2013-14, BWP doubled the rebate for LED lighting projects to $0.10 per kWh of annual energy saved. This higher rebate has led to more than a 600% increase in savings from LED lighting projects.

  BWP also began sending a customized digital newsletter, known as *The Wire*, to program participants and other large business customers that provides technical and operations assistance to save energy and water. The newsletter allows BWP to promote its rebates and other programs, and gives customers the ability to interact with their key account managers and other experts.

- **Home Improvement Program -** For residents, BWP's flagship program is the *Home Improvement Program*, which is available at no charge. The program was designed to reduce electric use. BWP introduced the program in November 2009 as a whole house, direct install program and has been expanding it ever since. BWP has also partnered with the Southern California Gas Company and the Metropolitan Water District of Southern California to leverage additional funding and reduce natural gas and water use as well.

The program has several components, including:

- in-home audit with energy and water education; and
- free installation of CFL and LED bulbs and water saving devices.

  In addition, BWP assesses single family homes for additional services including:

- installation of attic insulation;
- duct testing and sealing;
- central air conditioning tune-ups and air sealing; and
- outdoor water conservation measures.

In FY 2014-15, BWP had more than 900 households in the program, with an average savings of more than 800 kWh per household. As of November 2015, the program has served more than 5,800 households, more than 10% of Burbank households, after less than six years of operation.

With current changes to the program, many of the participating residents are now qualified to receive incentives through the state's *Advanced Energy Upgrade California Program*. In addition, the program continues to receive awards, from the CMUA and the American Council for an Energy-Efficient Economy (ACEEE).

3.7.5 Other Energy Efficiency Program Descriptions

BWP staff has grouped energy efficiency programs by associated sector-category classifications used in the reporting tool summary table provided to the State.

- Residential and Non-Residential Cooling: BWP provides services that address all aspects of space cooling for residential homes and commercial buildings, including rebates for the purchase of high-efficiency air conditioners and heat pumps, and free HVAC tune-ups. In FY 2013-14, BWP became one of the few utilities in the country to offer rebates for smart thermostats, which can be controlled remotely and programmed automatically. In FY 2014-15, BWP has had a 50% increase in smart thermostat rebate applications. BWP's combination of rebates for efficient equipment and controls makes it easier for customers to live comfortably during dry and hot summers while still reducing peak demand and saving energy.

- Residential Lighting: BWP provides free compact fluorescent and LED bulbs to residents in the *Home Improvement Program*, as well as participants in the *Refrigerator Roundup Program* and attendees at various community events. In FY 2014-15, BWP provided residents with 1,550 LED bulbs, an increase of more than 35% from FY 2012-13.

- Residential Refrigeration: BWP provides rebates for the purchase of ENERGY STAR refrigerators, and free new ENERGY STAR refrigerators to income-qualified customers. BWP also removes and recycles residents' second refrigerators at no cost in order to help reduce their bills and lessen these older appliances' impact on the grid. Through these programs, more than 1,000 inefficient refrigerators were replaced with more efficient models or removed from service altogether.

- Non-Residential Lighting: BWP provides free direct installation services, including for high efficiency lighting, to all qualified small businesses in Burbank. In addition, BWP provides rebates for customized lighting projects per annual energy saved, including $0.10 per kWh double rebates for LED lighting.

3.7.6 BWP's Energy Efficiency Programs

2014-15 SAVINGS		PROGRAM DETAILS	LIFETIME SAVINGS
44.23%	6,193,036 kWh	**Energy Solutions** Rebate program open to all Burbank Businesses who make energy-efficiency retrofits at their facilities.	79,958,904 kWh
24.96%	3,494,000 kWh	**Home Energy Reports** Report mailed quarterly to residents showing energy use compared to 100 similar Burbank homes.	6,988,000 kWh
10.7%	1,498,610 kWh	**Business Bucks** Direct install program for small to mid-sized businesses. Provides up to $5,000 in energy-saving installations.	13,584,389 kWh
6.18%	865,549 kWh	**LED Street Lighting Retrofit** Replacement of the community's older, inefficient street lights with brighter and more efficient LEDs.	9,521,034 kWh
5.4%	755,871 kWh	**Home Improvement Program** Free program for Burbank residents that provides home upgrades and energy and water saving devices.	7,189,795 kWh
2.81%	393,517 kWh	**Air Conditioning Tune-Ups** Program ensures that Burbank businesses and residents get the highest AC performance possible from tune-ups.	2,482,566 kWh
2.23%	312,449 kWh	**Home Rewards** Cash rewards for residents who purchase and install high-efficiency appliances and products in their home.	4,159,010 kWh

Figure 3.21 – BWP's Energy Efficiency Programs
Source: BWP

2014-15 SAVINGS		PROGRAM DETAILS	LIFETIME SAVINGS
3.49%	487,506 kWh	Other Programs	
	128,902 kWh	LivingWise School Kits Kits with energy and water saving devices provided to all 6th grade BUSD students.	1,160,118 kWh
	102,500 kWh	Ice Bear Peak Shifters Ice-making units that attach to commerical air conditioners to save energy in peak hours.	1,537,500 kWh
	85,624 kWh	Refrigerator Round Up BWP environmentally recycles second household refrigerators and provides the homeowner with $50.	428,120 kWh
	56,017 kWh	Made in the Shade Residential and business shade tree program designed to reduce air conditioning use and costs.	1,680,510 kWh
	37,492 kWh	Refrigerator Exchange Low-income residents may replace their old refrigerator with a free Energy Star™ unit.	524,888 kWh
	36,804 kWh	Non-Profit Demonstration A pilot program to retrofit cash-strapped Burbank's community non-profits with lighting and HVAC upgrades.	368,040 kWh
	31,588 kWh	Water Transportation Savings Energy saved from transporting less water due to California's reduced water consumption.	157,942 kWh
	8,579 kWh	Efficient Lightbulb Distribution At events, BWP provides CFL and LED light bulbs for Burbank Residents.	42,895 kWh

Figure 3.22 – BWP's Energy Efficiency Programs
Source: BWP

All of these programs have led to significant energy savings for Burbank.

Energy Savings

YEAR	NET PEAK SAVINGS kW	GROSS ANNUAL SAVINGS kWH	GROSS LIFECYCLE SAVINGS kWH	TOTAL RESOURCE COST (TRC)	NET LIFECYCLE GHG REDUCTION (METRIC TONS)
2010-11	4,262	13,824,872	160,474,123	1.26	86,594
2011-12	4,386	12,356,629	124,768,204	1.76	67,458
2012-13	3,249	11,292,372	103,374,349	2.08	55,731
2013-14	3,097	11,730,959	97,005,344	2.14	52,808
2014-15	3,044	14,000,539	129,783,711	2.64	77,649

Figure 3.23 – BWP's Energy Savings
Source: BWP

3.8 Customer Distributed Generation

Distributed generation is smaller-scale power generation occurring at a customer's premises. In contrast, BWP's generation portfolio is primarily comprised of large-scale power generation located either outside Burbank or within the BWP system but outside a customer's premises, such as local generation resources like Magnolia and Lake One. The customer-owned distributed generation in Burbank is all solar PV systems, commonly known as "rooftop solar", and is being installed throughout the City.

Rooftop solar has benefits and drawbacks. It is environmentally friendly and does not require transmission to reach customers. On the other hand, it is an intermittent resource: it only generates when the sun is up and not obscured by clouds or obscured by trees, but passing clouds cause power generation to swing up and down rapidly, challenging reliability. Rooftop solar also affects rate design, as discussed elsewhere in this IRP.

To help customers capture the benefits of rooftop solar, BWP offers a Solar Rebate Support program which actively encourages the installation of solar PV systems on customer's premises. In addition to the substantial subsidies to customers who install these systems, BWP also offers solar workshops, tours of the BWP Solar PV Demonstration Installation, and other educational outreach.

Falling prices, rebates and tax incentives, and no-money-down leasing arrangements have created a new solar reality for many Californians. In a November 2014 survey, about a third of Burbank homeowners said they plan to install solar energy at their home in the next two years.

Since 2010, customer participation in this program has grown more than five-fold. There are 347 installations totaling approximately 3.6 MW as of October 2015. This growth continues even though the subsidy levels were reduced recently, in line with reductions in the cost of solar panels.

BWP expects that by 2020, there will be between 6 and 10 MW of cumulative capacity installed in Burbank with approximately 8,000 MWh of solar generation from customers annually.

Distributed Generation Growth in Burbank

YEAR	ESTIMATED ANNUAL PRODUCTION: MWh	MW
2009 - 10	344.04	0.20
2010 - 11	1576.13	0.95
2011 - 12	401.66	0.26
2012 - 13	279.21	0.18
2013 - 14	412.52	0.26
2014 - 15	711.36	0.46

Figure 3.24 – Distributed Generation Growth in Burbank
Source: BWP

The increase of solar generation plays a major role in BWP's resource planning. BWP must be prepared to deal with the daily load impacts solar makes to BWP's power supply in the middle of the day, when solar power is being generated. Properly balancing the increase of this intermittent power source to BWP's supply is paramount to ensuring low electric rates and system wide reliability.

3.9 Fuel Cells

Distributed generation can also take different forms, such as reciprocating engines (similar to vehicle engines) or fuel cells. While reciprocating engines are usually used as standby, emergency-only power due to their air emissions, fuel cells can operate as base-load units, i.e., producing power nearly all the time.

In recent years, fuel cells have gained attention as another option for customer installed generation. Fuel cell technologies provide similar efficiency benefits like that of large utility-owned generating units but are smaller and can be located at customer sites. Fuel cells generate electricity by a chemical reaction. As long as a continuous source of fuel and oxygen is provided, fuel cells can produce electricity continuously. For larger customers, fuel cells have an economic appeal. State and Federal incentives have made this technology enticing to companies that can leverage these incentives with favorable natural gas prices. There are customers in Burbank that have expressed interested in this emerging technology.

The State of California, as a matter of policy, supports customer installed generation as a way to reduce electric load, reduce greenhouse gases, and improve the electric delivery system. Burbank supports renewable energy generation. However, the issues for cities like Burbank are:

- Type of customer installed generation. Is it best suited for the community given local energy policy?
- Economic impact for the entire rate-paying customer base?

Current fuel cell technology uses natural gas to power the cell. Natural gas is a fossil fuel and hence a non-renewable resource. While fuel cells are a valuable generation alternative in certain circumstances, their reliance on fossil fuel makes their presence in Burbank inconsistent with Burbank's existing and long-standing energy policy.

While state policy encourages the expansion of customer generation as a way to reduce peak energy demand, reduce energy line losses, defer distribution system upgrades, and increase service reliability, very few of these benefits have been adequately quantified. In Burbank, customer generation actually offers little assistance for the electrical system. Burbank has maintained its infrastructure and has invested in its internal transmission and distribution system on an ongoing basis. BWP's electrical line losses are very low and system reliability is astonishingly high, with 99.999% availability in 2014 and 2015.

BWP's high reliability and system performance magnifies the fact that the Burbank transmission and distribution system is in a much better position than other utilities and would not benefit from customer distributed generation to the same degree.

Burbank is also fully resourced. In fact, Burbank is over-resourced due to BWP's commitment to conservation and the addition of utility and customer-owned renewable energy. Adding resources when none are needed has consequences to the other customers that must be considered.

- First, traditional electric rates are designed to recover costs on units of energy sold, including both fixed and variable costs. If consumption drops, fixed costs currently included in the unit cost of energy will not be recovered. Under the current rate structure, customers who self-generate and reduce their purchase of energy from the utility will not be contributing to the recovery of certain fixed costs, such as distribution wires and power poles. Unless there is growth in the City to contribute to fixed cost recovery, these fixed costs must be shifted to other customers.

- Second, since Burbank has secured more than sufficient resources to meet customer needs, customer generation contributes to an additional excess supply of energy in the City. While sale of excess energy is feasible, the wholesale value of the excess energy is far less than its cost. For example, currently BWP credits solar customers $0.16 per kWh for the solar power. Burbank sells power on the market for just $0.01 to 0.03 per kWh, if possible. In fact, some days there is negative value in the market and BWP must pay others to take the energy. BWP is not the only utility in this position and given the continuous adoption of renewable energy in the Western United States, it is expected that holders of excess energy will continue to pay other parties to take the energy. Remember the "Duck Curve": this is exactly the situation in the belly of the duck, lots of excess energy, hence creating a policy problem for the City and the State.

Although fuel cells are very clean fossil fuel technology, the impact of fuel cells generating 24 hours a day further exacerbates the problems associated with excess energy. If the market value of energy produced 24 hours a day is about $0.03 per kWh, and the average retail energy rate is $0.09 per kWh for the average commercial customer, there would be a fixed cost recovery loss of $0.06 for each kWh of energy generated by additional generation from fuel cells. Therefore, for each megawatt of customer-owned fuel cell generation, Burbank customers must absorb $525,000 of additional rate increases annually for the lost fixed cost recovery.

There are approximately 300 commercial customers in Burbank who could have their energy needs partially met with a fuel cell. This might translate to 10 MW of fossil fuel generation in the City in the next five to seven years. Without growth to offset the loss of fixed cost recovery, fuel cells will have a disproportionate impact on non-participating customers, translating to a 30-40% rate increase. Therefore, allowing fuel cells in Burbank at this time will increase the need to raise rates.

Consistent with City Council direction on April 28, 2015, BWP has deferred consideration of allowing fuel cells, fueled by fossil fuels, until such time as there is sufficient growth to mitigate the rate impacts to the non-participating electric customers. Along the same directive, BWP will consider fuel cells, if the fuel cells are fueled with CEC-qualified renewable fuel.

Chapter 4 - Long Term Planning Environment

4.1 Legislative and Regulatory Factors

The business of providing electricity is changing dramatically. The change is due to power and commodity market developments, government legislation and regulations at the national and state levels, politics, new technologies, and the economy. Customer needs are also changing and affecting the business.

The electric utility industry is heavily regulated at the national, regional, and state levels. As a result, legislation and regulation significantly influence long-term resource planning for BWP. This chapter highlights the current legislative and regulatory environment and provides an overview of BWP's toolkit to deal with the challenges. BWP's tools include, but are not limited to, rate design, power supply agreements and procurement, distribution planning, and financial and operational analysis.

4.1.1 Greenhouse Gas Emissions

A primary reason for utility-related government regulation and legislation is to reduce GHG emissions. Accordingly, GHG reductions may be the primary challenge for BWP to meet in the years ahead. GHG serves as the backdrop for much of the legislation and regulation affecting BWP.

Greenhouse gases act like a blanket around the Earth, trapping energy in the atmosphere and causing the Earth to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth. However, the buildup of greenhouse gases can change the Earth's climate, and have dangerous effects to human health and to ecosystems. This effect is widely known as climate change.

In the past century, human activities have released large amounts of CO_2 and other greenhouse gases into the atmosphere. The majority of greenhouse gas emissions have come from burning fossil fuels, although deforestation, industrial processes, and some agricultural practices can also emit gases into the atmosphere. According to the U.S. Environmental Protection Agency (EPA), CO_2 accounted for about 82% of all U.S. greenhouse gas emissions in 2013.

The combustion of fossil fuels to generate electricity is the largest single source of CO_2 emissions in the nation, accounting for about 37% of U.S. CO_2 emissions and 31% of U.S. GHG emissions in 2013. Different types of fossil fuels and methods of combustion used to generate electricity emit different amounts of CO_2. To produce a given amount of electricity, burning coal will produce more CO_2 than oil or natural gas. Investing in clean power sources such as solar, wind, hydro, and geothermal can help offset climate change but they can come at a higher cost to customers. Balancing the cost of procuring clean energy, reducing emissions, and maintaining reliability will continue to be a significant challenge.

California has also mandated the use of energy efficiency programs to offset GHG. These programs have not only lowered customer bills, they have helped enhance customers' understanding of energy efficiency as a tool to combat climate change.

The following chapter covers significant legislation and regulation currently affecting BWP as of December 2015:

4.1.2 Federal Legislation

There have been many major federal Energy Policy Acts that have been enacted in the last few decades, which include provisions on energy conservation, such as the ENERGY STAR program, and energy development, with grants and tax incentives for both renewable energy and non-renewable energy. The most notable issues are the EPA regulations and comprehensive energy legislation to reduce GHG.

In 2013, President Obama announced a series of executive actions to reduce carbon pollution, to prepare the U.S. for the impacts of climate change, and to lead international efforts to address global climate change. These executive actions have been the vehicle of choice for policy direction, largely because Congress has not been able to pass comprehensive long-term energy policy or climate change legislation. President Obama issued a Presidential Memorandum establishing a Quadrennial Energy Review to focus on "[t]he Nation's infrastructure for transporting, transmitting and delivering energy. The first Quadrennial Energy Review will serve as a roadmap to help address these challenges."

4.1.3 EPA Clean Power Plan

On June 2, 2014, the EPA issued its proposed Clean Power Plan (CPP) to reduce GHG, especially targeting CO_2 emissions from existing power plants. The CPP is expected to have far-reaching impacts on states and the power sector. On August 3, 2015, the EPA finalized the rules. These rules have since been the subject of litigation.

The CPP establishes carbon pollution standards for power plants, called CO_2 emission performance rates. States will develop and implement tailored plans to ensure that the power plants in their state meet these standards. The CPP provides some flexibility in how state plans can design and implement, including opportunities for states to include trading and demand-side energy efficiency, and allow states to develop "trading ready" plans or to participate in "opt in" emission credit trading markets with other states, and/or take parallel approaches without the need for interstate agreements. All low-carbon electricity generation technologies, including renewables, energy efficiency, natural gas, nuclear and carbon capture and storage, can play a role in state plans. States will detail how they will meet the standard in what are known as state implementation plans, or SIPs.

By driving emission reductions from power plants, the CPP builds on other federal initiatives to reduce emissions, including investments to deploy clean energy technologies, doubling the fuel economy of our cars and light trucks, and reducing methane pollution.

Taken together, the CPP puts the United States on track to achieve the President's near-term target to reduce GHG emissions of 17% below 2005 levels by 2020 and lay a strong foundation to deliver the President's long-term target to reduce emissions 32% below 2005 levels by 2030.

The EPA offered three building blocks to achieve GHG reductions, but states are not required to follow the guidelines. These building blocks are based on actions already underway in many states:

- Make fossil fuel burning plants more efficient;
- Dispatch low-emissions sources, namely natural gas, more often; and/or,
- Continue the renewable energy expansion already underway and continue using existing nuclear power.

The CPP affects BWP in many ways, but its primary impact is on the future of Intermountain, which burns coal. The nature and consequences of the CPP on Intermountain are currently being studied by Intermountain's owner, Intermountain Power Agency, and the Intermountain participants.

4.1.4 Tax-Exempt Financing

Tax-exempt financing is the chief means by which governments (like the City of Burbank) and municipally owned utilities (like BWP) finance infrastructure construction. This infrastructure includes the power system: from power plants to transmission and distribution facilities to other utility assets. Tax-exempt financing allows municipal entities to issue bonds that are not subject to federal income tax for the bondholders, therefore lowering borrowing costs and the cost of infrastructure projects. Access to this type of financing tool facilitates local government borrowers to make infrastructure improvements.

Tax-exempt financing remains available but is periodically subject to legislative challenge. BWP, together with SCPPA and other regional and national bodies, continues to monitor legislation surrounding its favorable tax treatment.

4.1.5 Dodd-Frank and Swap Transactions

In 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act became law. The legislation, known as "Dodd-Frank," is a massive package of financial reform legislation passed in response to the financial crisis of 2007-2009. Dodd-Frank seeks to reduce systemic risk in the U.S. financial system, increase transparency of the financial markets, and promote market integrity. However, one provision of Dodd-Frank has inadvertently affected the way municipal utilities can conduct their business.

This provision makes it more difficult for municipal utilities to use financial instruments known as "swaps" to hedge their operational risks, such as changes in fuel prices. A "swap" is a transaction in which two counterparties exchange cash flows of one party's financial instrument for those of the other party's financial instrument. In a utility context, swaps are one of many types of transactions used to hedge risks that utilities cannot control through their own operations, such as the risk that natural gas prices increase and therefore increase power costs for utility customers.

This provision was controversial because it could exclude some of public power entities' financial counterparties (including some of BWP's current energy derivative swap partners), such as natural gas producers, investor-owned utilities, and other energy firms) from swapping other energy derivatives with BWP. Fewer swap partners for BWP could lead to fewer opportunities to manage and reduce BWP's costs, thereby hampering BWP's ability to keep electric rates low.

In response to this provision in Dodd-Frank, in 2014 the US Commodity Futures Trading Commission, a US federal government regulatory commission, approved a final rule to make swaps available to public power utilities. Further, to eliminate any ambiguity, in April 2015 U.S. Sens. Jim Inhofe (R-Okla.) and Joe Donnelly (D-Ind.) reintroduced S. 1111, the *Public Power Risk Management Act*, bipartisan legislation that would clarify these same provisions of Dodd-Frank.

4.1.6 California Legislation

For more than a decade, California has been on the leading edge of state policies affecting energy efficiency, the environment and resource planning. The American Council for an Energy Efficient Economy (ACEEE) currently scores California as #2 in the United States pursuant to its annual ACEEE Energy Efficient Scorecard, which ranks the effectiveness of state energy efficiency policies and program efforts.

The following legislation has shaped California's current energy policy since 1996.

4.1.6a Energy Efficiency Legislation

- *Assembly Bill (AB) 1890 – Public Benefits Surcharge (1996)*
  AB 1890 specifies that all electric distributing agencies must set aside 2.85% of annual electric retail revenues for public benefit programs. Eligible programs for this spending requirement must fall into at least one of the following four categories related to the public benefits of electricity:

  - ✓ Energy efficiency;
  - ✓ Low-income electric rate assistance;
  - ✓ Renewable energy; and,
  - ✓ Research, demonstration and development.

- *Senate Bill (SB) 1037 – Achieving Energy Efficiency (2005)*

SB 1037 established several energy efficiency policies including a statewide commitment to energy efficiency with a goal that all utilities consider energy efficiency before investing in any other resources to meet growing demand.

- *Assembly Bill 2021 – Verifying Energy Efficiency Programs (2006)*

  AB 2021, together with companion legislation SB 1037, requires independent evaluation to measure and verify the energy and demand savings produced by a utility's energy efficiency programs.

  AB 2021 also requires that publicly owned utilities go through a third-party to identify all potentially achievable cost-effective energy efficiency savings, and update the ten-year targets every three years.

4.1.6b State Greenhouse Gas Reduction Legislation

- *Senate Bill 2: Mandatory State Renewable Portfolio Standards (2002)*
  Established in 2002, under Senate Bill 1078, accelerated in 2006 by Senate Bill 107 and expanded in 2011 under Senate Bill 2, California's Renewables Portfolio Standard (RPS) is one of the most ambitious renewable energy standards in the country.

  The RPS program requires all utilities, to increase renewable energy resources to 33% of total energy by 2020. This legislation set the stage for California Governor Edmund G. Brown Jr. to increase to 50%, renewable sources by 2030, in Assembly Bill 350.

- *Senate Bill 1 – Subsidies for Customer Solar (2005)*

  In 2005, SB 1 was enacted with the intention of expanding rooftop solar PV systems as a means to reduce energy use and therefore GHG. It had two mandates:

  1. Required utilities provide subsidies to customers for the installation of PV solar systems on their premises.
  2. Established resource adequacy requirements for all load-serving entities in the State.
     This means that municipal utilities must maintain and have physical generating capacity that is adequate to meet its peak demand requirements.

- *Senate Bill 1368 – Fossil Fuel Emissions Limits (2006)*

  SB 1368 set emission limits on resources that California electric utilities can import from outside California. Pursuant to SB 1368, California electric utilities will not be able to enter into energy contracts for terms longer than five years from high-GHG power resources, such as Intermountain. In particular, SB 1368 specifies that for resources expected to run at greater than a 60% capacity factor, the average CO_2 output needs to be less than 1,100 lbs./MWh. Intermountain's average CO_2 output exceeds this threshold.

The most significant impact of SB 1368 is that it severely limits BWP's ability to renew its contracts with Intermountain after the current contracts expire in 2027.

- *Assembly Bill 32 – Greenhouse Gas Limits (2006)*

AB 32 was far-reaching, first-of-its-kind legislation to reduce GHG.

The goal of AB 32 is to reduce GHGs to 1990 levels by 2020. Today, California's goal is a reduction of 80% below 1990 levels by 2050. However, until recently, there was not a plan or mid-term target between 2020 and 2050.

Under AB 32, the California Air Resources Board (CARB), a state regulatory agency, is responsible for monitoring and reducing GHG emissions. This responsibility included developing a scoping plan for regulating statewide GHG emission caps, mandatory GHG reporting, and evaluating the impact of AB 32 on the economy, environment, and power system reliability.

Below, the CARB provides a graph from the Scoping Plan 2013 of the various contributions to GHGs in California. The Scoping Plan is updated every five years. This graph shows the need for further reductions in the transportation sector, most likely by switching from gasoline and diesel fuels to electricity and hydrogen.

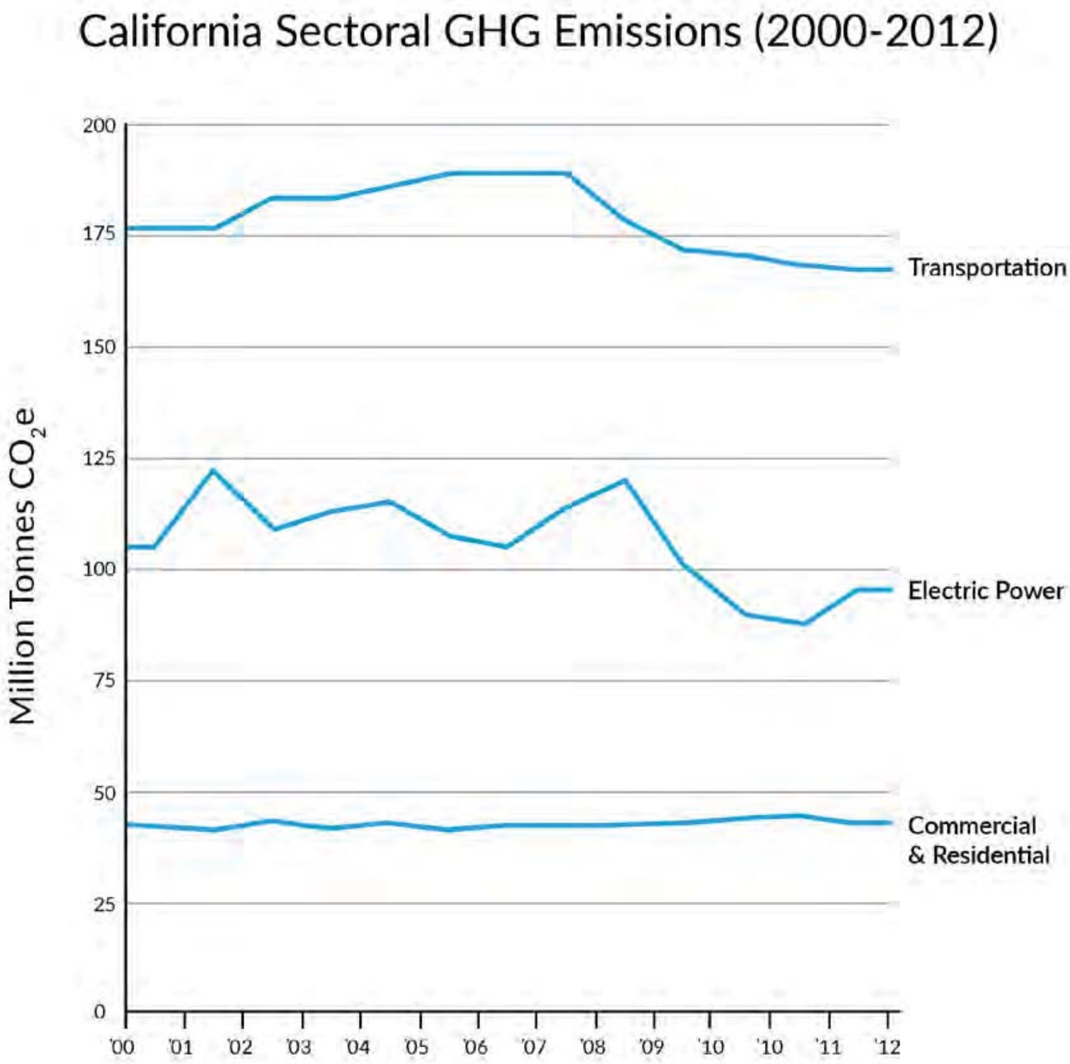


Figure 4.1 – California Sectoral GHG Emissions (2000-2012)
Source: California Air Resources Board

In 2012, CARB developed the State of California's landmark GHG Cap-and-Trade Program, under which companies must hold enough GHG emission allowances to cover GHG emissions created by their activities. The availability of GHG allowances is designed to decrease over time, such that affected companies or utilities are compelled to either reduce GHG emissions, or buy allowances to cover GHG emissions that have not yet been reduced.

Because of early action in the form of setting renewable energy targets and acquiring renewable resources, prior to passage of AB32, the electric utility industry was allocated allowances throughout the term of the program (through 2020) to help reduce the costs of the program. Burbank expects to receive its annual allotment. The table below shows the annual allowances that have been and will be allocated to Burbank.

Cap and Trade

Compliance Instrument Allocation

YEAR	COMPLIANCE INSTRUMENTS
2013	626,377
2014	621,216
2015	613,617
2016	606,653
2017	605,197
2018	592,719
2019	584,011
2020	576,628

Figure 4.2 – Cap and Trade Compliant Instrument Allocation
Source: California Air Resources Board

AB 32 has the potential to reduce California's GHG emissions substantially, as shown in the graph below. GHG emission reductions are measured as per million metric tons of carbon dioxide emissions (MMT CO_2).

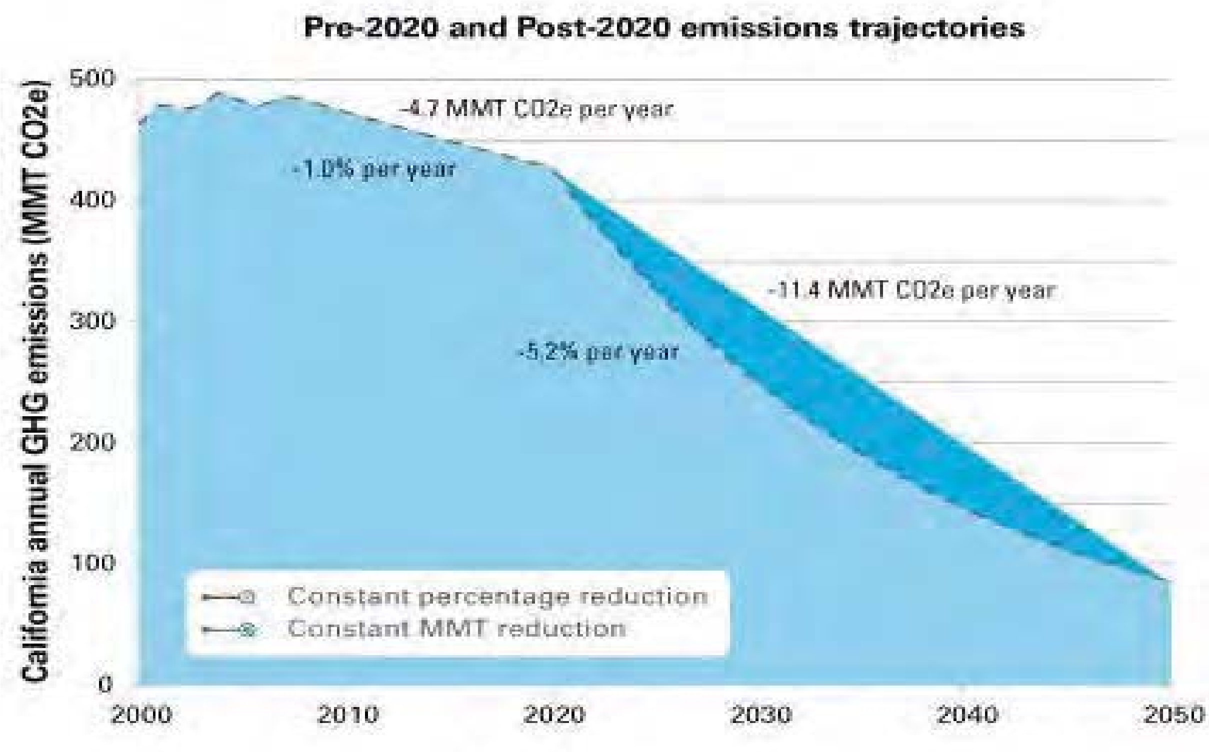


Figure 4.3 – Pre- and Post-2020 Emissions Trajectories
Source: California Air Resources Board

AB32 has also impacted the transportation fuel industry, specifically via the Low Carbon Fuel Standard (LCFS). The LCFS calls for a reduction of at least 10% in the carbon intensity of California's transportation fuels by 2020. These reductions include not only tailpipe emissions but also all other associated emissions from production, distribution and use of transport fuels within the state. The standard is also aimed to reduce the state's dependence on petroleum, create a market for clean transportation technology, and stimulate the production and use of alternative, low-carbon fuels in California. Low-carbon fuels mean less CO_2 and are typically cleaner fossil fuels including compressed natural gas and liquefied petroleum gas or alternative fuels such as biodiesel, bio-alcohol, propane, biomass, and chemically stored electricity such as fuel cells or batteries.

- *Executive Order B-30-15 (2015)*
  In April 2015, Governor Brown issued Executive Order B-30-15, which establishes a new interim statewide GHG emission reduction target to reduce GHG emissions to 40% below 1990 levels by 2030 in order to ensure California meets its target of reducing GHG emissions to 80% below 1990 levels by 2050.

- *Governor's 50-50 Plan - Senate Bill 350 (2015)*

  In Governor Brown's January 2015 inaugural address, he called for 50% of California's electricity to come from renewable sources by 2030, up from a 33% goal by 2020. Governor Brown also called for doubling the energy efficiency of existing buildings and reducing automobile dependency on oil and gas by 50%.

  In October 2015, Governor Brown signed SB 350 into law which moves much of the Governor's plan into effect, less the plan on reduction of automobile dependency on oil and gas by 50%.

  SB 350 aims to do the following:

- Increase RPS to 50% by 2030;
- Direct the CEC to set annual statewide targets to double energy savings through energy efficiency by 2030;
- Initiate the process to create a multi-state regional governance structure for the CAISO;
- Create new integrated resource planning requirements for investor-owned utilities, many of the publicly owned electric utilities, electric service providers, and community choice aggregators; and
- Direct the CARB to adopt regulations to remove disincentives for utility investment in transportation electrification

4.1.7 Beyond 2020

With SB 350 and the EPA's CPP, legislators and regulators clearly intend to reduce GHG emissions to minimize the impact of climate change. BWP has the same goal: to reduce GHG emissions, in large part through achieving a 50% RPS by 2030 while maintaining affordable and reliable service for Burbank.

4.2 Rate Design

BWP's electric rates are designed to recover the cost of serving its customers, which includes the cost to maintain excellent reliability, customer service, and creditworthiness. Beyond this objective, BWP's near and long-term rate design objectives are to ensure that its rates adhere to

Cost of Service principles, that its rates are sending appropriate price signals, and that its rates do not shift costs from any one group of customers to another.

Carefully designed utility rates are fundamental to maintaining reliable and affordable service, especially during evolving legislative and regulatory pressures to reduce GHG emissions.

BWP currently has five general rate schedules for its customers:

- residential
- small commercial
- medium commercial
- large commercial
- extra-large commercial

4.2.1 Rate Design Factors

BWP's electric rates are designed to recover the cost of serving its customers, which includes the cost to supply energy, maintain excellent reliability, and provide customer service. Beyond this objective, BWP's near and long-term rate design objectives are to ensure that its rates adhere to Cost of Service principles, that its rates are sending appropriate price signals, and that its rates do not shift costs from any one group of customers to another.

4.2.2 Cost of Service Analysis

The purpose of a cost of service study is to ensure that each customer class is paying its fair share of total system costs. A cost of service analysis also greatly informs the rate design process because rates are often designed to recover specific system costs. A cost of service analysis is used to determine the cost of serving each customer class. An electric utility cost of service study was completed in 2013 with the assistance of rate consultants, Microdesign Northwest. A cost of service analysis follows three general steps:

1. Functionalization: Operations and maintenance costs are categorized by specific utility functions, such as power supply, distribution system, or customer service.
2. Classification: Costs by function are classified according to how these costs vary. Costs may vary according to total energy sales, peak demand, or number of customers served, for example.
3. Allocation: Costs by classification are allocated to each customer class according to each customer class' share of the measure of variation of energy sales, peak demand, etc. The total allocated cost for each customer class is the cost of serving that customer class and as such, rates should be designed to recover that amount.

4.2.3 Appropriate Price Signals

Beyond ensuring that each customer class pay its fair share of operating and maintaining the electric utility, BWP believes its rates should send appropriate price signals to customers to help them understand—and respond to—how the utility's costs vary overall. Naturally, the more energy customers use, the more costs are incurred. However, *when* and *how* customers use more energy greatly impacts which costs are incurred for BWP and how much. BWP believes electric rates should be designed to reflect the *when* and *how* costs are incurred. This belief is reflected in the rates for BWP's largest customers. Large and extra-large commercial customers are subject to time-varying energy charges called Time-of-Use (TOU) rates, which reflect the cost of time-varying bulk power supply, and demand charges that reflect the cost of maintaining both distribution system capacity and peak power supply capacity.

TOU rates were introduced for BWP's extra-large customers in 2007, for large customers in 2008, followed by medium commercial customers in 2015 and are projected for small commercial customers in 2017. BWP intends to bring TOU rates to residential customers in FY2018-19.

4.2.4 Residential Rates

Residential customers include single family residential, multifamily residential, and lifeline customers. Single family residential and multifamily residential customers are the largest group with over 45,000 customers and have three types of electric charges. Each single family and multifamily residential customer is subject to:

- a monthly customer service charge.
- a two-tier inclining-block rate for energy measured in kWh. As of December 2015, the composite two-tier energy rate is separated by the first 300 kWh to encourage energy conservation.
- a service size charge which recovers customer-specific system costs, including the cost of wires and transformers but is determined by the customer's electrical panel size and the number of homes or buildings sharing a single transformer.

Customers are split by small, medium and large panel sizes, defined as follows:

- Small: Service location with two or more meters per service drop and does not meet definition of large; typically multifamily residential.
- Medium: Service location with one meter per service drop and does not meet definition of Large; typically single family residential.
- Large: Service with panel size greater than 200A.

Lifeline customers are senior or permanently disabled customers who receive a discounted electric rate on their utility bills. Lifeline customers are subject to the service size charge and a two-tier rate for energy.

A two-tier inclining-block rate for energy measured in kilowatt hours (kWh). As of December 2015, the composite two-tier energy rate is separated by the first 400 kWh to encourage energy conservation.

BWP also offers an optional Time-of-Use (TOU) rate for its electric vehicle customers. This optional rate schedule is designed to encourage electric vehicle owners to charge their vehicles during low-cost periods. A more-detailed discussion of Time-of-Use rates is presented in the Large Commercial and Extra-Large Commercial sections. The TOU rate for electric vehicle customers includes the following:

- A monthly customer service charge.
- The same service size charge as detailed above.
- TOU Energy Charges, with time periods as follows:

Time-of-Use Periods for Residential EV TOU Customers Summer June 1 -October 31 November 1 - May 31	**Time Periods**
Summer On-Peak	All Days 4pm-7pm
Summer Mid-Peak	All Days 8a – 4p, 7p-11p, except Holidays
Summer Off-Peak	All Other Hours
Winter Mid-Peak	All Days, 8am-11pm
Winter Off-Peak	All Other Hours

4.2.5 Small Commercial

Small commercial customers include commercial customers with billing demands below 20 kilovolt-amperes (kVA). BWP is required to have electricity available to meet customer needs, whenever they need it, even if they need it all at the same time. In other words, BWP must be ready to provide electricity whenever customers "demand" it. Small commercial customers are not billed for billing demand.

These include many small retail and small office customers, such as local barber shops or mom-and-pop clothing stores. Small commercial customers have just two different types of electric charges. Small commercial customers are subject to:

- a monthly customer service charge
- a uniform non-tiered rate for energy

4.2.6 Medium Commercial

Medium commercial customers include commercial customers with demands above 20 kVA but below 250 kVA. These customers have high demands and are billed a demand charge for this service. This appears as a "demand" charge on a customer bill and is measured in kVA. The charge is for the highest 15-minute period during the month. High demand is usually associated with equipment start-up, which requires higher energy use than routine operations. These include many auto repair, medium sized retail stores and multilevel office buildings.

Medium commercial customers have three different types of electric charges. Medium commercial customers are subject to:

- a monthly customer service charge
- a demand charge based on a 15-minute demand
- TOU energy charges

Note that the monthly customer service charge varies depending on whether the customer is unmetered, has single phase service, or three-phase service.

TOU energy charges are volumetric ($/kWh) rates that vary based on the time of day, season, and observation of holidays. BWP's TOU charges for its medium commercial customers have three unique periods, On-Peak, Mid-Peak, and Off-Peak in the summer and On-Peak and Off Peak periods only in the winter. Medium commercial TOU rate time periods are defined below:

Time-of-Use Periods for Medium Commercial Customers Summer June 1 -October 31 November 1 - May 31	**Time Periods**
Summer On-Peak	All day 4pm-7pm, except Holidays
Summer Mid-Peak	Weekdays 8a–4p,7p-11p,except Holidays
Summer Off-Peak	All Other Hours
Winter Mid-Peak	Weekdays, 8am-11pm
Winter Off-Peak	All Other Hours

4.2.7 Large Commercial

Large commercial customers include commercial customers with demands above 250 kVA but below 1000 kVA. These include many supermarkets, larger office buildings and "big box" retail stores. Large commercial customers have four different types of electric charges, which vary depending on whether the customer owns and maintains their own transformer on site, which defines them as a primary service customer, or a secondary service customer which is served by a utility-owned and maintained transformer.

These large commercial customers are subject to:

- a monthly customer service charge
- a distribution demand charge
- a reliability service demand charge
- TOU energy charges

BWP's TOU rates for its large commercial customers currently have three unique periods: On-Peak, Mid-Peak, and Off-Peak and they are as follows:

Time-of-Use Periods for Large Commercial Customers Summer June 1 -October 31 November 1 - May 31	Time Periods
Summer On-Peak	Weekdays 4pm-7pm, except Holidays
Summer Mid-Peak	Weekdays 8a–4p, 7p-11p,except Holidays
Summer Off-Peak	All Other Hours
Winter Mid-Peak	Weekdays, 8am-11pm, except Holidays
Winter Off-Peak	All Other Hours

4.2.8 Extra Large Commercial

Extra large commercial customers include commercial customers with demands above 1,000 kVA. Extra large commercial customers have four different types of electric charges, which vary depending on whether the customer owns and maintains their own transformer on site which defines them as a primary service customer or a secondary service customer which is served by a utility-owned and maintained transformer.

Extra large commercial customers are subject to:

- a monthly customer service charge
- a distribution demand charge
- a reliability service demand charge
- TOU Energy charges

BWP's TOU rates for its extra large commercial customers have three unique periods: On-Peak, Mid-Peak, and Off-Peak and are as follows:

Time-of-Use Periods for Extra Large Commercial Customers Summer June 1 -October 31 November 1 - May 31	**Time Periods**
Summer On-Peak	Weekdays 4pm-7pm, except Holidays
Summer Mid-Peak	Weekdays 8a–4p, 7p-11p,except Holidays
Summer Off-Peak	All Other Hours
Winter Mid-Peak	Weekdays, 8am-11pm, except Holidays
Winter Off-Peak	All Other Hours

These rates are designed to recover the cost of bulk power supply; as such, they vary according to three basic market price categories.

4.2.9 Electric Rate Comparison

BWP's residential electric rates remain among the lowest in the region including other municipal utilities, as well as investor-owned utility Southern California Edison. BWP's electric rates have increased at less than the long-run rate of inflation for over a decade.

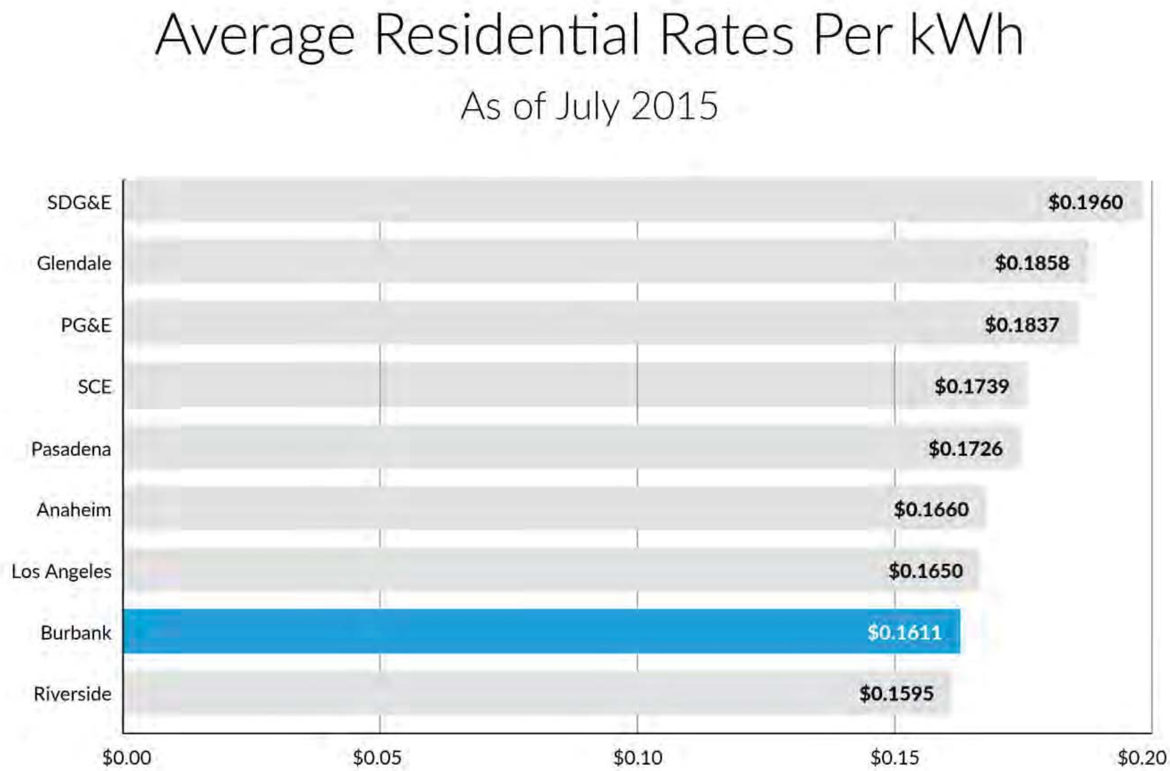


Figure 4.4 – Average Residential Electric Rates per kWh Comparisons for 2015
Source: BWP

Unlike most electric utilities, BWP does not utilize "cost trackers." Cost trackers are fees or charges in addition to its rates that automatically track and adjust to unanticipated changes in costs such as natural gas or wholesale power market costs, the costs of meeting state-mandated renewable energy requirements, or change in sales. In this sense, BWP's rates are "what you see is what you get." All fees and charges are brought before the City Council for approval on an annual basis. Note that while the BWP General Manager has the authority to use trackers, called the Energy Cost Adjustment Charge (ECAC) on a monthly basis, they have not been utilized by BWP for over 10 years.

BWP has also developed short-term as well as long-term energy procurement strategies to reduce price risks and volatility. These strategies are monitored by BWP management utilizing the Energy Risk Management Policy, originally adopted in 2003 and amended in April 2009. Under the Energy Risk Management Policy, the Risk Oversight Committee was formed and meets regularly to discuss the power supply risks, market condition, and transactions needed to maintain reliable and affordable rates to Burbank.

OPERATIONAL ISSUES

4.3 Balancing Authority Services

At any given moment, Californians are consuming enormous amounts of electricity. This electricity is supplied by an interconnected grid of conventional and renewable generation plants, transmission lines, substations, distribution lines, transmission towers, and power poles. The standards for the operation of the interconnected grid in the western region of the United States and Canada are developed by the Western Electricity Coordinating Council, or "WECC."

For operational purposes, WECC serves smaller areas called "balancing authorities" (or "BA"). Each BA is responsible for safe, reliable electricity supply within its area and between its areas to other BAs. Within each BA, individual utilities – like BWP – have a subset of the same operational responsibilities.

To keep electricity flowing reliably and safely, operations at each level – the WECC level, the BA level, and the utility level -- must play their part in continuously balancing the supply and demand of electricity. This ensures that enough power is available to meet electricity needs without placing undue stresses on the interconnected power system.

4.3.1 Western Electricity Coordinating Council

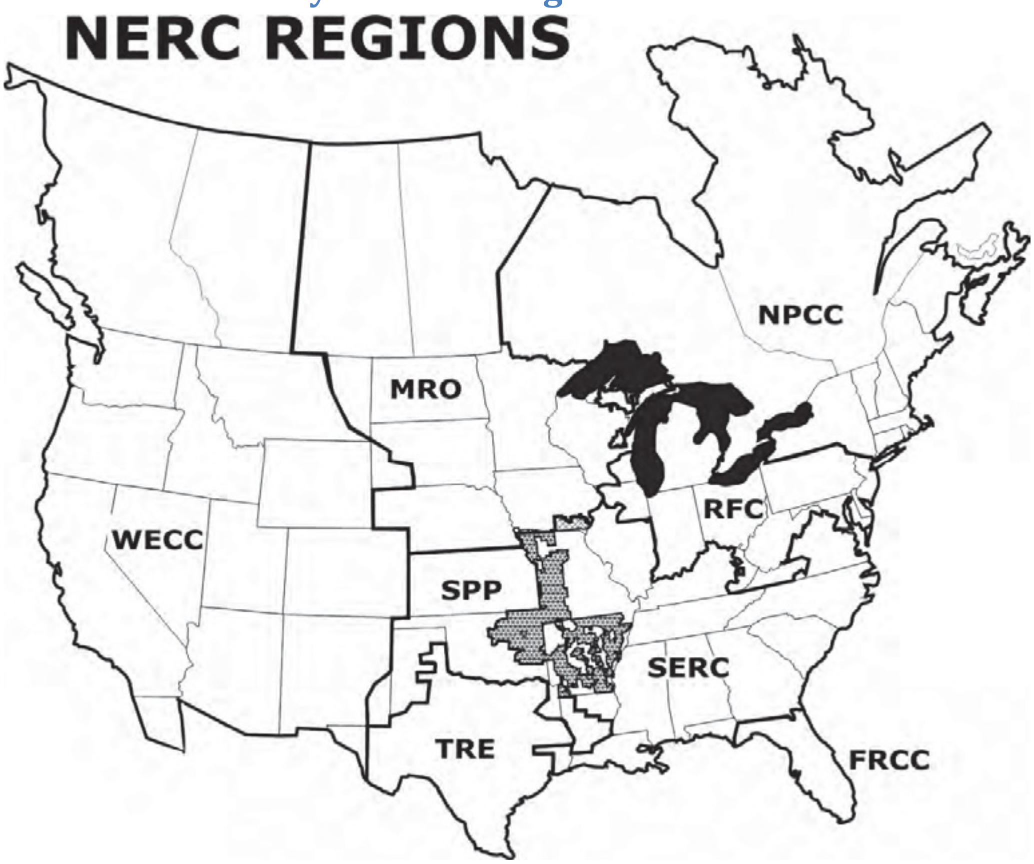


Figure 4.5 – NERC Regions
Source: NERC

For the western U.S., WECC is the organization that sets technical and operating standards for the interconnected electrical grid. Figure 34 above is a map of the continental U.S and the area that WECC oversees.

Among these criteria is WECC's reserve criteria that mandates readiness for unforeseen events, such as equipment failures and natural disasters, which are the most important for reliable power supply. WECC's reserve criteria requires BAs to provide the following reserves to ensure region reliability:

1. **Regulating Reserve –** This is spinning reserve capacity that must be immediately available and responsive to the needs of the electric grid. This is the generating cushion required to maintain interconnection reliability by balancing real power demand and supply in real-time.
2. **Contingency Reserve –** Power plants must have an amount of spinning and/or supplemental reserve power which can be made available within 10 minutes of an outage to replace a resource.
   - Spinning reserve is any online back-up energy production capacity which can be made available to a transmission system within 10 minutes.
   - Supplemental reserve is off-line generating capacity which is capable of being brought online within 10 minutes.

4.3.2 Balancing Authority

There are currently 38 BA's in the Western Interconnection, which serves most of the Western U.S., Western Canada and some of Mexico.

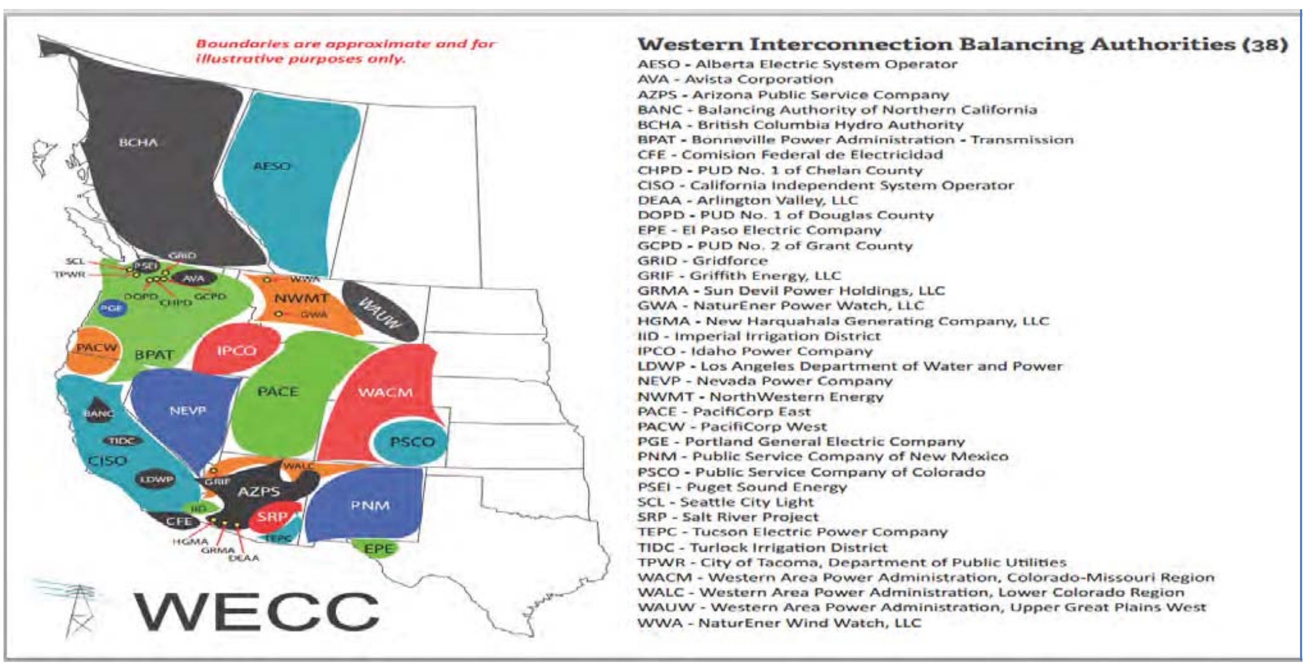


Figure 4.6 – WECC Balancing Authorities
Source: WECC

When the electrical infrastructure was first being built 130 years ago, individual power companies developed their own local electricity systems which, over time, became interconnected with one another. Connections between the neighboring electricity systems improved reliability and efficiency of the whole system, while still allowing the individual power companies to remain in control to serve their own customers' needs. The development of BA's helps to maintain the stability and safety of the entire grid. Problems, such as outages caused by fires or earthquakes, can be isolated and controlled without causing a risk to other parts of the electric grid.

In California, there are eight BAs:

1. Balancing Authority of Northern California (BANC)
2. California Independent System Operator (CAISO)
3. Imperial Irrigation District (IID)
4. Los Angeles Department of Water and Power (LADWP)
5. PacifiCorp-West
6. Turlock Irrigation District (TID)
7. Western Area Lower Colorado (WALC)
8. Sierra Pacific Power (SPP)

The CAISO is the largest of the BA's in California, covering 132,000 square miles in 58 California counties and a small portion of Nevada.

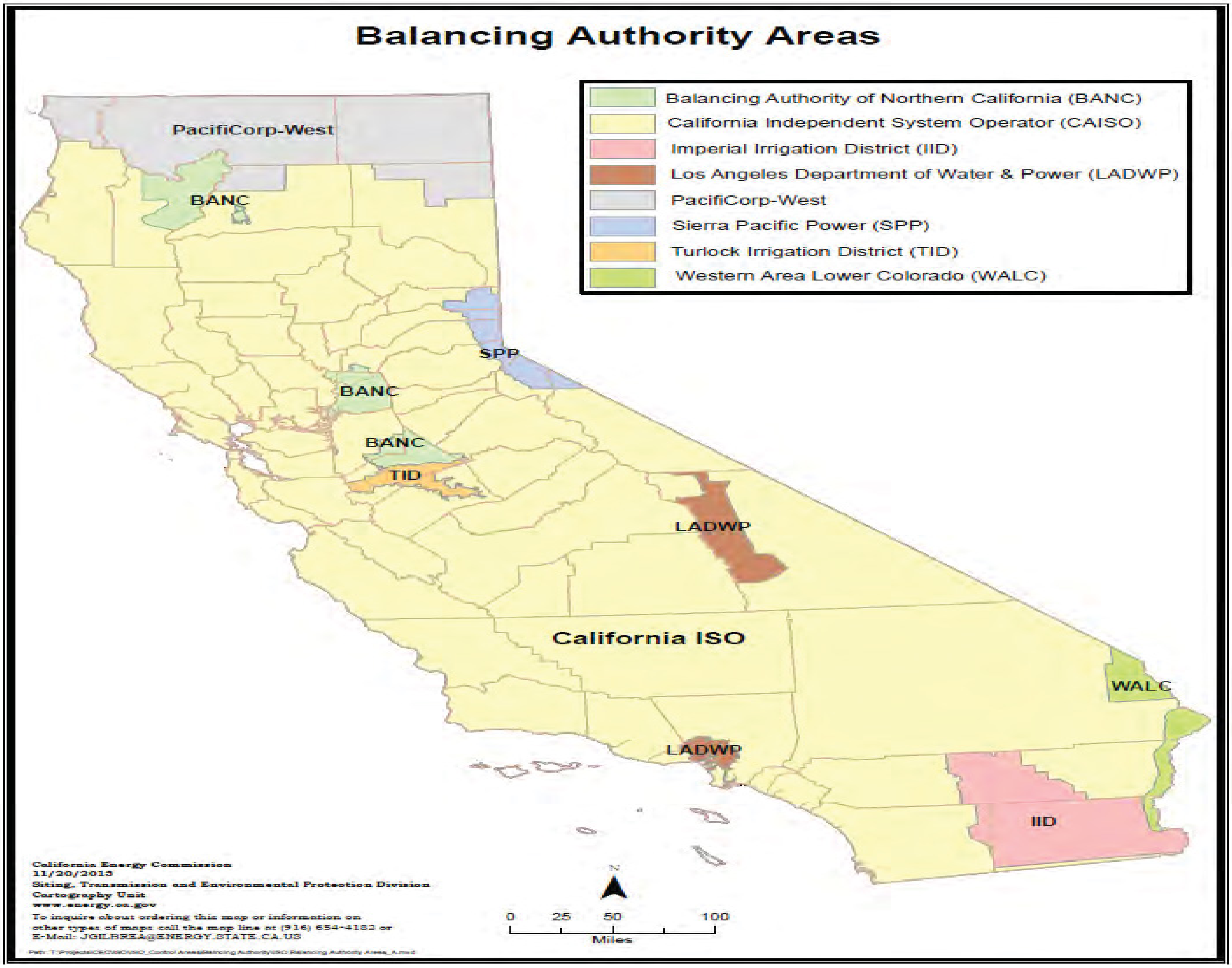


Figure 4.7 – Balancing Authority Areas
Source: CEC

LADWP, Burbank and Glendale are in Los Angeles Department of Water and Power's (LADWP) BA. BWP has been a member of the LADWP BA area (previously called a "control area") since 1937.

A BA has several ways to maintain the balance of supply and demand, from turning generators up and down and on and off, to importing or exporting electricity to or from their neighbors.

4.3.3 BWP Within LADWP's Balancing Authority

Even though BWP is a member of LA's BA, it still needs to provide for its own reserve requirements to cover possible unforeseen events involving its own operations, including its share of generating facilities and transmission lines. Historically, BWP has met this reserve requirement using its local generating facilities. This arrangement was governed by the Southern California Utility Power Pool (SCUPP) agreement, which governed the participation of LADWP, BWP, and Glendale Water and Power (GWP) in LADWP's BA.

In 2011, LADWP cancelled the SCUPP. The SCUPP did not reflect modern industry practice, costs, or cost-allocation. While operations were not affected by this termination, operating within a BA without a formal agreement is a poor practice. For many years after the SCUPP was canceled, LADWP, BWP, and GWP worked without success to develop a new BA agreement.

In August 2013, LADWP issued a proposed Open Access Transmission Tariff (OATT). An OATT is issued by the transmission provider or BA, such as LADWP, to set the terms and conditions, under which any electric market participant may purchase access to that utility's transmission system and associated resources. Under industry practice, a utility issues a proposed OATT for stakeholder review and comment. The OATT is then finalized and implemented only after stakeholders have had an opportunity to gain a detailed understanding of the technical, commercial, and financial assumptions underlying the proposed OATT and to challenge those assumptions through a public process. During this public process, the issuing utility must defend and support the proposed assumptions.

BWP staff and a team of outside specialists, in conjunction with GWP, were very concerned about the OATT's inconsistencies with current rate-making public policy.
Assessing this inconsistency requires a detailed understanding of the assumptions underlying the OATT, and then comparing that understanding with the policies and practices established by the Federal Regulatory Energy Commission (FERC).

Despite BWP and GWP's challenge over the substance of the OATT during the stakeholder process, the proposed OATT was approved by the Los Angeles City Council and made effective in July 2014. To protect ratepayer interests, BWP and GWP jointly filed a complaint at FERC, challenging LADWP's OATT on April 3, 2015.

4.3.4 Balancing Authority Solution

Meanwhile, intensive BA agreement negotiations took place between May and September 2015. These were complex and sometimes contentious negotiations, involving intertwined technical, operational, commercial, legal, and regulatory issues. In the end, LADWP, BWP and GWP were successful in negotiating a Balancing Authority Area Services Agreement (BAASA) that is cost-based and founded on modern industry policy and practice. It is comprehensive, flexible, and fair, therefore, it should provide a durable basis for BWP's operations and planning.

As part of the BAASA, BWP also negotiated the opportunity to purchase all of its reserve obligations from LADWP, instead of using BWP's own assets and limited market access to provide for the reserves. BWP reserve obligations were determined during and through negotiation of the BAASA as 40 MW of spinning capacity and 40 MW of supplemental capacity for a total of 80 MW of reserve capacity. In this connection, it is important to note that LADWP does not guarantee that the full 80 MW of these reserves will be available for purchase every year, subject to LADWP's load growth and resource planning. BWP staff anticipates working closely with LADWP staff to manage this risk.

With these opportunities, staff expects to drive down BAASA service costs considerably over time.

4.4 Southern California Public Power Authority (SCPPA)

SCPPA, a joint powers authority, was created for the purpose of planning, financing, developing, acquiring, constructing, operating and maintaining projects for the generation or transmission of electric energy. SCPPA is governed by its Board of Directors, which consists of a representative from each of its Member Agencies. BWP's General Manager is its representative on the SCPPA Board.

BWP works within the SCPPA framework on a variety of generation, transmission and renewable energy projects that use economies of scale to help keep BWP costs down and electric rates low. In addition, SCPPA issues Requests for Proposals for new initiatives, including procurement of renewable energy resources.

In other words, membership in SCPPA lets BWP (and SCPPA's other members) "punch above their weight" in seeking the best outcomes for their respective ratepayers and cities.

Member Agencies consist of eleven cities (and one irrigation district) which supply electric energy within Southern California, including the municipal utilities of the cities of Anaheim, Azusa, Banning, Burbank, Cerritos, Colton, Glendale, Los Angeles, Pasadena, Riverside, and Vernon, and the Imperial Irrigation District.

Figure 4.8 – SCPPA Projects across the Western U.S as of Fiscal Year 2013-14
Source: SCPPA

4.5 Compressed Air Energy Storage (CAES)

BWP must constantly look ahead, plan ahead, and then act decisively. In this connection, BWP is carefully evaluating compressed air energy storage (CAES) as a potentially important component of its future power supply portfolio.

CAES is essentially a large mechanical battery that takes an intermittent resource and turns it into a controllable one. When electricity is generated and not needed, the electricity is used to pump air into an underground cavern at very high pressure where the air can be stored.

BWP is investigating the use of energy storage to assist in operating its system reliably and cost-effectively in an increasingly renewable power system, including BWP's own procurement of renewable energy in response to the RPS mandate. Specifically, BWP seeks to avoid over-generation in the middle of the day, reduce power generation ramping in the late afternoon, and manage instantaneous intermittency from renewable resources like solar energy.

When electricity is needed, the air is fueled by a small amount of natural gas. A small amount of natural gas is burned in the air stream to re-heat the air. Instead of a compressor, you have, in effect, a balloon of compressed air underground. The air loses heat underground, so in order to make electricity, natural gas gets burned in the air stream reheating the air which then runs through a turbine and turns a generator.

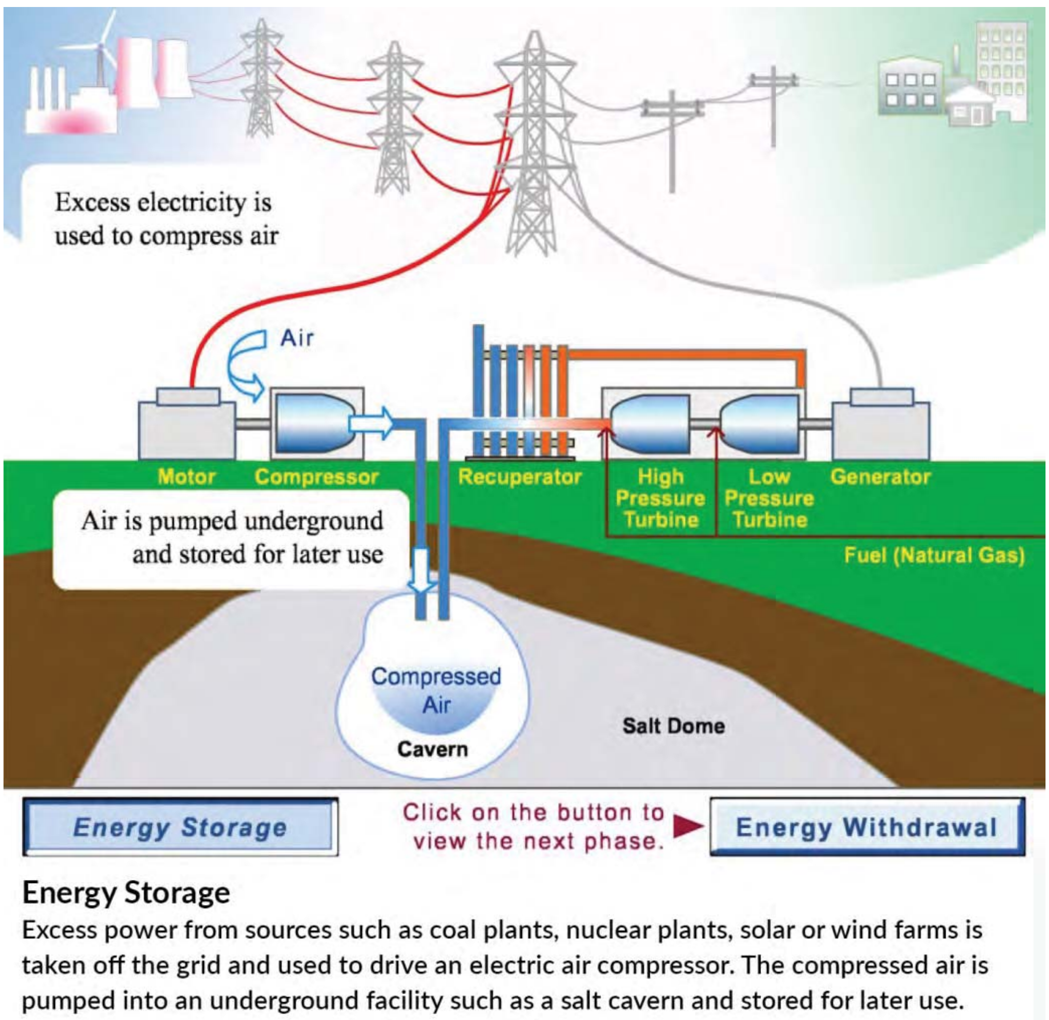


Figure 4.9 – CAES Energy Storage Overview

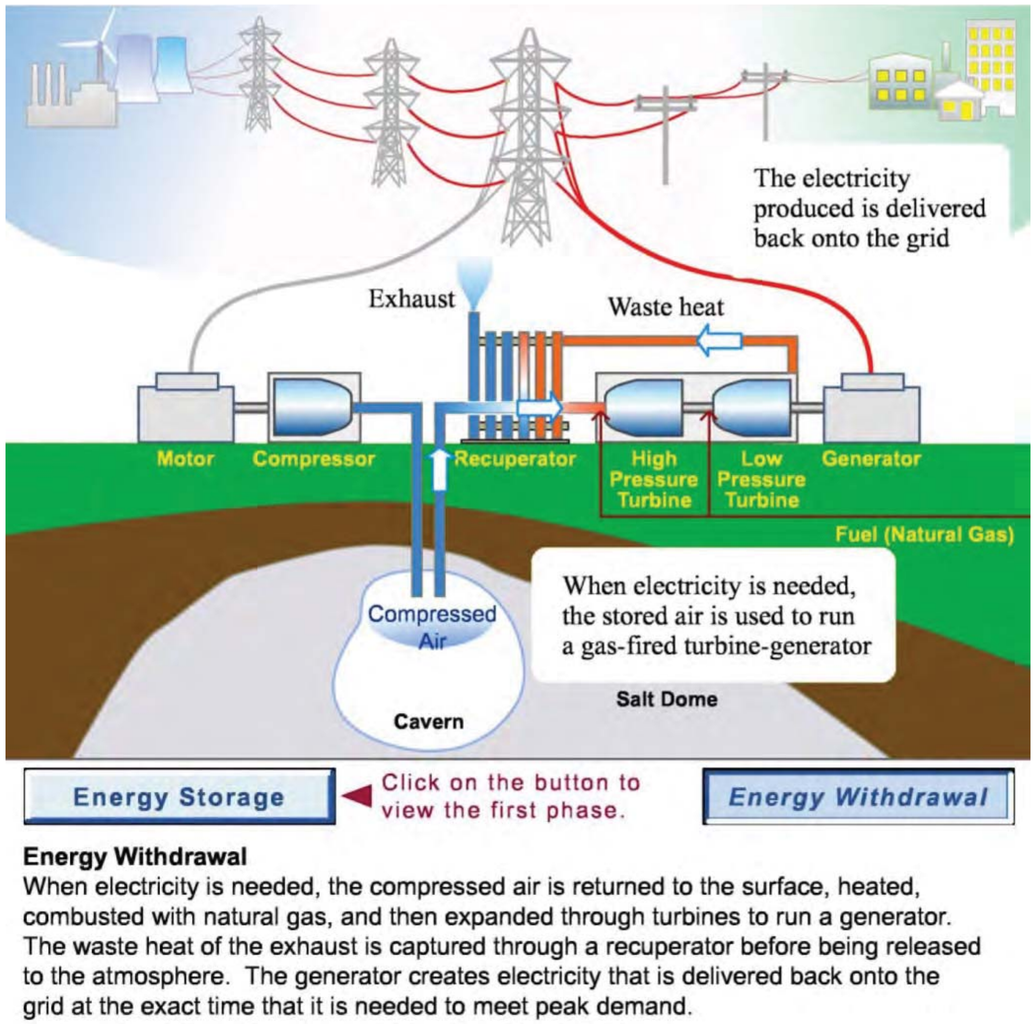


Figure 4.10 – CAES Process

An ideal site for a CAES project may be Delta, Utah where Intermountain is located. Large salt deposits exist thousands of feet beneath the Intermountain site which can be used for the underground air storage. Delta is also very well-positioned at the top of the STS transmission system. The salt deposits are plentiful and proven. The site has hosted Intermountain for decades and has ample water, railroad access, and a proven workforce.

CAES is one of only two types of technology that can store energy for hours or days instead of minutes. The other technology also capable of this is pumped hydroelectric. However, CAES is more cost-effective on a capital costs basis than pumped hydro, at about half the cost of pumped hydro. Both CAES and pumped hydro depend on specific geology for success. Thus, the salt deposits at the Intermountain site, ideal for CAES, are particularly advantageous.

CAES technology is proven at two active CAES projects, one in Alabama and one in Germany.

Energy Storage Cost Comparison

TECHNOLOGY	HOURS OF DISCHARGE POTENTIAL	TOTAL CAPITAL, $/kW
Compressed Air		
· Large Salt (100 - 300 MW)	48	$1,200 - 1,600
Pumped Hydro		
· Conventional (1000 MW)	10	$2,500 - 4,000
Battery (10 MW)*		
· Lead Acid, Commercial	4	$1,740 - 2,580
· Lithium-Ion, Commercial	0.25 - 1.25	$1,010 - 2,551
· Flow (Target)	4	$1,545 - 3,100
Flywheel (Target) (1000 MW)	0.25	$3,695 - 4,315

* Costs do not include expected cell replacements, which are expected to occur several times throughout the life of a battery storage project. (Source: EPRI, Sandia National Labs)

Figure 4.11 - Energy Storage Cost Comparison

CAES & Combined Cycle Gas Turbine Comparison

	CCGT	CAES	CAES vs.
Technology Status	Mature	Mature	Similar
Capital Cost ($/kW for 2018 COD)	$1,375	$1,380	Similar
Fixed O&M Cost (2010, $)	$19.80/kW-YR	$16.60/kW-YR	Similar
Roundtrip Efficiency (%)	~50%	~50%	Similar
Ramp Rate (MW/Minute)	13	60	**Better**
Minimum Load (% of Maximum)	55%	10%	**Better**
O&M Increases with Cycling	Yes	No	**Better**
Operational Start-Up Cost ($)	$ Large	$ Small	**Better**
Ability to Integrate Renewables	1MW:1MW	2MW:1MW	**Better**
Ability to Store	No	Yes	**Better**
CO_2 Emissions (Ton/MWh Generated)	0.5	0.3*	**Better**

* Using stored renewable energy.

Figure 4.12 - CAES and Combined Cycle Gas Turbine

4.5.1 Pathfinder and CAES

BWP has been discussing the CAES solution with Pathfinder LLC who has been conducting development work for the project. In early 2015, Pathfinder, together with BWP and CAES equipment manufacturer Dresser-Rand, submitted a preliminary non-binding application to the DOE for a loan to finance a 300 MW / 48-hour CAES pilot. The U.S. Department of Energy (DOE) responded favorably to this preliminary, non-binding application, and Pathfinder, BWP, and Dresser-Rand expect to submit a more detailed loan application to the DOE in accordance with the loan guarantee program's schedule.

In the meantime, on June 30, 2015, the Burbank City Council approved a one-year agreement with Pathfinder LLC that places BWP in position to help design the pilot project and be involved early on. BWP has continued its due diligence on the project since the expiration of that agreement.

It is not a foregone conclusion that BWP will move forward with CAES in Delta, Utah, as BWP intends to carefully evaluate every aspect of the project first.

4.5.2 Pathfinder Wind

If the CAES pilot project moves forward, Pathfinder is also looking to build low cost wind energy in southeast Wyoming. Southeast Wyoming is a terrific location for wind, with strong, consistent winds rivaling those found out in the ocean. Such strong, consistent winds allows a wind farm to produce energy at a greater percentage of the time, driving down the cost of each MWh produced and making integration easier. In connection with the Pathfinder wind project, an affiliate of mid-Atlantic utility, Duke Energy, is developing a transmission line, called Zephyr, from the Pathfinder wind site in Wyoming to Delta, Utah. With CAES at Delta, this wind energy could be controlled and sent to BWP. BWP is researching this as a potential second step to the proposed CAES project.

Chapter 5 - BWP Customer Perspectives

5.1 Public Education & Outreach

Community input lies at the heart of this Integrated Resource Plan. BWP set an IRP goal to engage the public at an unprecedented level. BWP staff interacted with Burbank's residents and businesses to receive their perspectives both in person and through the internet. Staff developed an engaging presentation for the community that drew customer feedback and guidance to assist BWP in tackling future challenges.

BWP staff used this presentation in a multi-platform marketing campaign. Staff publicized IRP community meetings at BWP events, via public access television commercials on Channel 6, in newsletter mailings, online at burbankwaterandpower.com, and through social media including Twitter at @BurbankH20Power.

Staff also garnered feedback from community groups via a dozen interactive IRP meetings from April 2014 through July 2015. Below is a list of the various meetings:

- City Council
- BWP Board
- Joslyn Adult Center
- Town hall meetings
- Burbank Board of Realtors
- Burbank Chamber of Commerce
- Key account customers
-

5.2 Major Issues Discussed

BWP set out to gain customer perspectives on major issues impacting BWP's provision of reliable, affordable, and sustainable electric service to Burbank:

- Renewable Energy: California state and federal regulations related to renewable energy and greenhouse gas emissions restrictions;
- Coal: Exiting coal-fired Intermountain, currently a major source of power for BWP; and,
- Solar Distributed Generation: The rise of customer solar generation and its effects on load growth, power supply, and rates.

BWP posed three topic questions. Policy decisions made around these areas could dramatically shape the energy future of Burbank:

1. Renewable Energy: How much and at what price?
2. Coal: Should BWP exit from coal early?
3. Solar Distributed Generation Subsidy: Who pays?

Issue 1: Renewable Energy
During the public forums, BWP staff explained how Burbank's power supply portfolio, by law, must include at least 33% renewable energy by 2020 and in 2015, BWP had already met this requirement, five years ahead of schedule.

BWP also explained two challenges related to renewable energy:

1. Wind and solar energy resources are intermittent. Therefore, BWP must carefully manage its resource mix to ensure reliability; and,
2. Renewable energy can be more expensive than conventional sources.

BWP asked the public to help answer the following questions related to renewable energy:
33% of Burbank's power supply portfolio will come from renewables such as wind and solar by 2016. Is this enough, or should Burbank add more?

What electric rate impact would be acceptable to increase the percentage of renewable energy in Burbank's portfolio?

Issue 2: Coal
Just a decade ago, about two-thirds of Burbank's energy came from coal. In 2016, that amount is less than one-third. Progress in reducing coal dependency aside, currently BWP's largest source of electrical generation remains the 75 megawatts of capacity the utility has contracted to purchase from Intermountain in Utah.

BWP's contract to purchase power from Intermountain will expire in 2027. BWP and six other Southern California municipal utilities – including the Los Angeles Department of Water and Power (LADWP) – purchase power from Intermountain, along with more than two dozen Utah municipals and cooperatives.

Further, current California law, specifically, SB 1368, severely limits utilities in purchasing power generated by coal after existing contracts have expired. But due to long-standing contractual obligations, BWP will have continuing payments to make on Intermountain through contract expiration whether or not BWP elects to take energy. Nevertheless, BWP must examine alternatives for its largest current source of generation at Intermountain.

There are many potential alternatives for BWP to consider in analyzing competing generation sources to replace Intermountain, which are examined in greater detail in *Chapter 4: Long Term Planning Environment* of this IRP. For the purpose of the community presentation, BWP shared the pros and cons of coal.

On the plus side, coal generation is both reliable and inexpensive compared to other forms of energy production. Coal is also abundant in the United States. On the contrary, coal is not environmentally preferred as it is a major contributor to GHG emissions. With new federal and state mandates to reduce GHG emissions having been announced by President Obama and Governor Brown in 2015, BWP must plan today how to maintain reliability and low rates without coal generation. Accordingly, BWP is on track to reduce GHG emissions consistent with state goals.

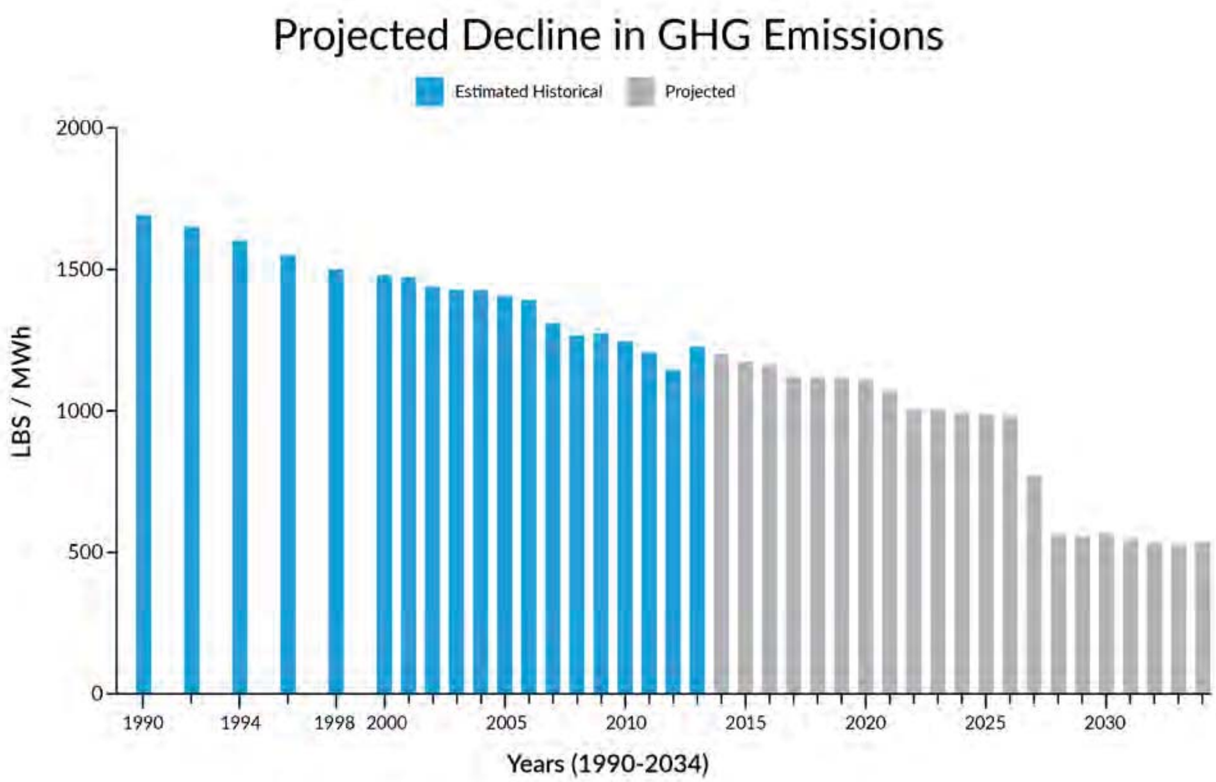


Figure 5.1 – Projected Decline in BWP's GHG Emissions
Source: BWP

BWP posed two questions to the public related to coal:

1. Today, Burbank receives 40% of its energy from coal. Burbank's coal contract with the Intermountain facility is set to expire in 2027. Would you like Burbank to exit from coal earlier than 2027?
2. Recognizing that there are costs to exiting out of the coal contract prior to 2027, how much more would you be willing to pay for electric energy to exit out of coal early?

It is important to note that, since this public outreach, the 36 Intermountain purchasers (including BWP) have agreed to contract modifications by which their respective power purchases from Intermountain would cease in 2025 and a different type (or types) of power generation technology installed. Those modifications are discussed in greater detail in Section 6.2 of this IRP.

Issue 3: Solar Distributed Generation
The third topic that was discussed during the public outreach sessions was customer rooftop solar generation and how it affects the electric rates paid by BWP's customers.

Rooftop Solar

Community Advantages

- Sustainable
- No Green House Gas Emissions
- No transmission
- No Fuel Costs

Community Disadvantages

- Generates part of the day only
- Intermittent
- Subsidized by non-solar customers

Figure 5.2 - Rooftop Solar Advantages and Disadvantages
Source: BWP

BWP supports solar energy (including rooftop solar) but wants to ensure that no one group of customers subsidizes another. Staff described how, as a result of current rate design, BWP customers that have not installed rooftop solar panels subsidize customers that have installed rooftop solar. This is the case not just in Burbank, but throughout California.

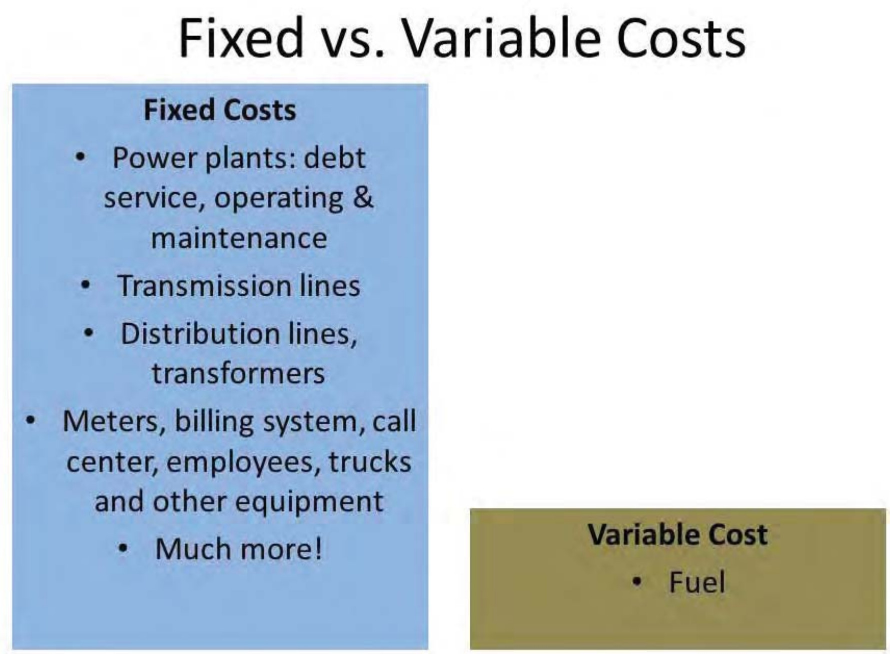


Figure 5.3 - Fixed vs. Variable Costs Comparisons
Source: BWP

Customers that install rooftop solar generation are eligible for the benefits of Net Energy Metering (NEM). With NEM, the customer's meter, in effect, runs forward when energy provided by the utility is being used and runs backward (or forward more slowly) when their solar generation system is producing energy. The difference between what each rooftop solar customer uses and what his or her solar system generates is what the customer is billed for. This means that solar customers get the full credit for every kilowatt-hour generated by their solar system, not just the fuel portion that the utility was able to avoid when a customer generates their own energy. This cost-shift is effectively a solar subsidy.

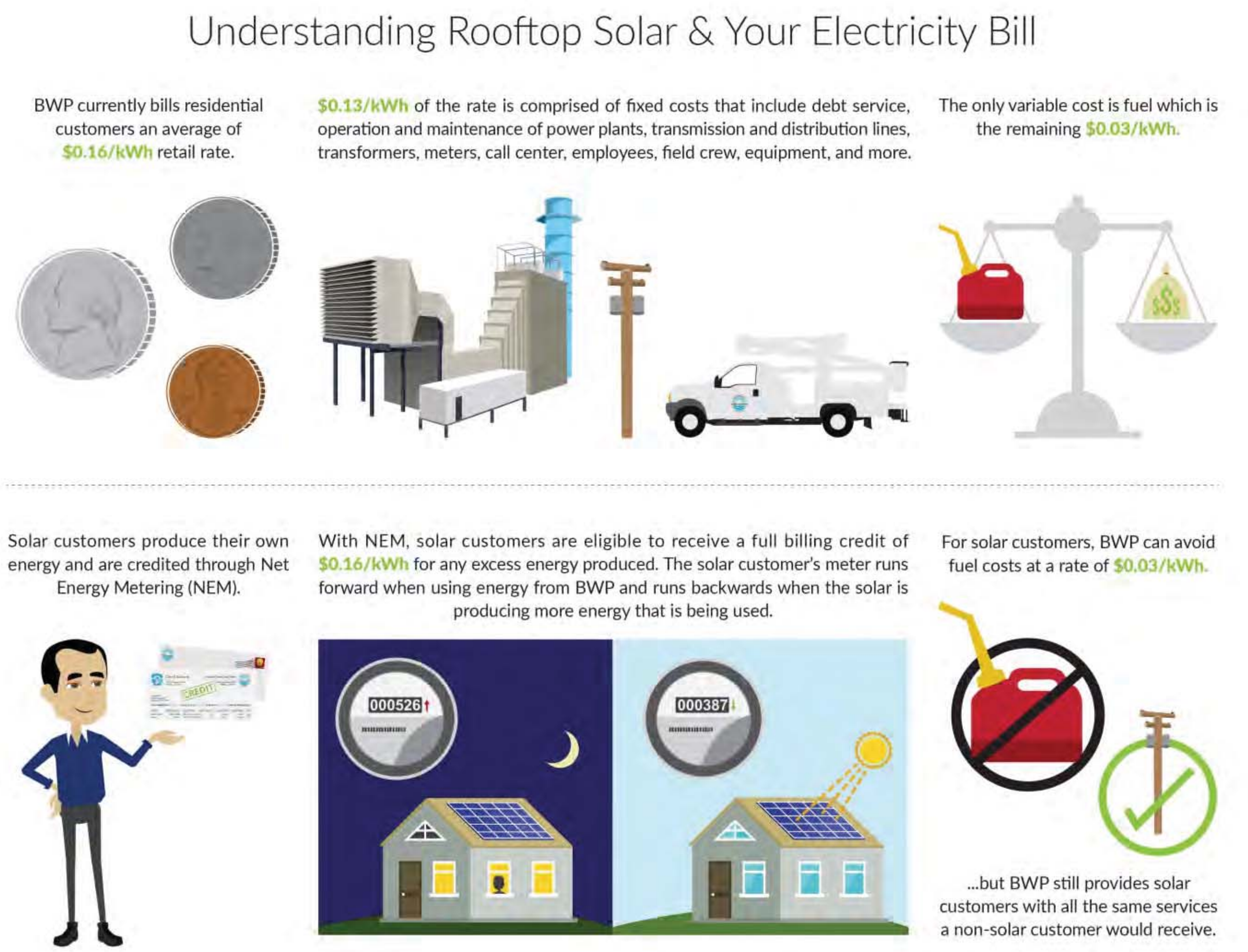


Figure 5.4 - Understanding Rooftop Solar and Your Electricity Bill
Source: BWP

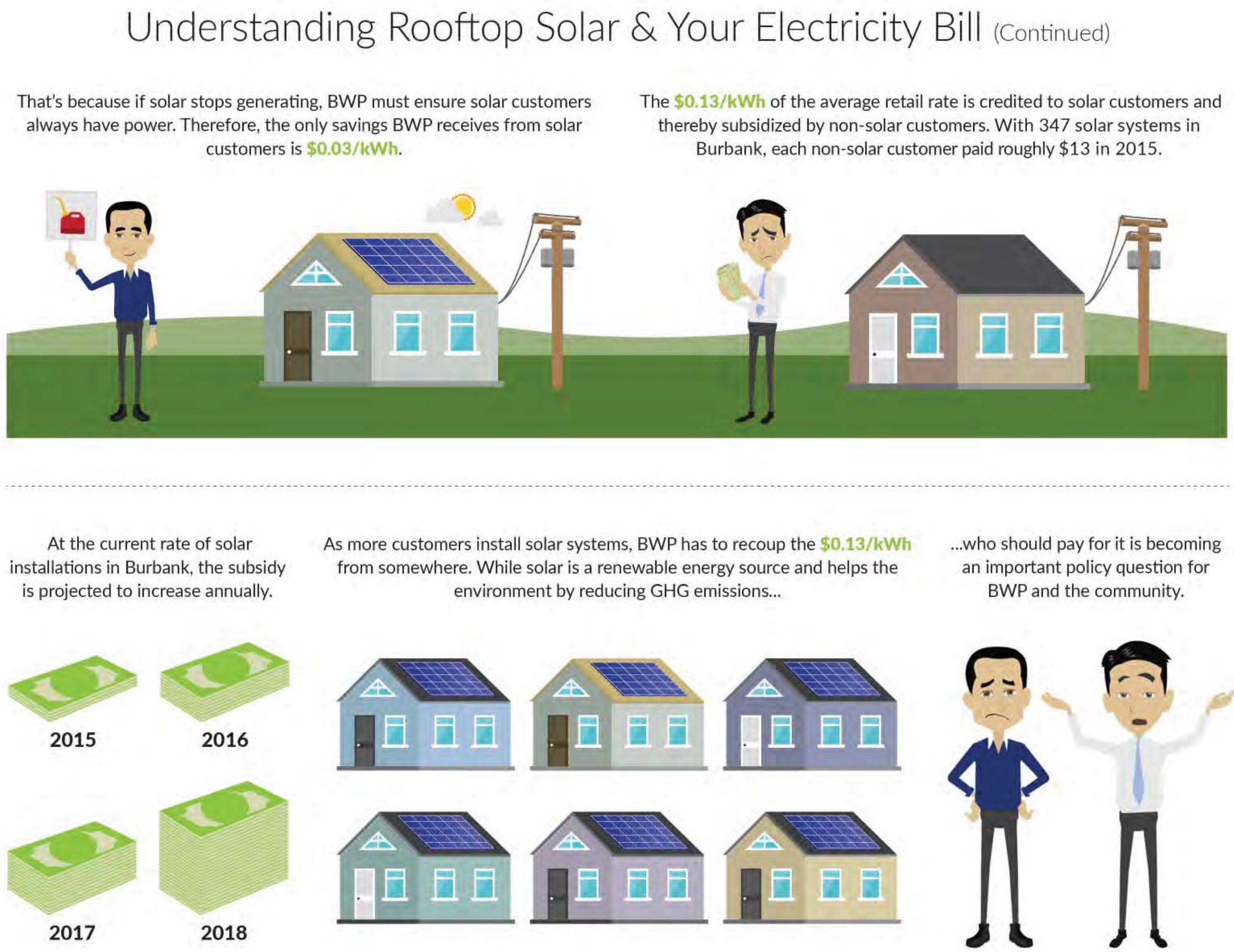


Figure 5.5 - Sample Residential Retail Rate
Source: BWP

When there were only very few solar systems in Burbank, the total impact of this subsidy was negligible. However, as more rooftop solar systems are installed, BWP must recover the 13¢ for a greater volume of kilowatt-hours. And rooftop solar systems in Burbank have increased dramatically, year after year. With 325 solar system installations in Burbank as of September 2015, the customer solar subsidy – an amount paid by each non-solar-generation household – is $13 per year. With the current rate of solar installations, that subsidy is projected to increase annually under BWP's current rate design.

Figure 5.6 - Example of Potential Annual Customer Subsidy
Source: BWP

Bottom line issue for residents to consider on solar:

- Under Net Energy Metering, solar customers get full credit for every kWh solar-generated;
- The only cost BWP is able to avoid is the fuel cost per kWh when customers generate their own energy;
- The fixed costs do not go away, they just get reapportioned to other customers;
- The cost-shift to non-solar customers is effectively a subsidy that will only rise due to growing solar installations; and,
- Distributed solar generation is good for the environment as it provides a renewable source which avoids GHG emissions, but who pays for it has become an important policy question.

After explaining the distributed solar generation issue facing BWP and its customers, two questions were posed to the public:

1. Is it acceptable that "non-solar" customers subsidize "solar" customers?

2. As more solar systems are forecasted to be installed in Burbank, the cost to each non-solar customer will go up. Do you view this additional cost as acceptable?

5.3 What BWP Heard from Customers

Members of the community gave BWP their perspectives on these issues at various public meetings and by responding to a nine-question survey at burbankwaterandpower.com. Over 100 respondents participated in the online survey. The survey results were posted at burbankwaterandpower.com, and were accompanied online by the filmed community outreach meeting, conducted on Saturday, April 5, 2014. The full online survey results are included in Exhibit B. The filmed presentation ran in regular rotation on the City of Burbank's public access television channel for several months. Below is a summary of the questions asked and customer, responses.

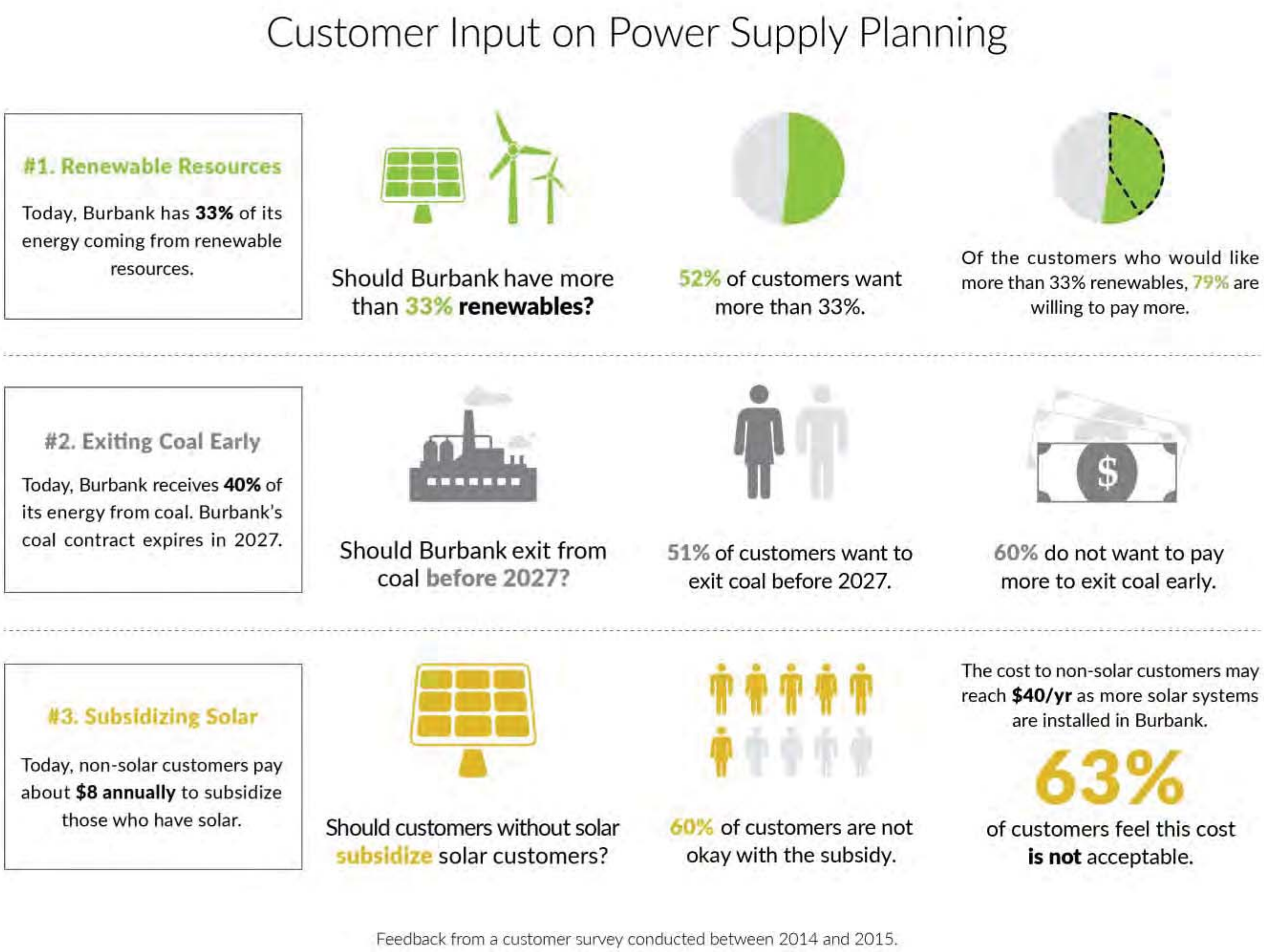


Figure 5.7 - Customer Input on Power Supply Planning
Source: BWP

Issue 1: Renewable Energy

Customer Response: While response was spread across the spectrum, a majority supported additional renewables, as long as cost control by BWP was consistent with past practice, meaning rate increases not exceeding the long-run rate of inflation.

Responses from the public indicated:

- 52% of customers reported a willingness to pay at least 2.5% more in rate increases;
- 25% of customers willing to pay increases of 10%, to go beyond 33% renewables; and,
- 21% were not willing to pay more to go beyond 33%.

Issue 2: Coal

Customer Response: The majority's message was to get off of coal in due time – BWP has to, by California law – yet take the time to get it right.

Furthermore, customers want BWP to also explore a number of possibilities:

- Energy efficiency and conservation;
- Other forms of power generation as well as energy storage; and,
- Optimizing the value of transmission resources associated with an Intermountain replacement project following the end of coal generation.

Customers had strong opinions about coal and BWP heard the gamut at the public events, including getting out of coal generation as quickly as possible and at any cost. The most commonly heard opinion was that an early exit from Intermountain was not economically prudent if Burbank was still contractually obligated to 'pay the mortgage' on the plant.

The majority of online respondents echoed this sentiment:

- 60% responding that they are not willing to pay any more for electric energy than they do today to exit out of coal early;
- 32% collectively stated that they would pay at least 10% more; and,

- 7% of customers reporting that they want Burbank to stop using coal now, regardless of cost.

Issue 3: Distributed Solar Generation

Customer Response: The clear majority stated that ongoing subsidies are not favored.

60% of respondents believe that non-solar customers should not be subsidizing solar customers. Customers attending the community meetings, as well as online respondents, voiced very similar concerns. One particular Burbank resident, who has installed solar energy at her home, shared in a meeting that she has no interest in being subsidized by non-solar customers and felt that she should therefore appropriately be charged more. There were strongly voiced opinions in all directions on this topic, but a majority opinion did not support the current subsidies for customers who install distributed solar generation.

Chapter 6 IRP Forecast Analytics

In 2014, BWP engaged Leidos Engineering (Leidos) to assist in developing forecasts for the IRP. The primary goals were to analyze the impacts and tradeoffs of current and future resource planning decisions on providing affordable, reliable, and sustainable power to BWP customers in light of future uncertainties.

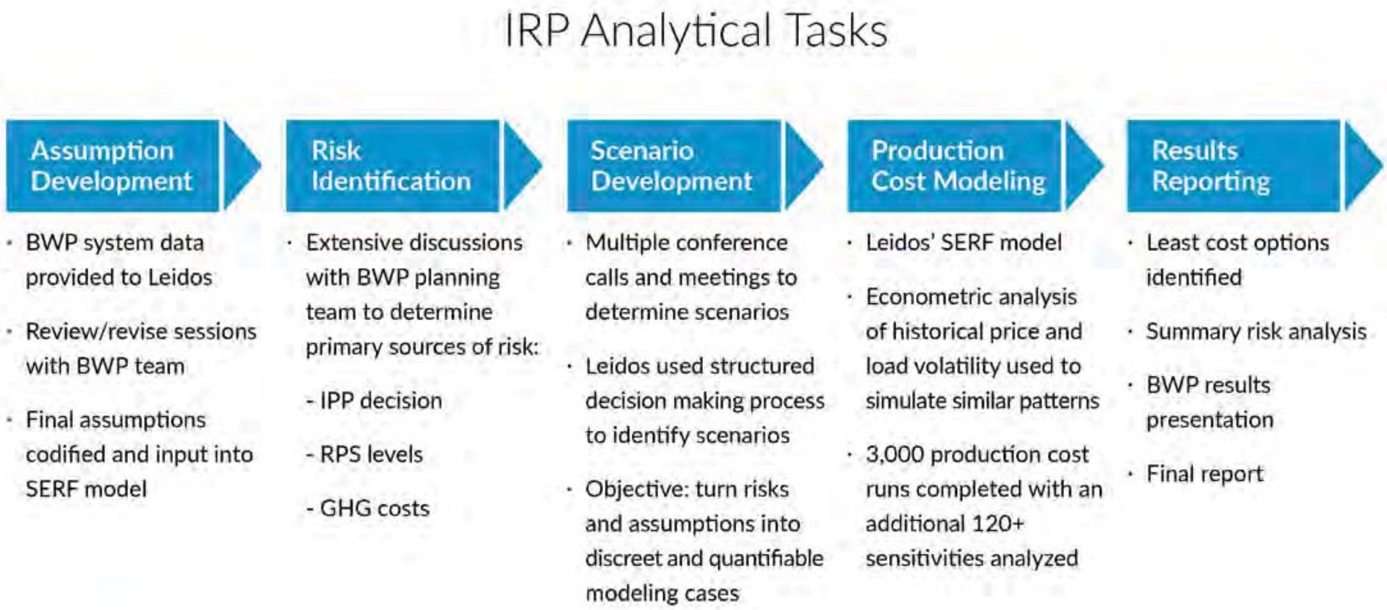


Figure 6.1 - IRP Analytical Tasks
Source: Leidos

The analysis modeled a set of power supply options for BWP under different future market scenarios with the goal of producing an optimized portfolio of electrical generation capacity.

It is important to note that this modeling is *directional* rather than *determinative*; in other words, it is intended to illuminate potential paths to success rather than trying to determine an exact path to success.

A major factor that will drive BWP's decision making is the need to replace or repower Intermountain by or before 2027. BWP therefore directed Leidos to model new natural gas-fired generation; both simple-cycle and combined-cycle, at the IPP site, so BWP could better analyze its options pursuant to Intermountain renewal. In addition to Intermountain, BWP also faces significant uncertainties related to load forecasts, the magnitude of customer-side solar generation, wholesale power costs, emissions costs, fuel costs, transmission constraints, and other market drivers.

BWP worked with Leidos to define a set of scenarios to be analyzed and to establish assumptions to be used in the analysis. Using Leidos' proprietary Stochastic Econometric Regional Forecast

(SERF) production cost model, Leidos projected the power supply costs of 60 discrete power supply scenarios for a 20-year period (2015-2034). The resulting cost projections help inform BWP's various potential power supply decisions.

The study conducted by Leidos allowed Burbank to examine a few options with respect to the replacement of Intermountain coal capacity in 2025. The goal of the study was not to determine the best option for Burbank, as there are many items that still need to be worked through, however, to conduct a relative comparison of options that the industry participants consider relevant in contemporary times. The Leidos modeling is therefore best viewed as illustrative.

Burbank included a CAES energy storage system as one of the options to replace Intermountain capacity due to a unique synergy of factors specific to Delta, UT, along with modern combined-cycle and simple-cycle gas-fired resources. The study showed that the two lowest cost options could be replacement of Intermountain capacity with combined-cycle gas or utilization of a CAES system to accomplish the same.

Further work is required in order to better refine and understand the implications of these options to Burbank in the future.

6.1 Leidos Scenarios

As with most scenario-based modeling, developing a set of alternative scenarios based on the underlying risk drivers can be challenging due to the relationships between the underlying drivers. Mapping the interrelationships of each of these variables is required to ensure that the appropriate baseline variables (those variables that are considered influencing to all other variables) are uncovered and identified. This helps ensure that the scenarios developed are distinct enough to lead to meaningful results.

Leidos determined that the following factors were most likely to impact either the composition of the optimal portfolios or BWP's optimal costs:

- The year in which BWP exits Intermountain;
- The type of generating capacity selected to replace the Intermountain capacity, regardless of the timing;
- The amount of renewable energy in the portfolios; and,
- The projected GHG compliance costs BWP will incur.

Of these, it was determined that the most important input was the type of generating capacity BWP chooses to replace Intermountain. The following are the five capacity types:

1. **Combined-Cycle Capacity**

   This scenario envisions replacing existing Intermountain capacity with 108 MW of natural gas-fired combined-cycle capacity, similar to Magnolia. This 108 MW represents BWP's share of the capacity of the STS transmission line from Delta to the LA Basin.

2. **Compressed Air Energy Storage (CAES) Capacity**

   This scenario envisions replacing Intermountain capacity with CAES at Delta. This CAES capacity would be combined with wind energy generated from the proposed Pathfinder Wind project in Wyoming and transmitted to Utah via the proposed Zephyr Transmission Project.

3. **Renewable Resources**

   This scenario envisions replacing Intermountain energy with renewable resources and replacing Intermountain capacity with market-based capacity. The renewable energy would be transmitted to BWP using BWP's share of the STS.

4. **Utah Combustion Turbine Capacity**

   This scenario envisions replacing Intermountain capacity with a natural gas-fired simple-cycle combustion turbine located near the existing Intermountain site, with power transmitted to BWP over the STS. This combustion turbine would be similar to BWP's Lake One unit, but larger. For modeling purposes, Leidos used a General Electric LMS-100.

5. **Local Combustion Turbine Capacity**

   This scenario envisions replacing Intermountain capacity with a simple-cycle combustion turbine located in the City of Burbank.

   Using the five capacity types as the foundation for the scenarios, Leidos and BWP developed combinations of the capacity types along with the remaining three additional primary assumptions to develop 60 discrete scenarios to be modeled. The followings ranges were used for the three additional assumptions:

   - The timing of BWP's exit from Intermountain: 2020 or 2027;
   - The level of renewable energy in BWP's portfolio: 33%, 50% and 66%; and,
   - The level of projected carbon compliance costs BWP will incur with a given portfolio: low-carbon costs bases versus high carbon costs.
   -

Since the completion of the Leidos analysis, AB 350 has replaced California's "33% renewables by 2020" mandate with a "50% renewables by 2030" mandate. Because the timeframe of this IRP goes through 2030, only the 50% and 66% renewables scenarios will be discussed.

6.2 BWP Load Assumptions

In addition to the primary input variables described above, Leidos and BWP established values for other key inputs, including:

- BWP's load forecast;
- BWP's existing resource and purchased power costs and operating characteristics;
- Fuel and market pricing forecast;
- Renewable energy pricing forecast; and,
- Capital and operating cost forecasts of potential replacement capacity.

Assumptions

Intermountain - When to exit? 2020 or 2027

BWP decided to evaluate the options of exiting Intermountain in either 2020 or 2027. In both cases, Intermountain debt service costs were incurred until the debt was paid off in 2023, and fixed costs were incurred through the end of the existing contract in 2027.

Transmission

BWP's 108 MW allocation of the STS transmission line is assumed through the analysis period. This line can provide access to renewable energy projects to help meet BWPs renewable energy targets.

Load Forecast
BWP's 2015 forecast of annual peak demand and energy forecast through 2034 was used. The peak demand forecast is the 90th percentile forecast and inclusive of reserves.

Reserve Requirements
The analysis assumes that BWP's resources, including the Olive units, provide sufficient capacity reserves to maintain reliability. The production cost modeling assumed Burbank must maintain enough capacity to meet its annual peak demand capacity requirement at the 90th percentile forecast level.

6.3 BWP Cost Assumptions

1. Renewable Energy
BWP provided a forecast of Net Energy Metered (NEM) rooftop PV facilities. For the purposes of calculating BWP's renewable energy generation, it was assumed that the NEM capacity does not contribute to meeting BWP's renewable energy targets.

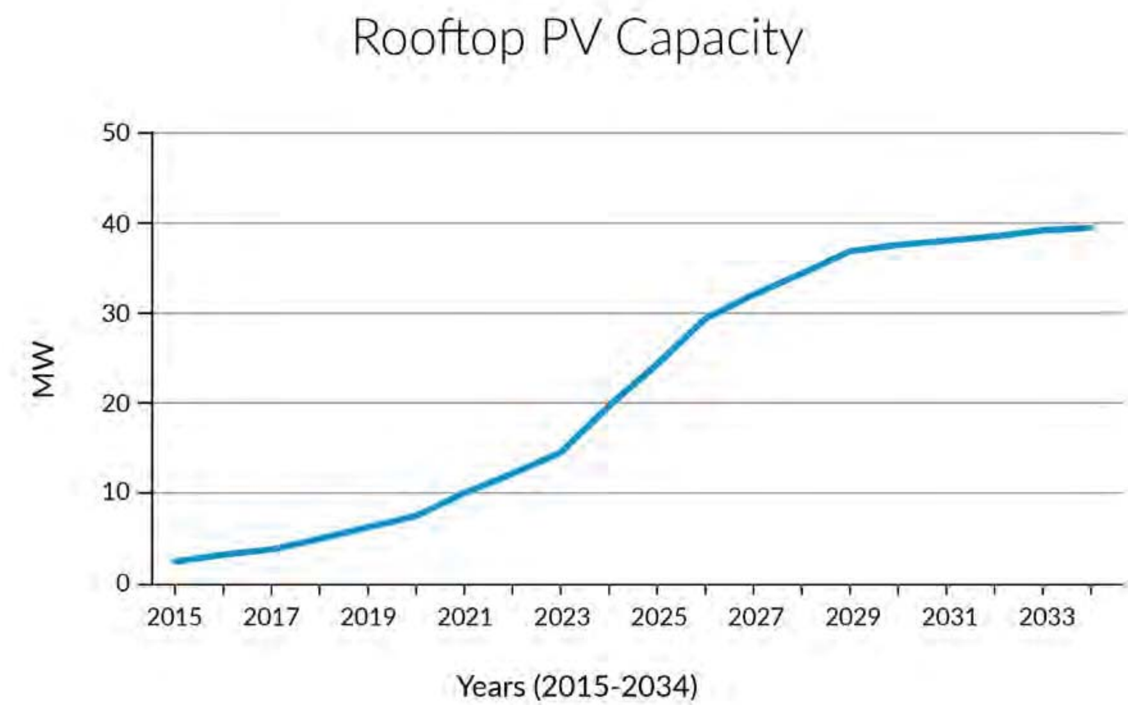


Figure 6.2 - IRP Rooftop PV Capacity
Source: Leidos

2. Renewable Portfolio Standards (RPS)
Through BWP's public outreach process, staff understood that customers want additional renewables in BWP's power supply portfolio, regardless of state mandates, as long as power supply costs are controlled. As such, the modeling looked at 50% and 66% RPS even before AB350 became law.

3. Carbon Compliance Cost
The "base" carbon case assumes prices will not rise above the CARB auction reserve level with escalations. The "high" carbon case assumes carbon prices reach the CARB Allowance Price Containment Reserve with escalations. Escalations are annual increases in minimum carbon prices as mandated by CARB.

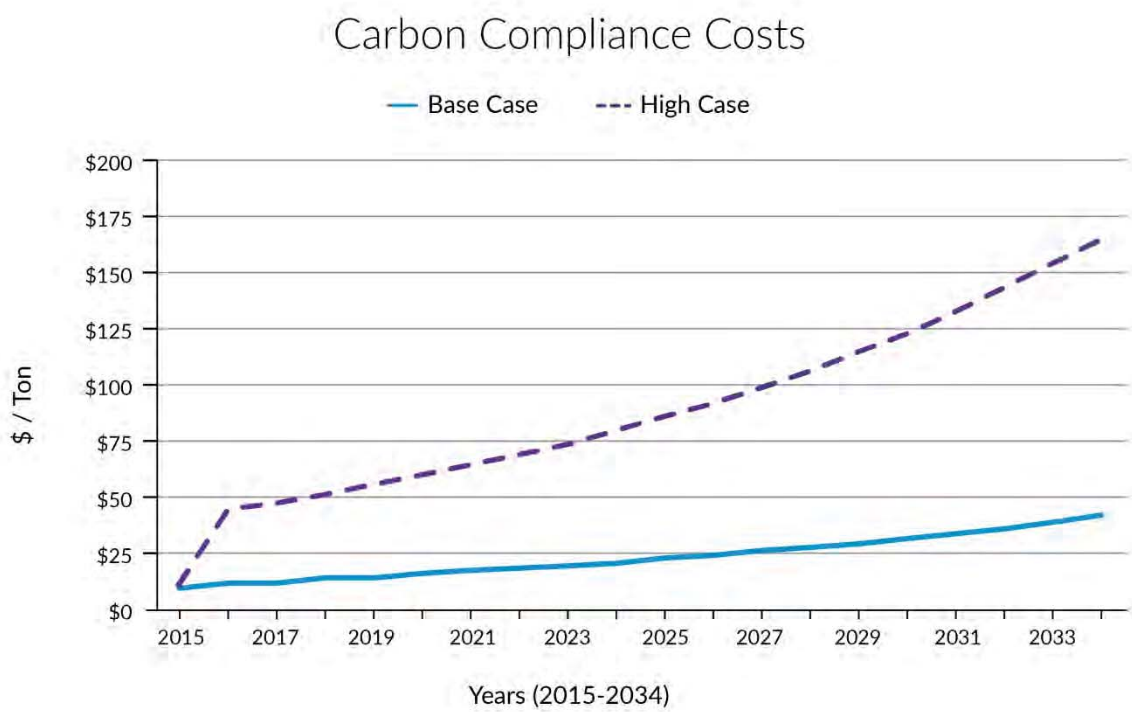


Figure 6.3 - IRP Carbon Compliance Costs
Source: Leidos

4. Renewable Integration/Ancillary Services Costs

Since BWP is not its own Balancing Authority, Leidos assumed that integration costs for any future intermittent (wind or solar) renewable energy projects would mirror those incurred today.

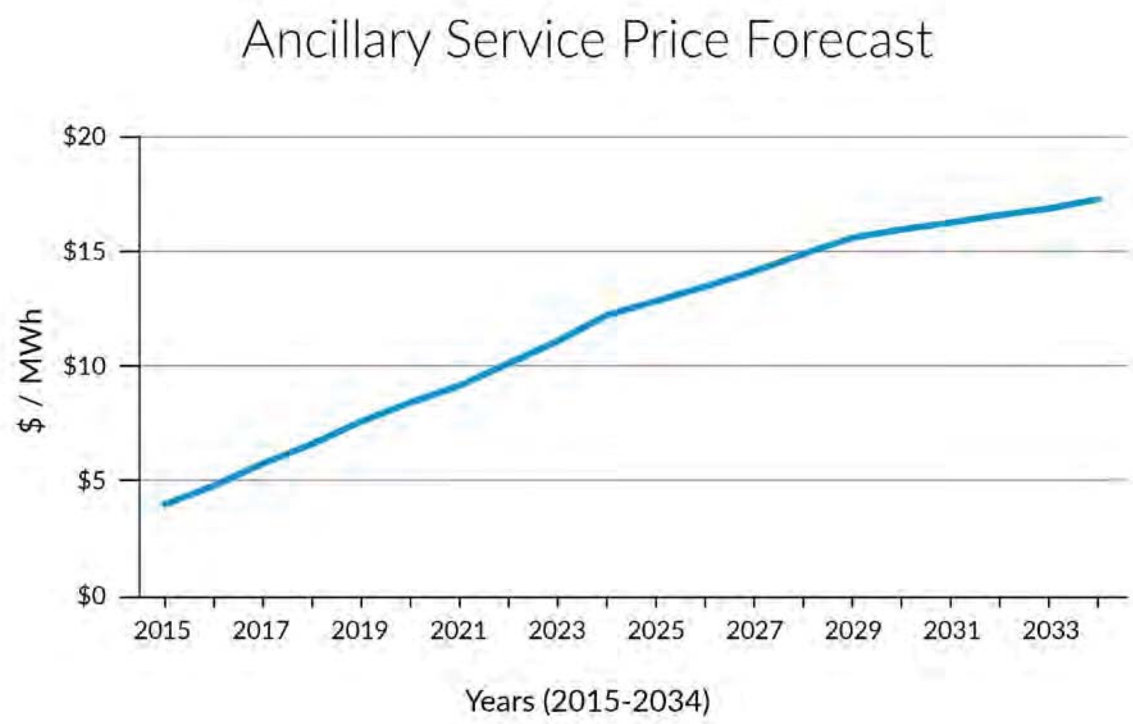


Figure 6.4 - IRP Ancillary Services Price Forecast
Source: Leidos

Once effective, the BAASA will provide additional options for renewable integration going forward.

5. Fuel and Market Price Forecast

Leidos developed price forecasts for natural gas delivered to both Utah and Burbank using a market model that incorporates historical prices, futures prices and market fundamentals. Future price volatility is estimated using historical prices and is used to model the uncertainty in future natural gas prices.

Fuel and variable costs at Intermountain were derived from the 2013 Intermountain annual forecast provided by BWP. Market coal prices are an internally developed Leidos forecast.

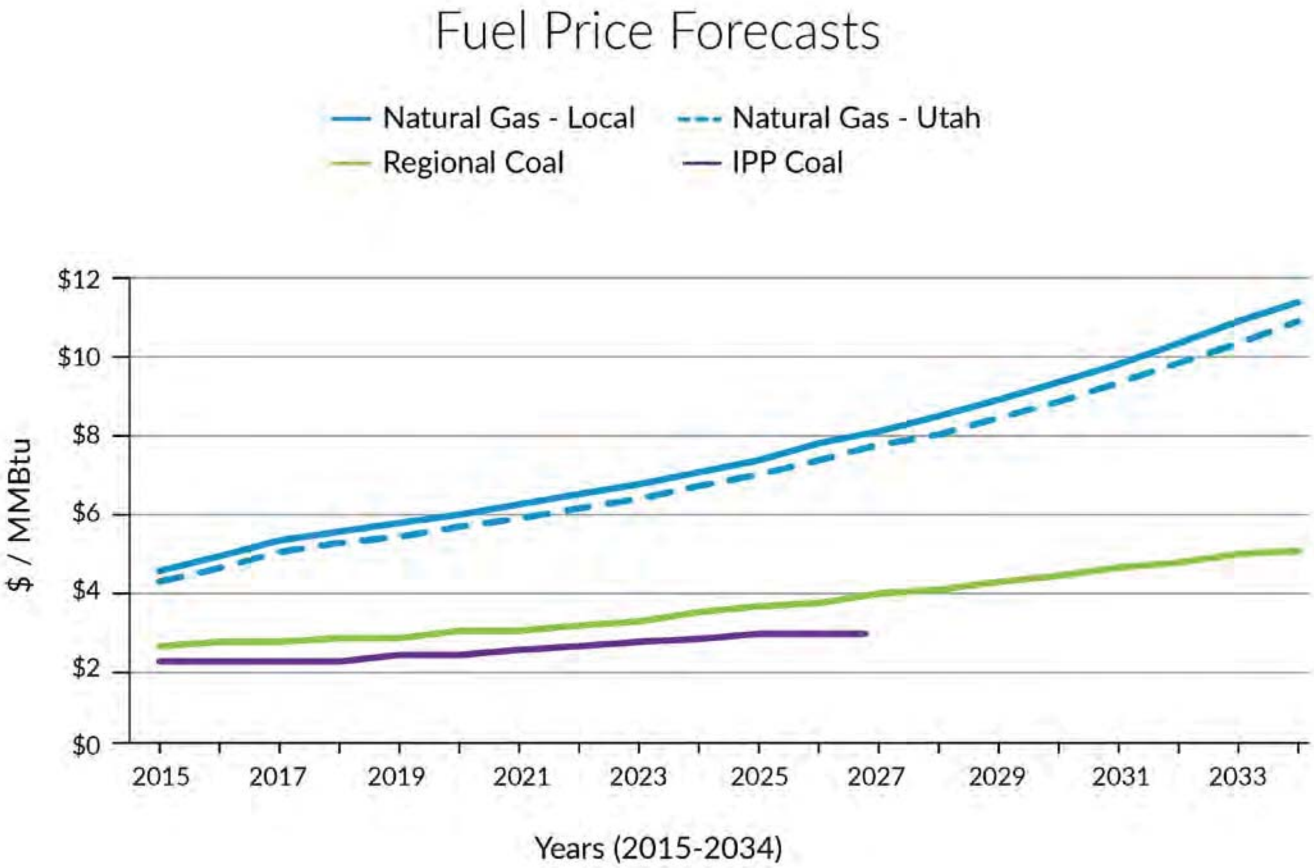


Figure 6.5 - IRP Fuel Price Forecasts
Source: Leidos

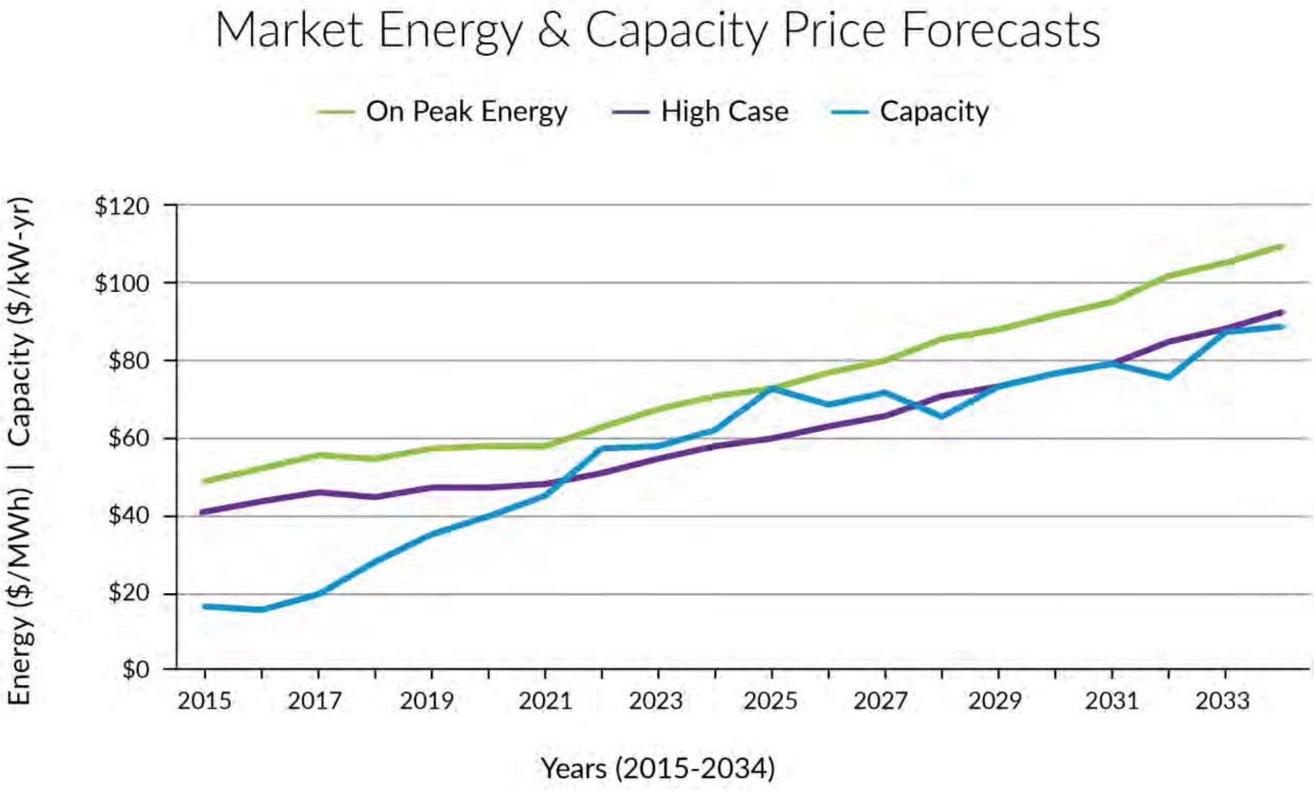


Figure 6.6 - IRP Market Energy and Capacity Price Forecasts
Source: Leidos

6. Generation Characteristics

6a. Future Generation Characteristics

During discussions with Leidos, the selection of future potential resources available to BWP was agreed upon. Leidos developed characteristics for these future generation options based on its internal engineering expertise. It was assumed that BWP would be able to acquire an ownership (or ownership-like) share of each resource equivalent to the need specified in the IRP.

Future Generation Characteristics

OPERATING CHARACTERISTIC / COST	1X1 FRAME 7 CC		LMS 100 CT		SOLAR	WIND	CAES
	SUMMER	WINTER	SUMMER	WINTER			
Min Capacity (MW)	153	174	47.0	47.0	N/A	N/A	N/A
Max Capacity (MW)	276	318	94.1	94.1	20	20	N/A
Min Up Time (Hours)	12.0	12.0	2.0	2.0	N/A	N/A	N/A
Min Down Time (Hours)	8.0	8.0	1.0	1.0	N/A	N/A	N/A
Forced Outage Rate (%)	2	2	2	2	1.5	1	N/A
NOX Emission Rate (lb/MMBtu)	0.01	0.01	0.01	0.01	0.00	0.00	N/A
SO2 Emission Rate (lb/MMBtu)	0.00	0.00	0.00	0.00	0.00	0.00	N/A
CO2 Emission Rate (lb/MMBtu)	120.00	120.00	120.00	120.00	0.00	0.00	N/A
Min Load Heat Rate (Btu/kWh)	8,194	7,816	10,726	10,490	N/A	N/A	N/A
Max Load Heat Rate (Btu/kWh	7,148	6,867	8,898	7,737	N/A	N/A	N/A
Generator Max Output (MW)	N/A	N/A	N/A	N/A	N/A	N/A	1,200
Generator Min Output (MW)	N/A	N/A	N/A	N/A	N/A	N/A	60
Heat Rate (Btu/kWh)	N/A	N/A	N/A	N/A	N/A	N/A	4,300
Compressor Max Input (MW)	N/A	N/A	N/A	N/A	N/A	N/A	600
Compressor Min Input (MW)	N/A	N/A	N/A	N/A	N/A	N/A	360
Air Out / In Ratio (%)	N/A	N/A	N/A	N/A	N/A	N/A	76
Capital Costs ($/kW)	1,000	1,000	1,200	1,200	3,000	2,800	1,600
Start Cost ($)	N/A	N/A	N/A	N/A	N/A	N/A	2,000
Variable O&M ($/MWh)	1.56	1.56	3.08	3.08	0	0	2.00
Fixed O&M ($/kW-mo)	1.04	1.04	3.09	3.09	2.33	5.15	1.67

Figure 6.7 - IRP Future Generation Characteristics
Source: Leidos

6b. Existing Generating Resources

The table below presents BWP's existing and currently planned generation resources by fuel type and nameplate capacity. A new geothermal unit is assumed to come online in 2021 and is included in each case of the IRP.

BWP Existing Generating Resources

RESOURCE	FUEL TYPE	TOTAL NAMEPLATE CAPACITY (MW)
Magnolia	Natural Gas	89.00
LakeOne	Natural Gas	45.00
InterMTN	Coal	74.00
Paloverde	Nuclear	9.00
Hoover	Hydro	20.00
Tieton	Hydro	8.71
DACambell	Geothermal	3.00
CopperMtn	Solar PV	37.15
Pebbles	Wind	9.20
SW Wyoming	Wind	4.96
Milford	Wind	9.53
Ameresco	Landfill Gas	1.17
New GeoThermal (2021)	Geothermal	5.00
Exchange Energy	Energy Exchange	10.00
SummerCall	3rd Party	50.00

Figure 6.8 - BWP's Existing Generating Resources
Source: Leidos

6.4 Building Blocks of Scenario Development

Once the fundamental variables were identified, the model developed discrete alternative planning scenarios that BWP might face. It was determined that the key issues that needed to be resolved before identifying these alternative paths could be framed into the following four questions. Answering these would form the foundation of the modeling scenarios.

- When should BWP exit Intermountain?
- What should replace lost Intermountain capacity?
- What should be done with the STS?
- What percentage of retail sales should stem from renewable energy?

6.5 Exiting Intermountain

Although the decision to exit Intermountain has already been made, the real question becomes whether to exit early or to delay exiting until the current purchase contract terminates in 2027. Public outreach supported a "stay the course" strategy for Intermountain: taking advantage of Intermountain's reliability and cost-effectiveness for as long as practical, then exiting.

6.5a Replacing Intermountain Capacity

Replacing lost Intermountain capacity is fundamentally tied to BWP's rights in the STS transmission line. Thus, the answer to the question has two dimensions. First, BWP must determine what fuel or technology sources should be modeled. Second, BWP must determine whether replacement capacity is physically located near the Intermountain site or closer to Burbank. It was decided that the modeling should assess costs associated with replacing Intermountain capacity with the following options:

- A combined-cycle, natural gas-fired unit sized at approximately 108 MW and located near the Intermountain site;
- A 98 MW LMS100 combustion turbine located at the Intermountain site;
- A 98 MW LMS100 combustion turbine located in the City of Burbank;
- CAES at the Intermountain site using wind generated from the Pathfinder Wyoming project and transmitted via the Zephyr Transmission Project; and,
- A combination of generic wind and solar energy interconnected to the STS sized at 98 MW.

6.6 STS Utilization

The STS is an important transmission asset of BWP whose future value is intrinsically tied to the Intermountain replacement capacity decision. It was assumed that in all scenarios, BWP would retain its rights to the STS and utilize the available transfer capacity to suit its broader purposes of increased renewable energy usage.

BWP's interest in the STS is to provide access to RPS-eligible resources for Burbank. Because the STS is part of the LADWP Balancing Area (and therefore part of California), California RPS regulations consider renewable energy delivered on the STS to be "portfolio category one," which is required to be the majority of BWP's renewable portfolio. BWP's allocation of the STS was assumed to be 108 MW, with up to 10 MW reserved for energy from the Milford Wind Project, located in Beaver and Millard counties in Utah. All scenarios assume BWP's allocation of STS remains constant throughout the study period.

6.7 Renewable Energy Targets

As noted above, each of the identified scenarios contemplated renewable energy making up 50% or 66% of BWP's portfolio. The modeling examined two major issues in this connection: 1) what percentage of total retail sales should be comprised of renewables (i.e., 50% or 60%) and 2) what is the relative mix of different renewable technologies at different locations and when do they come on-line during the study period. The most efficient answer was to include varying percentage targets as scenarios and different percentage mixes of the renewable portfolio as sensitivities.

6.8 Other Variables Include in the Sensitivity Analysis

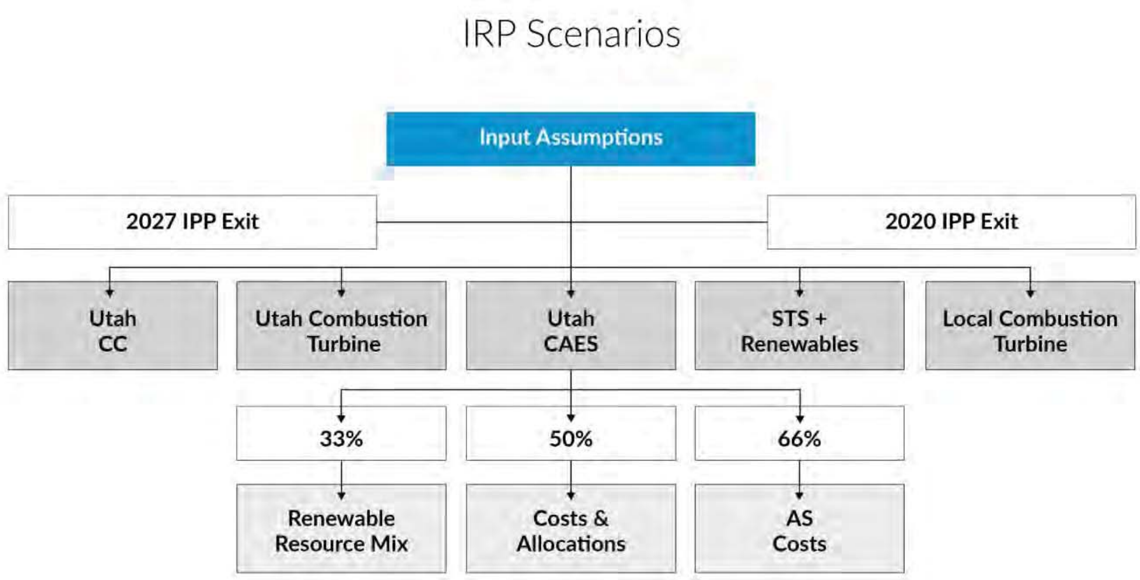
Other significant input variables were also run across all scenarios:

- Natural gas prices;
- Load growth;
- Market prices;
- Amount and mix of renewable resources;
- GHG costs and allowance allocations; and
- Ancillary services costs, such as reserves.

The value ranges for natural gas prices, market energy prices, and load growth were captured stochastically in the modeling based on 50 random draws. The values for the remaining variables including the mix of renewables, GHG costs and allocations, and ancillary services costs were based on deterministic assumptions bracketing potential outcomes in high and low cases.

6.9 Description of Modeling Scenarios

The resulting scenarios were driven by replacement of the Intermountain capacity. These are described below.



Note: "AS" means ancillary services

Figure 6.9 -IRP Scenarios
Source: Leidos

6.10 Overview of Leidos Analytics

After defining scenarios and establishing values for key assumptions, Leidos conducted detailed production cost modeling to simulate the operations of BWP's electrical system for the 20-year period 2015-2034. Leidos and BWP quantified the potential cost impacts of exiting Intermountain in 2020 versus 2027 and replacing it with various types of supply options. The analysis identified the scenarios with the least projected power supply costs, giving insight into the projected cost relationships between the supply options and the California electricity market.

6.11 Leidos Analysis Scenario Results

A. ***Combined-Cycle Scenario***
The combined-cycle scenarios generally have the lowest projected power supply costs when compared to other scenarios and similar secondary assumptions.

B. ***CAES Scenario***
The CAES scenarios generally have the second lowest projected power supply costs when compared to other scenarios and similar secondary assumptions.

C. ***Utah Combustion Turbine Scenario***

The combustion turbine scenarios projected power supply costs are generally more costly than the combined-cycle and CAES scenarios.

D. Local Combustion Turbine Scenarios

The local combustion turbine scenarios projected power supply costs are generally the most costly of the dispatchable generation options.

E. Renewable Scenarios

The renewable scenarios projected power supply costs are the most expensive of the scenarios. The higher costs of these scenarios are driven by the fact that renewable energy along with market capacity must be purchased to meet peak demand requirements.

6.12 All Scenarios Modeling

Projected Power Supply Costs of Top Scenarios - Base CO_2

PORTFOLIO	% CHANGE FROM TOP RANKED SCENARIO
2027 Combined Cycle, 33% RPS	-
2027 CAES-R, 33% RPS	2.0%
2027 Utah CT, 33% RPS	3.3%
2027 Local CT, 33% RPS	3.9%
2027 Combined Cycle, 50% RPS	5.2%
2020 Combined Cycle, 33% RPS	6.9%
2027 CAES-R, 50% RPS	7.3%
2027 Utah CT, 50% RPS	8.2%
2027 Local CT, 50% RPS	9.0%
2020 CAES-R, 33% RPS	9.5%
2027 Combined Cycle, 66% RPS	10.2%
2020 Combined Cycle, 50% RPS	11.6%
2020 Utah CT, 33% RPS	11.7%
2027 CAES-R, 66% RPS	12.5%
2020 Local CT, 33% RPS	13.1%
2027 Utah CT, 66% RPS	13.3%
2027 Renewable, 33% RPS	13.3%
2020 Local CT, 66% RPS	14.1%

Figure 6.10 - IRP Projected Power Supply Costs Scenarios
Source: Leidos

The above figure illustrates the projected annual power supply cost differences associated with each of the modeled portfolios.

6.13 Summary of Scenarios

The following tables highlight the five most cost effective scenarios determined by the analysis study.

Projected Power Supply Cost by Scenario

PORTFOLIO	LEVELIZED COST (¢/kWh)
2027 Combined Cycle, 50% RPS, Base CO2	9.20
2027 CAES, 50% RPS, Base CO2	9.34
2027 Utah CT, 50% RPS, Base CO2	9.39
2027 Local CT, 50% RPS, Base CO2	9.45
2027 Renewable, 50% RPS, Base CO2	9.94

Figure 6.11 - IRP Projected Power Supply Costs Scenarios
Source: Leidos

The following table highlights the most cost-effective scenarios assuming BWP exits Intermountain in 2020:

Projected Power Supply Cost if BWP Exits IPP by 2020

PORTFOLIO	LEVELIZED COST (¢/kWh)
2020 Combined Cycle, 50% RPS, Base CO2	9.80
2020 CAES, 50% RPS, Base CO2	10.09
2020 Utah CT, 50% RPS, Base CO2	10.20
2020 Local CT, 50% RPS, Base CO2	10.30
2020 Renewable, 50% RPS, Base CO2	11.20

Figure 6.12 - IRP Projected Power Supply Costs If BWP Exits IPP by 2020
Source: Leidos

6.14 Formal Analysis Summary

As noted above, given the current uncertainties faced by BWP and all California utilities in long-term planning, the Leidos modeling is best viewed as illustrative and as a starting point for further analysis over time. BWP is currently evaluating all scenarios as the time nears to make these far-reaching decisions. Importantly, other considerations outside this analytical model are discussed elsewhere in this IRP.

Chapter 7 - BWP: Next 20 Years

BWP's approach to resource planning involves looking ahead, planning ahead and acting ahead with the goal of continuing to lead the Southern California region in reliability while offering low rates and meeting all renewable requirements. The next 20 years will be no different.

7.1 Load

BWP forecasts that load will remain flat -- zero net load growth -- over the next 20 years.

Three factors primarily drive this forecast. First, Burbank is a fully built-out city and expectations for further development are low. Second, California Senate Bill 350, enacted in October 2015, doubles statewide energy efficiency mandates through 2030. Third, more customers will elect to install solar as installation costs continue to decline. These last two factors – energy efficiency and distributed generation – are expected to offset any load growth.

That said, load growth can be highly uncertain, especially over the longer term. Weather, local development and population growth, economic trends, and energy consumption behaviors are among the key variables that impact BWP's view of future resource needs. Accurately forecasting any one of these variables over a 20-year period is a considerable challenge. If load growth occurs, it will be met by equivalent increases in conservation, energy efficiency, and renewable energy (including rooftop solar), pursuant to California's loading order.

7.1.1 Over-Generation

At the same time, the amount of intermittent energy on the grid is expected to increase, perhaps substantially. As physics dictates that electricity must be consumed the moment it is generated, this will likely intensify an already growing over-generation problem in California.

As discussed in Chapter 3, the "Duck Curve" is a challenge for all California utilities, including BWP. Rapid growth in solar PV energy generation capacity creates a glut of energy in the middle of the day – too much, in fact, to be used by customers on all but the hottest days. This is true of all solar PV: from the smallest rooftop system to giant utility-scale projects like Copper Mountain. Something has to give, and it is usually non-solar generators forced to reduce production to less efficient levels or turn off all together. At the end of a hot day when sunlight diminishes and solar switches off, load continues to increase rapidly. This requires non-solar generation to "ramp up" dramatically – to increase production from minimum to maximum – very rapidly. Most non-solar generators are not designed for this kind of ramping and are quite costly to operate this way, if they can even operate this way at all.

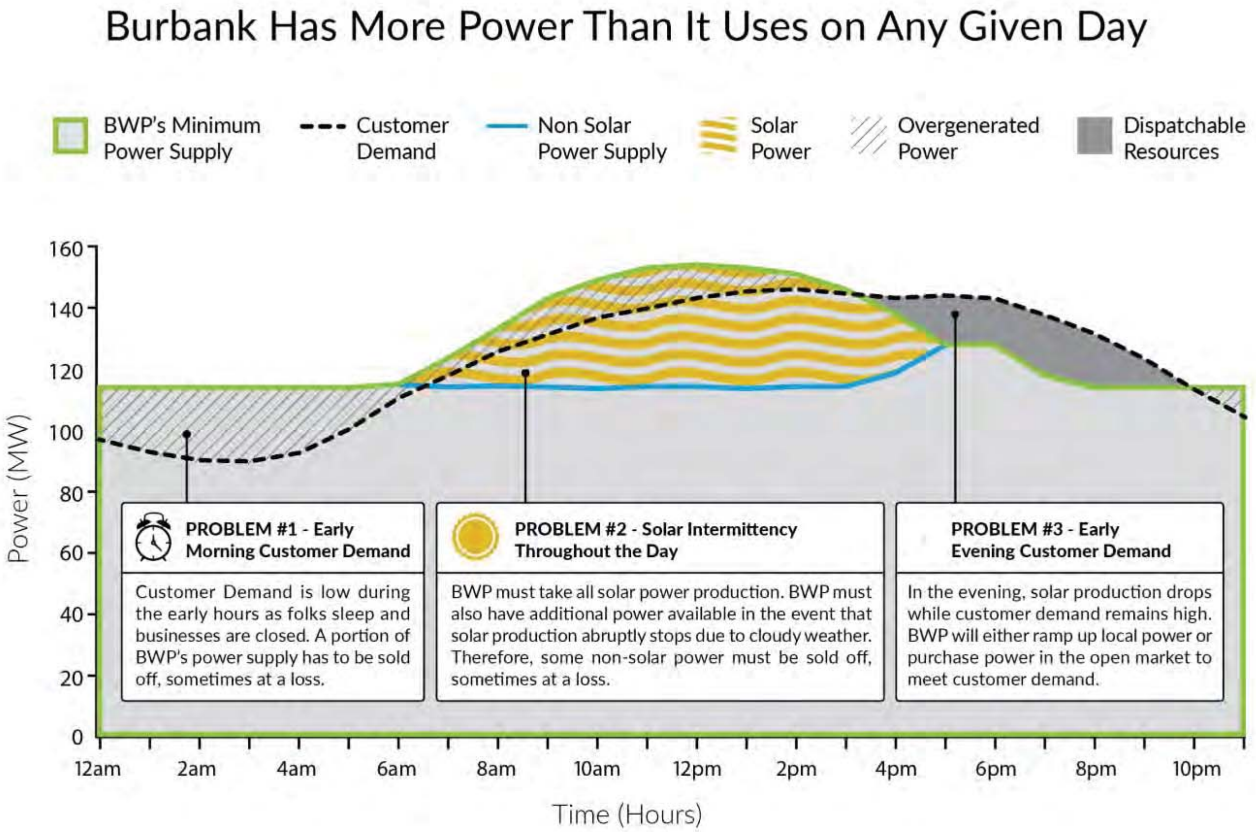


Figure 7.1 - Burbank has More Power Than it Uses on Any Given Day
Source: BWP

Unfortunately, the "Duck Curve" is only forecast to get "fatter" as time goes on, increasing both mid-day over-generation and afternoon ramping needs, as more solar is added to the electricity system.

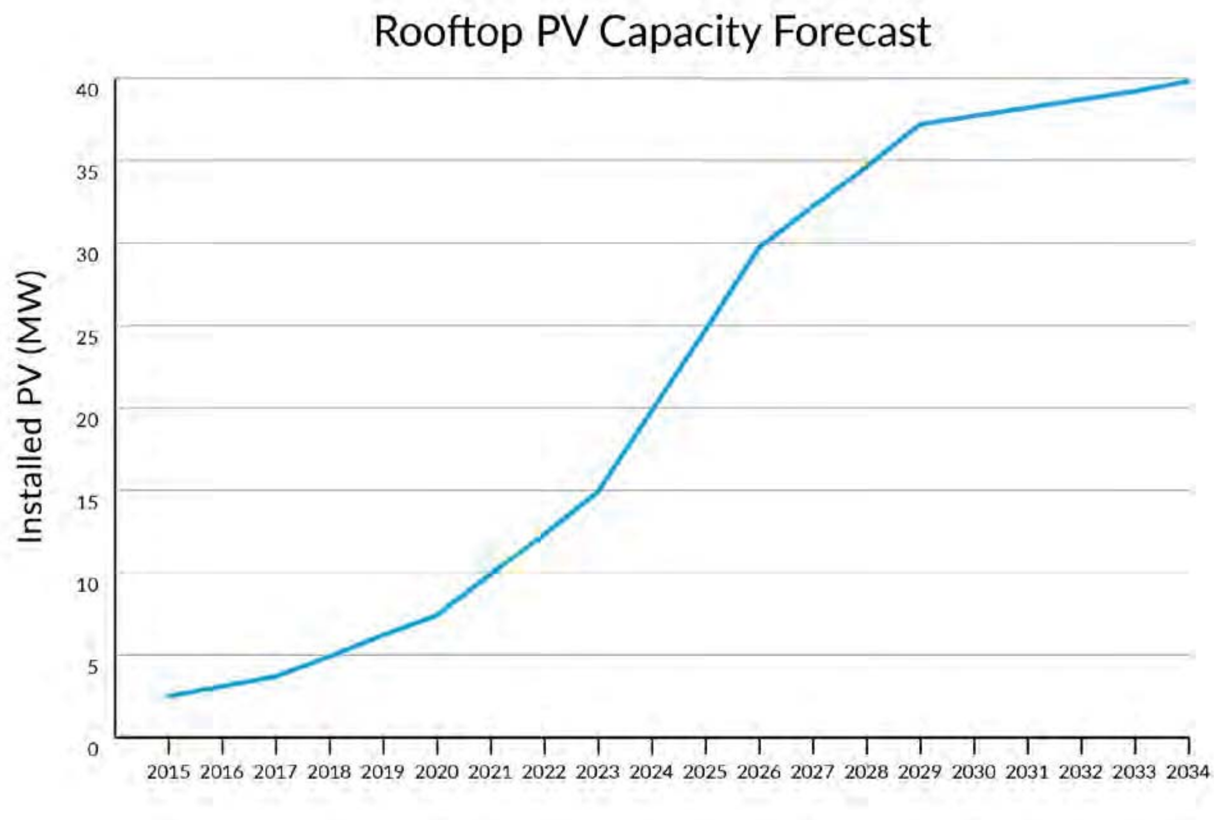


Figure 7.2 – Burbank Rooftop PV Capacity Forecast
Source: BWP

7.1.2 Strategies to Mitigate Duck Curve

In order to mitigate the inevitable increase in solar production, BWP hopes to influence customers to use power when it is more plentiful and less expensive. BWP can do this by implementing different strategies, starting with a move from tiered rates to Time-of-Use (TOU) rates. TOU rates, by adjusting electricity rates during the day based on BWP's cost to provide it, would provide a financial incentive to consume energy in low-cost periods such as solar noon. Thus, BWP would both minimize the impact of over-generation and decrease the severity of the late afternoon ramp.

Another strategy is to develop new business opportunities to increase or shift load via increased electrification, demand side management (DSM), and to help manage the "Duck Curve."

Like most utilities, BWP designs its electric rates to recover the cost of serving its customers and to fairly recover these costs among its different customer classes. Beyond these minimum goals, BWP designs its electric rates to send appropriate price signals and align with long-term power supply planning goals.

In designing its electric rates, BWP specifically looks at ways to encourage conservation, higher load factors and more manageable daily load shapes. BWP also takes into consideration its potential *net* daily load shapes as a result of future energy efficiency, conservation, distributed generation, and electrification.

BWP can encourage higher load factors and more manageable daily load shapes through time varying, or TOU rates. TOU rates vary based on the time of day, day of week, and season to reflect the varying costs of serving our customers throughout the year. Approximately 85% of BWP's current commercial energy usage is charged based on TOU rates. By the end of 2017, all of BWP's commercial energy will be charged based on TOU rates and BWP will propose to charge all of its remaining customers based on TOU rates in FY2018-19.

BWP's current TOU rates and rate design are designed to mitigate the effects of a "Duck Curve" in Burbank. BWP's TOU rates are designed to reduce daily peak energy and demand during the weekday hours of 4:00 PM to 7:00 PM, when utility and customer solar begins to decline and BWP must quickly ramp up its thermal resources to meet demand. By reducing energy usage during these hours, BWP can more easily and economically meet its customer demand throughout the afternoon, maintain reliability, and continue to integrate renewables.

7.1.3 Electric Vehicle Charging

A new generation of PEVs is under development to be deployed in the next few years. PEVs represent new load to be served by the utility. Control of the charging and discharging of PEVs once plugged into the grid could become a valuable resource. PEVs parked during work hours could be contributing to the grid during high-cost hours while charging during low-cost hours.

64% of Burbank residents reported interest in learning more about PEVs. Since PEVs may significantly impact electricity demand, BWP has created a PEV TOU rate for residential customers to encourage them to charge their vehicle during low-cost hours. BWP also offers financial incentives to encourage customers to install PEV charging stations at home.

In this connection, BWP installed 11 Level 2 (240V) public PEV charging stations as a demonstration project in 2011. The 11 stations were installed at six parking lot locations in the city, with nine in downtown and two in the southwest corner of the city.

A review of charger use revealed that the two main determinants of usage of the charging stations are price and growth in PEV sales. For the first six months, charging was provided free of charge to promote awareness of the service. Following this introductory period, charging was priced at $2 per hour, which encouraged more frequent vehicle turnover but discouraged use from gas-PEV hybrids with smaller batteries. As a result, BWP again revised the pricing to a per kWh basis, and instituted TOU pricing so that summer weekday peak hour prices to incentives customers to defer charging during early evening hours.

The PEV market has evolved quickly. Auto manufacturers have reduced PEV purchase prices, resulting in more customers finding it realistic to purchase such a vehicle. BWP is helping customers make this decision easier by offering charging equipment rebates, a TOU rate for their home charging, and a multitude of publicly available charging stations citywide.

Based on the success of the original 11 chargers, BWP obtained State of California grants to expand its charging network and install eight dual Level 2 curbside PEV chargers. These were installed in August 2015, increasing the total number of public chargers to 27 at 14 sites throughout Burbank. The curbside project, the first of its kind in the country, brings added convenience to PEV drivers and increased visibility to BWP's PEV infrastructure.

As a result of increased adoption of PEVs, charger energy use has doubled nearly every year, a trend that is expected to continue.

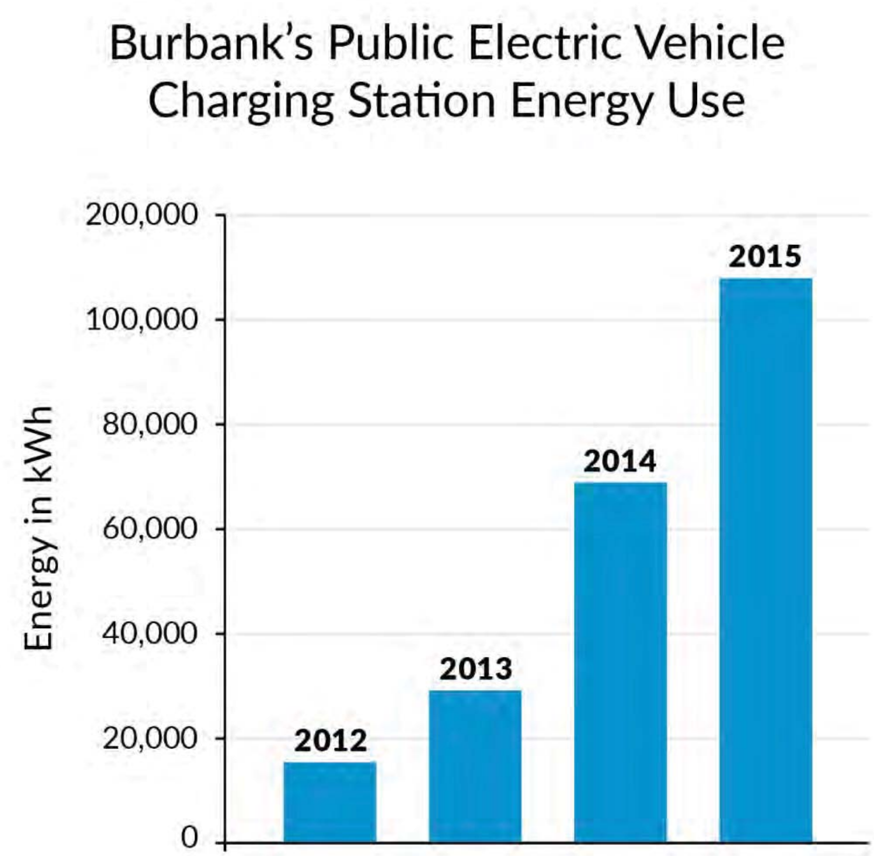


Figure 7.3 – Burbank's PEV Charging Station Energy Use
Source: BWP

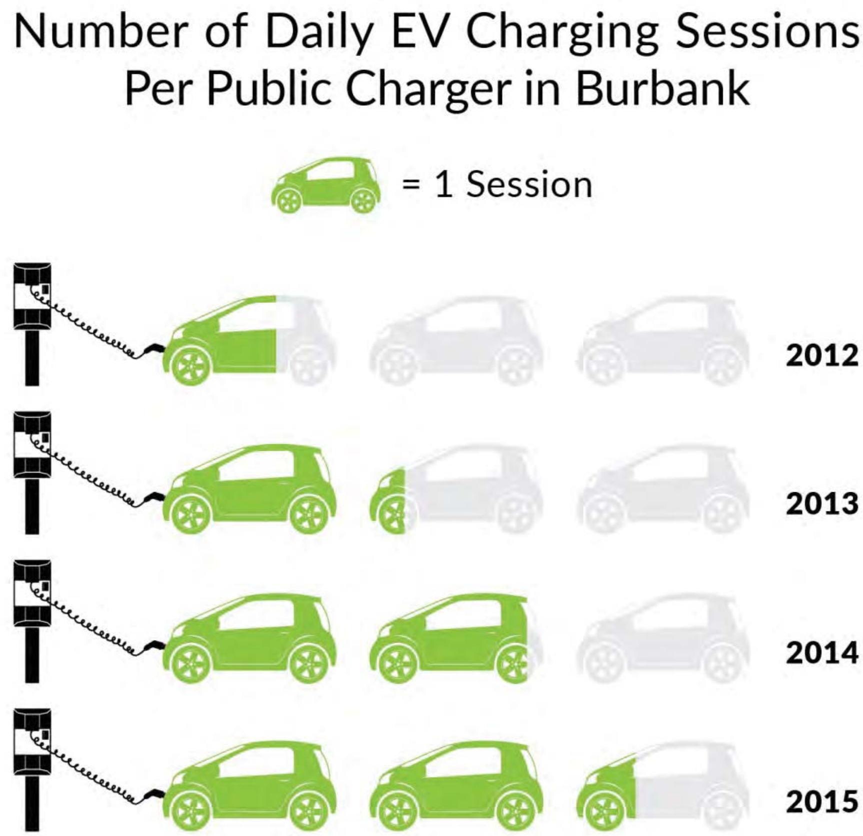


Figure 7.4 – Number of Daily EV Charging Sessions per Public Charger in Burbank
Source: BWP

Continued use of PEV chargers will depend on the following:

- Increasing availability of electric vehicles;
- Proximity of chargers to residential, workplace, retail, and highway corridor destinations;
- Availability of chargers – operational and not already in use;
- Fair pricing and ease of payment; and
- User comparison to other charging options

7.1.4 Potential EV Growth and Transportation Electrification

The potential load growth from PEVs is significant over the next 20 years. In 2012, Governor Brown mandated through Executive Order B-16-2012 that there be 1.5 million zero emission vehicles on California roads by 2025. This mandate coupled with falling PEV prices and existing state and federal incentives have led to a conservative growth estimate of 1 million PEVs on California roads by 2026, according to an October 2013 study by the CEC.

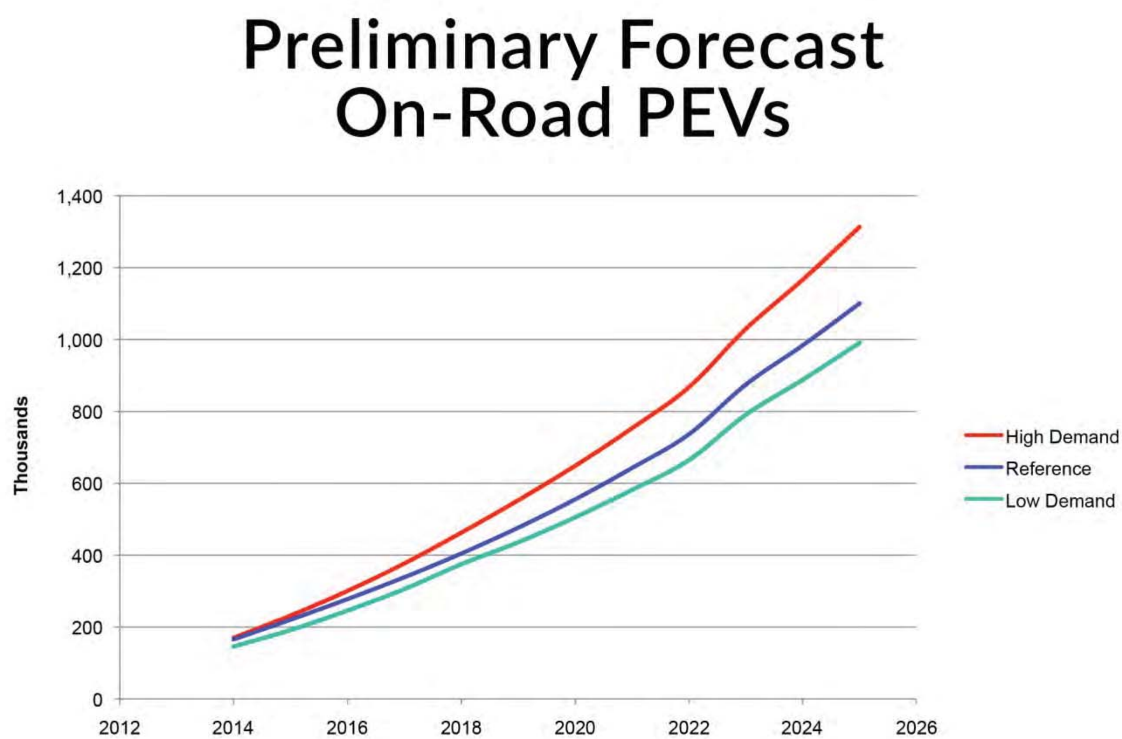


Figure 7.5 – California's Preliminary Forecast On-Road PEVs
Source: CEC

In September, 2015 Navigant Research Co., a market research and consulting company, released a report titled, *Electric Vehicle Geographic Forecasts*. The report forecasts that PEV sales in North America will exceed 1.1 million annually by 2024.

Navigant further concludes that the U.S. will continue to be the largest market throughout the forecast period, with annual PEV sales in 2024 exceeding 860,000 in the conservative scenario and 1.2 million in the aggressive. Navigant Research estimates this market will grow at a compound annual growth rate of between 14.7% and 18.6% between 2015 and 2024.

Navigant projects that California, federal, and state purchasing incentives, lower PEV prices, alongside the mandates of the California Zero Emission Vehicle Program, will likely continue to push PEV penetrations in the state to between 15% and 22% by 2024.

The Califonia Energy Commission also estimates that the projected price for purchasing a PEV will drop somewhere between 5%-10% by 2034.

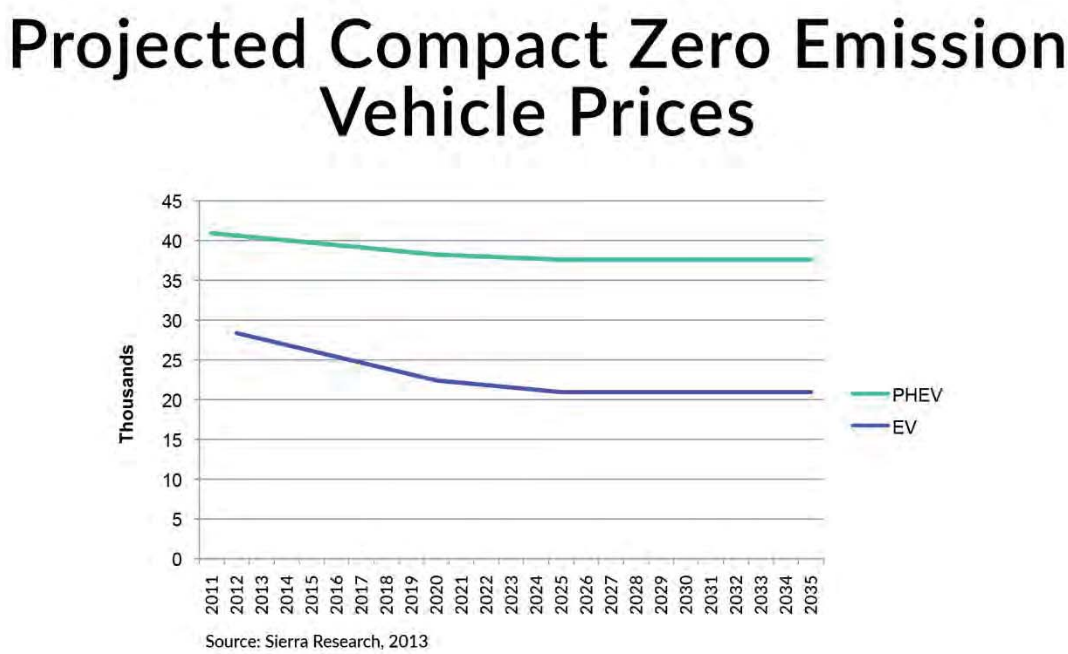


Figure 7.6 – Projected ZEV Compact Vehicle Prices
Source: CEC

BWP views TE as a tremendous opportunity to boost PEV use via home vehicle station rebates and a TOU rate to incentivize customers to charge during optimal times.

Finally, recent PEV driver survey results published by the California Center for Sustainable Energy (CCSE) provide some insights, indicating that environmental benefits (among other factors) contribute to the motivation to purchase a PEV.

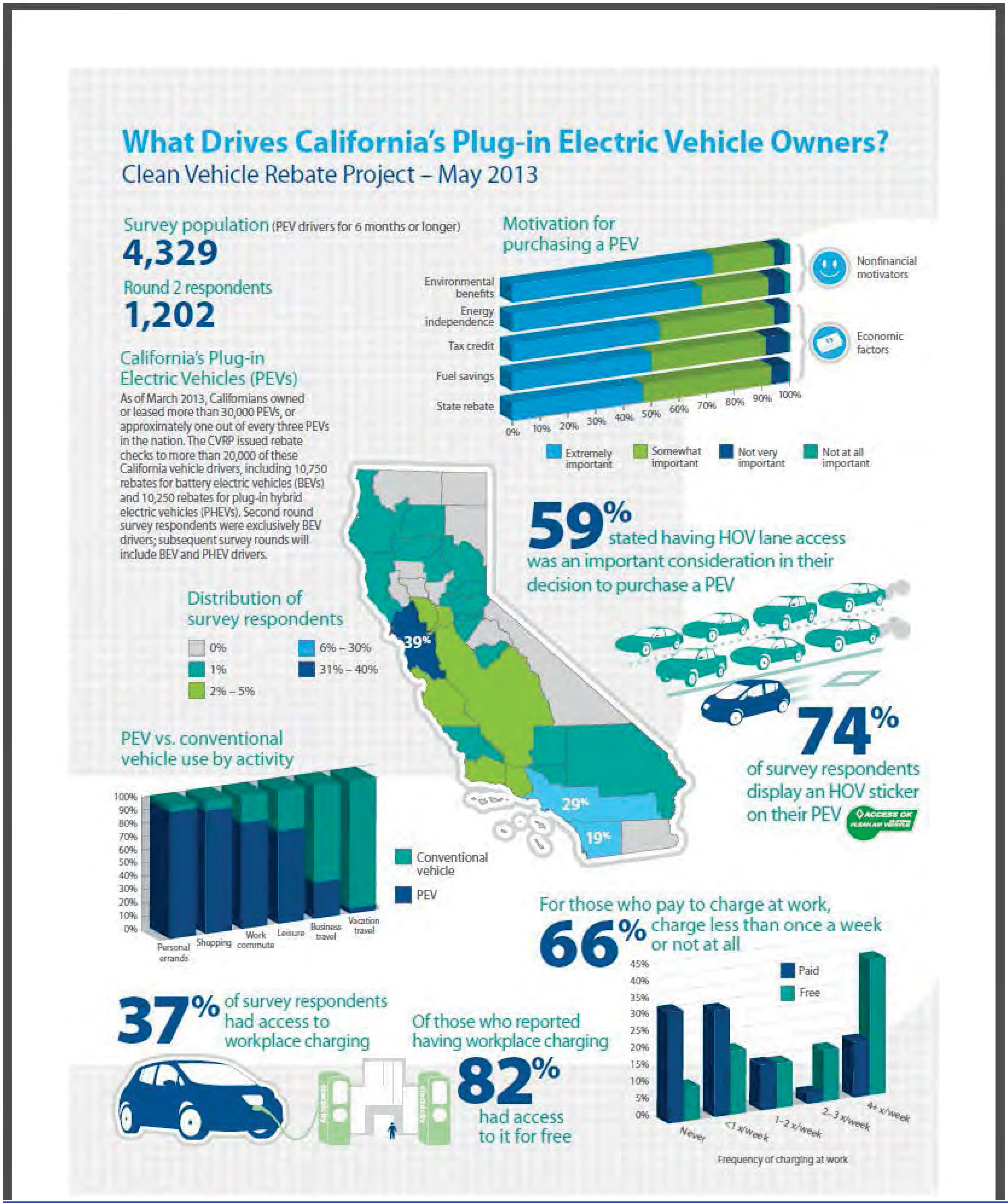


Figure 7.7 - What Drives California's Plug-In Electric Vehicle Owners? Source: Center for Sustainable Energy

7.1.5 Load Shifting Opportunities

With current California law requirement of 50% renewable energy by 2030 and the "Duck Curve" issue, BWP will require new innovation to meet these challenges head on. BWP is investigating the use of energy storage to avoid over-generation in the middle of the day and reduce power generation ramping in the late afternoon when customers come home from work. Large scale energy storage can become an important piece of minimizing the minute-by-minute intermittency challenges solar currently poses.

In this connection, Burbank seeks to explore opportunities for storage in a variety of forms. Burbank is interested in the development of customer-side programs that yield the equivalent benefits of real equipment installations however, without installing any actual equipment. One concept being discussed is a form of thermal storage: pre-cooling a home. This involves running an AC system continuously in the middle of the day, when demand on the electric system is lower and while supplies are plentiful. The goal would be to cool a home enough so as to require little to zero cooling during Burbank's system peak, when equipment is being stressed and the costs to serve load are the highest.

Burbank is also interested in exploring programs that would allow ratepayers to benefit from the installation of battery storage systems on their premises. Lithium based battery storage brings the promise of affordable storage to Burbank's homes and businesses and can provide new options that have never been cost effective before. Batteries offer many benefits; however, efficient utilization of battery systems to lower costs must be explored and appropriate customer programs developed.

Compressed Air Energy Storage (CAES)

At the utility scale, BWP is carefully evaluating compressed air energy storage (CAES) as large-scale, long-duration energy storage option. CAES is essentially a large mechanical battery that takes an intermittent resource and turns it into a dispatchable source. When electricity is generated and not needed, the electricity runs a compressor that pumps air under pressure into an underground cavern, where it is stored. When the electricity is needed, the air is released and, with a small amount of natural gas, it is run through a generator to produce electricity.

As described in Chapter 4, BWP is investigating a CAES pilot project at the Intermountain site in Delta, Utah.

7.1.6 Demand Side Management

Demand-side management (DSM) programs help customers manage their energy use while optimizing reliability, sustainability, and affordability across the BWP system. The goal of DSM is to encourage customers to consume electricity when it most plentiful and the least expensive to provide, and vice versa. DSM projects could incentivize customers to allow BWP to influence the timing (and as a result, the cost) of their energy use. Possible DSM programs include programmable thermostats, air conditioning cycling programs, PEV charging options for TOU or vehicle-to-grid pricing rates and incentives. Pilot control program options also include off-peak shifting of specific end-use loads, such as pool pumps, dishwashers and clothes washers. These demonstration projects for emerging trends in energy usage will be studied and evaluated.

7.1.7 Customer Web Portal

BWP's customer web portal enables Burbank residents to sign into burbankwaterandpower.com to access usage and pricing information anytime along with energy and water saving advice and program offers. Customers can even conduct what-if scenarios related to their usage.

7.1.8 Home Energy Reports

BWP uses Home Energy Reports to influence customer energy usage. Home Energy Reports, provided by OPower, were introduced to Burbank residents in 2010-2011 and have generated a 2% improvement in energy efficiency. This service integrates household usage data from the utility with an array of demographic, housing, and geographic information data to give customers personalized insights about their energy usage. Six reports are sent to Burbank residents each year showing comparative usage information and, with information about actions to reduce electricity consumption.

Perhaps the most useful feature of the reports is the comparison. Each customer is compared against a group of about 100 similar customers, indicating whether the customer uses more or less energy than neighbors. Similar customers are those who share similar usage criteria, such as property square footage and household size.

An online component to the service is also included as an extension of the paper reports. Combining advanced technology with Home Energy Reports delivers powerful insights and customized communications to promote both peak and overall demand reductions for BWP.

7.1.9 Load in 2034 Summary

BWP forecasts that Burbank's net load growth will be zero over the next 20 years. To continue to provide low rates while maintaining reliability and sustainability goals, BWP will be working on the following load stabilization strategies:

- Electrification- Decarbonize transportation fuels via electric vehicles
- Align time-of-use-rates with system conditions to incentivize customers to use power to mitigate the effects of the "Duck Curve."
- Increase energy storage (like CAES) and DSM programs such.

7.2 Energy Efficiency

Energy efficiency plays a major role in resource planning. The reduction of GHG emissions is an important goal of energy efficiency programs. BWP is on pace to continue to meet all GHG reduction goals.

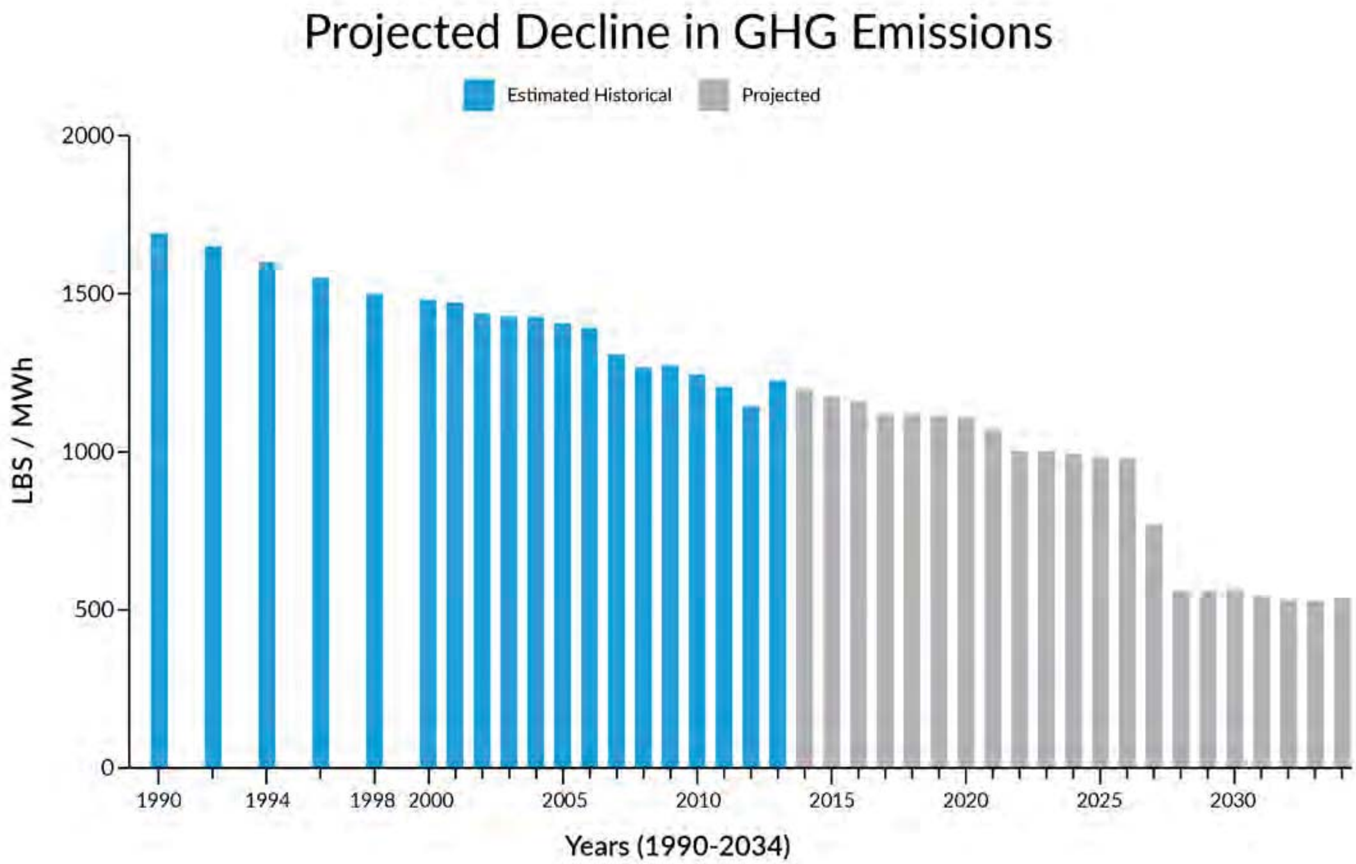


Figure 7.8 – Projected Decline in BWP's GHG Emissions
Source: BWP

However, a challenge for BWP over the next 20 years will be balancing energy efficiency with little to no load growth. With increased energy efficiency, BWP may ultimately make fewer sales to support large fixed operations and maintenance costs.

Nonetheless, BWP plans to continue offering award-winning energy efficiency customer programs which have historically reduced peak demand, saved energy and reduced GHG emissions. BWP's full suite of energy efficiency programs have been in operation for more than a decade. Programs are designed to address each major end-user and customer segment including single family, multi family, and low income households, as well as small to large businesses. For residents, BWP's program strategy began first with rebates and has evolved to include direct install and behavioral programs. For commercial customers, BWP offer direct install programs for small businesses, and rebate programs for large businesses. This diverse portfolio results in energy savings that are consistent from year to year and not completely dependent on a specific product, end-use, or target market.

These numbers reflect 2014-15 program activity:

- **Peak Demand Reduction:** BWP programs reduced peak demand by more than 3 megawatts.
- **Energy Savings:** Gross annual savings totaled 14 million kilowatt-hours.
- **Lifecycle Savings:** Gross lifecycle savings accruing from BWP's efficiency portfolio reached nearly 130 million kilowatt-hours.
- **GHG Reductions:** The net lifecycle greenhouse gas reductions are 77,649 tons.

State of California legislation determines specific goals in greenhouse gas reductions and the cost-effectiveness of the energy efficiency programs BWP must provide. AB 1890 mandates that BWP spend 2.85% of electric revenue on Public Benefit programs as follows:

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

BWP regularly evaluates the Public Benefits fund and the program portfolio to adjust funding levels on existing programs depending on the perceived societal benefit, community use, overall cost-effectiveness and for new program offerings.

7.3 Generation Portfolio

Within this complex planning context, BWP sees its generation resource portfolio changing drastically, with coal disappearing in 2025 and more renewables and more use of existing natural gas filling the gaps. BWP's small shares of Palo Verde and Hoover are expected to stay the same.

What types of renewable energy – like solar, wind, biomethane, geothermal – and the integration technologies – like storage and demand response – are less certain. This will be the subject of further analysis and planning as the need for those resources approaches. But regardless, BWP expects that changes in its energy supply will, over time, drive down its GHG profile, consistent with California policy.

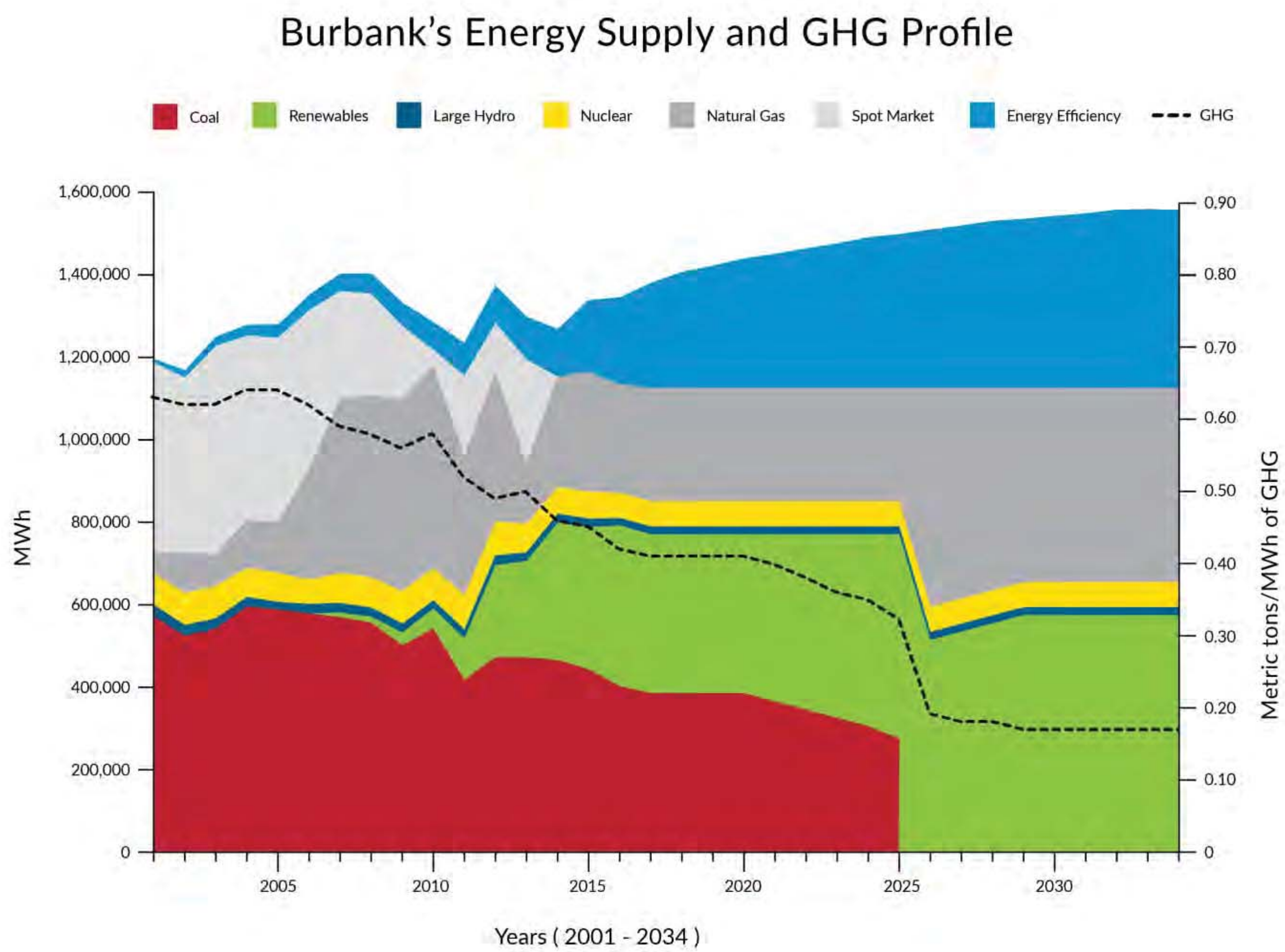


Figure 7.9 - Burbank's Energy Supply and GHG Profile
Source: BWP

7.4 What's Next?

As time marches forward, BWP must forecast the energy efficiency landscape and the direction of both California and national policies. The State of California has a climate change goal to reduce greenhouse gasses by 40% below 1990 levels by 2030. BWP is on pace to meet this goal by 2020.

In October 2015, Governor Brown signed SB 350 into law, which aims to reduce GHG emissions further. SB 350 mandates annual targets for statewide energy savings that will achieve the Governor's goal of doubling statewide energy savings by 2030. A major component of this plan is to double the amount of energy efficiency in commercial buildings by providing rebates and programs for customers to purchase LED lighting and more efficient appliances and equipment.

BWP must also stay aware of technological advances as more energy efficient smart appliances and equipment come into the marketplace which can be controlled via a mobile device from anywhere in the world or that can learn a user's behavior patterns. Such advances can be combined with rate design and customer programs to help balance BWP's future energy load.

AB 2021 requires public utilities to identify all potential cost-effective energy savings and establish annual targets for energy efficiency savings and demand reduction for the next ten years. The savings target is a percentage or kWh goal against which energy efficiency achievements will be measured.

With the assistance of Navigant Consulting in 2011, BWP identified annual energy efficiency savings targets. Using historical savings data, Navigant ran various scenarios to identify savings targets over ten years, from 2014 to 2023.

Navigant's analysis derived an average annual 0.89% savings target for the period of 2014-2023. The targets range from 0.80% in 2014 to 0.97% in 2021. The targets vary year-to-year based on products and programs that enter or exit the market, the effects of codes and standards, and other market conditions, including electricity prices.

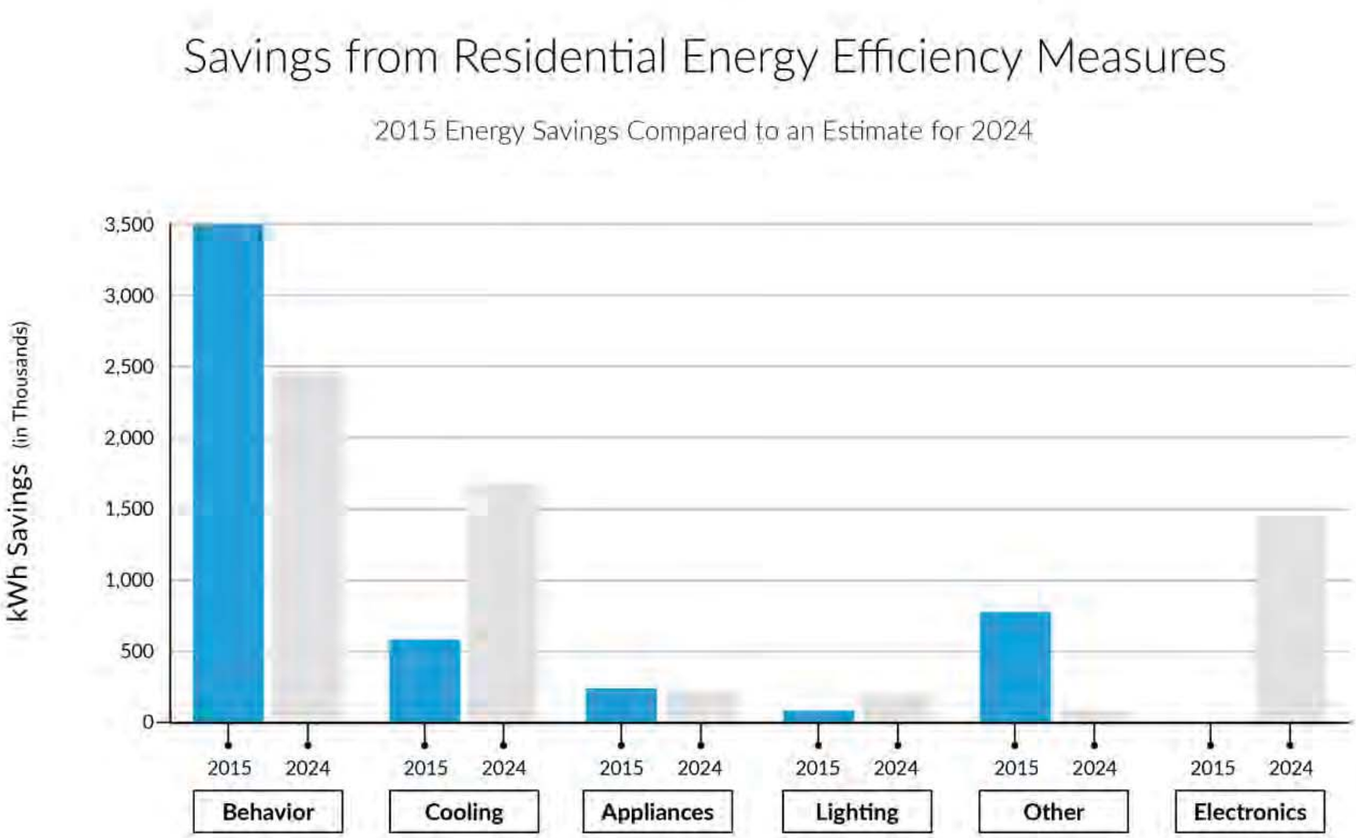


Figure 7.10 - Savings from Residential Energy Efficiency at BWP
Source: BWP

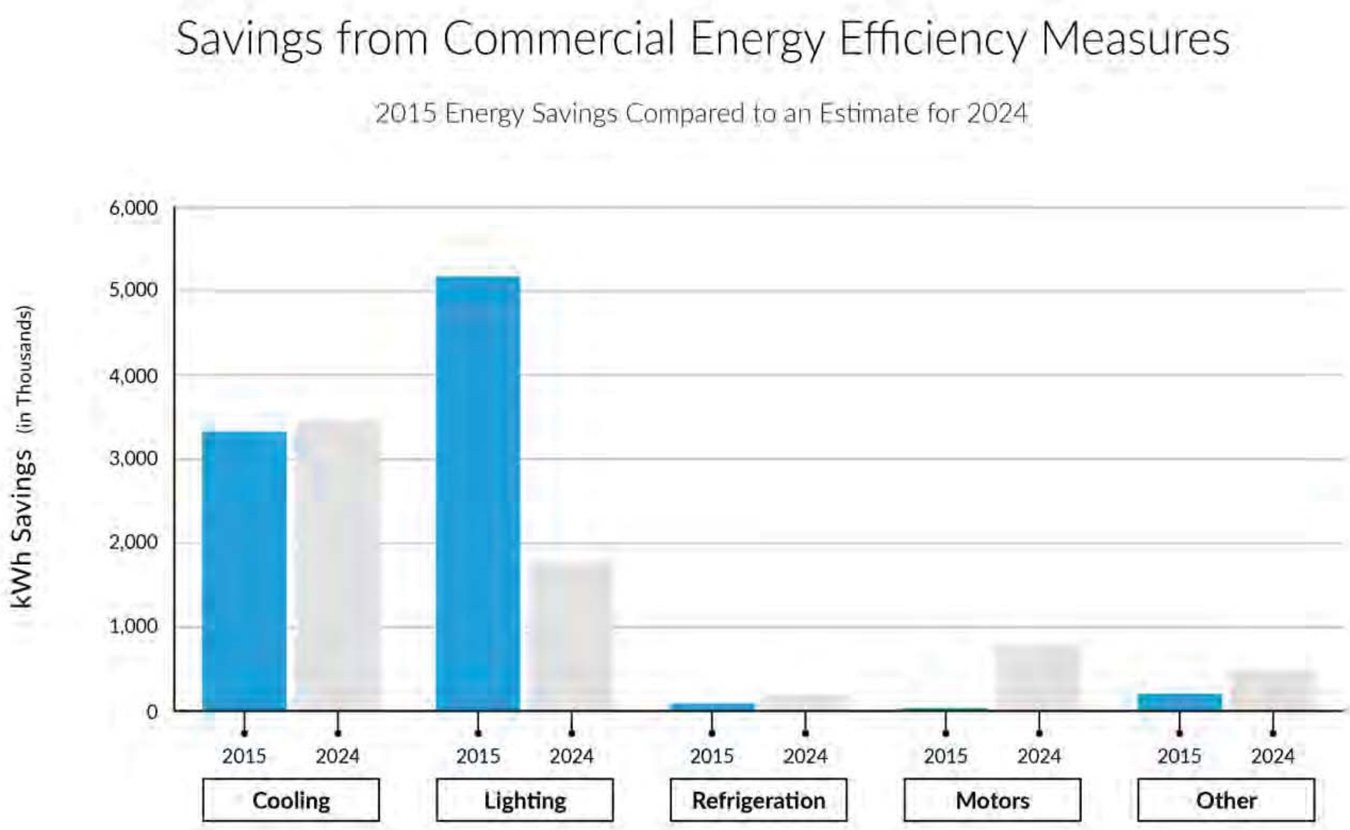


Figure 7.11 - Savings from Commercial Energy Efficiency at BWP
Source: BWP

This chart highlights the continuing ascension of residential behavioral programs such as Home Energy Reports via OPower, which provide customers with monthly energy use comparisons. Customers have been reducing their overall energy use in response to this program. Home Energy Reports are currently the third most effective energy efficiency measure in BWP's portfolio, but by 2024, BWP estimates that it will become the number one most effective measure.

Commercial and residential HVAC savings include the installation of energy efficient heating and air conditioning systems which replace older, less efficient models. These measures are projected to become the second and third most energy efficient measures customers will be making in 2024. The Other category includes loads such as computers, cooking, refrigeration for commercial building, office equipment or printers. Advances such as low power consumption by LCD monitors, more effective sleep modes and the uptake of a notebook laptop computer in lieu of a desktop computer have produced lower plug load power levels and will continue to do so into the future.

The cost of LED light bulbs has fallen by more than 85% since 2008. LED bulbs are now available for less than $4 per bulb. Lighting accounts for about 5% of a home's energy budget and switching to more efficient bulbs is one of the fastest ways to cut those costs, according to the Energy Department. LEDs use 75% - 80% less energy than incandescent bulbs and last 25 times longer. LEDs will account for 83% of the lighting market share by 2020 and almost all of it by 2030, according to the Energy Department.

This falling price of LED light bulbs and their growing market penetration among commercial customers will eventually lead to reduced but sustained impact on City-wide energy savings. Accordingly, commercial lighting energy savings are estimated to drop in half by 2024. There will be a similar reduction in residential lighting savings which will lead to residential lighting falling out of the top ten most effective energy savings measures. However, technological advances in lighting controls may become a significant source for new energy efficiency savings.

BWP estimates that residential electronics will make a huge leap in kWh savings due to residential customers replacing older, less efficient electronics such as televisions, DVD players, and cell phone chargers with newer electronics that are more energy efficient. BWP estimates a 300% increase in energy savings from 281 kWh per year in 2015 to 944 kWh in 2024.

BWP will continue to work with government and local agencies to find creative partnership and grant opportunities to provide energy efficiency programs at the least cost.

7.5 Regulatory Drivers

SB 350 became law in California in October 2015. From an integrated resource planning perspective, two requirements of this law are particularly relevant:

- Doubling of energy savings through energy efficiency programs by 2030; and
- Increasing the RPS to 50% by 2030.

The first two of these provisions – energy efficiency and transportation electrification – will affect load forecasts, albeit in different directions: energy efficiency measures will drive loads down and electrification will drive loads up. Regardless of load forecasts, though, the third provision – 50% RPS by 2030 – will cause BWP to add additional renewable resources, both to replace expiring contracts and to replace more non-renewable generation with renewable generation. This could mean a worsening of BWP's (and the Western U.S. region's) "Duck Curve" challenges, especially over-generation, depending on net load growth and the timing of resource retirements and additions.

At the federal level, the EPA's CPP will likely cause a substantial "decarbonization" of power generation in the United States, primarily through the retirement of coal-fired generators and less efficient natural gas-fired generators, in support of GHG reduction goals.

With California's SB 350 and the EPA's CPP, legislators and regulators clearly intend to reduce GHG emissions to minimize the impact of climate change. In response, BWP's planning goal is to reduce GHG emissions on the same track, in large part through achieving a 50% RPS by 2030 while maintaining affordable and reliable service for Burbank.

7.6 Storage

California Assembly Bill (AB) 2514, signed into law in September 2010, requires among other things, that the governing board of each publicly-owned California electric utility (such as BWP) undertake a process to evaluate energy storage opportunities and, by October 1, 2014, adopt targets, if any, for the procurement of "viable and cost-effective" energy storage systems by December 31, 2016 and December 31, 2020.

In this review, utilities may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems. AB 2514 also requires that each utility report these targets and policies, if any, to the CEC following such adoption. Utilities are further required to re-evaluate these targets and policies not more than every three years, with a report to the CEC.

7.6.1 What is Energy Storage?

The basic function of an energy storage system is to absorb energy when it is not needed, store it for a period of time with minimal loss, and then release it when needed. When deployed in the utility electric system, energy storage can serve a number of important roles in balancing generation and load, especially as increasing amounts of intermittent renewable energy resources are brought onto the system.

These applications can occur on a large, regional scale (e.g., within the bulk electric system) and at a more local scale (e.g., on the local distribution system or "behind the meter" on a customer's site), and can comprise a wide variety of technologies in various stages of development, including battery technologies, flywheels, and compressed air energy storage.

Energy storage is a potential enabling tool to continue to achieve BWP's commitment to reliable, sustainable, and affordable electric service to Burbank. For example, energy storage has the potential to effectively integrate intermittent renewable energy resources (such as solar and wind energy) by better matching the output of those resources to Burbank's needs.

7.6.2 Storage Options for BWP

BWP has been an early and active leader in investigating energy storage systems and applications for the benefit of its customers. For example, BWP has been an important catalyst for the investigation of compressed air energy storage (CAES) at the Intermountain site in Delta, Utah. The geology of this site, featuring a major underground salt deposit capped by solid rock, is particularly well-suited to CAES. A CAES project at this site has the potential to access low-cost, high-quality wind resources in Wyoming, store that energy and make it dispatchable through CAES, and transmit it down the existing direct current transmission line that currently brings Intermountain's output to Southern California. Such a project also has the potential to relieve solar-driven, over-generation issues in California, by absorbing that over-generation and then retransmitting it back to California when needed.

More generally, BWP is preparing its system for distribution-level and customer-owned energy storage in a number of ways. BWP is working closely with SCPPA and its fellow SCPPA member utilities in investigating potential energy storage technologies and projects, through leadership in an Energy Storage Working Group, as well as participation in a Renewable Energy and Energy Storage Request for Proposals and Post-2020 Generation and Energy Storage Request for Information.

Chapter 8 – Proposed Policy Guidelines and Action Items

BWP has a strong foundation of reliable, affordable, and sustainable electric service and has received invaluable guidance on key issues through its public outreach process. While many significant uncertainties make specific long-term plans imprudent at this time, two guiding principles emerged:

1. ***Stay The Course***: As noted above, BWP is providing reliable, affordable, and sustainable electric service to Burbank and, over the last decade or so, has made strategic decisions that will allow it to do so until at least 2020. In other words, BWP is on the right track for the foreseeable future and should stay on that track as BWP continues to plan for the future.
2. ***Take The Time To Get It Right***: Because BWP can "stay the course," BWP can focus on long-term planning in a measured, thoughtful manner – the same way that the foundations for today's great performance were laid years before – to achieve that same great performance in years to come, despite significant uncertainty. BWP has given itself "time to get it right" and, over the next few years, BWP will tirelessly position itself to continue reliable, affordable, and sustainable electric service for Burbank for years and decades to come.

PROPOSED POLICY GUIDELINES

BWP is committed to providing reliable, affordable, and sustainable electric service to Burbank. BWP does so in the context of state and federal regulatory mandates, local mandates, and under the direction of its Board and the Burbank City Council.

Burbank will continue to meet electricity demand growth from energy efficiency and conservation, then renewables. Burbank does not plan any new fossil-fueled power generation.

This IRP proposes a number of policy guidelines:

A. Optimize cost-effective energy efficiency and conservation programs.
B. Add renewable energy to the extent needed.
C. Plan to achieve greenhouse gas emissions reductions consistent with state goals.
D. Maintain low cost of service, including striving to maintain rate increases at or below the long-run rate of inflation.

ACTION ITEM HIGHLIGHTS

In turn, this Plan includes the following action items, consistent with the foregoing:

1. **Maintain the 33% Renewable Portfolio Standard through 2020 and achieve 50% by 2030** through maximizing BWP's flexibility on renewal of Intermountain; expanding BWP's access to regional electricity markets; continuing to investigate energy storage opportunities and other cost-effective renewable energy integration strategies, ideally with dispatchable resources;

managing oversupply; making opportunistic cost-effective long-term purchases when warranted; and considering incremental transmission rights.

2. **Continue to complete Burbank's journey off coal as a resource**. Intermountain is a reliable and affordable part of BWP's power supply portfolio, despite its environmental challenges. BWP will continue to manage its long-term investment in Intermountain until Intermountain is retired, and look to maximize BWP's flexibility on its renewal. At the same time, BWP will work to mitigate the effects of electricity oversupply and seek renewable energy to meet unmet load.
3. **Redesign rates to mitigate subsidies for and facilitate cost-effective investment in rooftop solar**. At the same time, this effort must be phased-in so that sudden changes in customer electric bills are avoided.
4. **Pursue all cost-effective and operationally sound programs for energy efficiency and conservation in Burbank**, together with the development of effective customer-level program assessment tools. In a similar vein, reduce distribution losses to less than 3% by 2030, pursuant to the Distribution Master Plan, as lower losses mean less electricity generated in the first place.
5. **Improve the relationship between customer demand and a generation resource mix heavily dependent on renewable energy**. BWP is pursuing rate design improvements (including Time-of-Use rates across BWP's customer base), energy storage opportunities, and overall electrification (such as electric vehicles and electric heating and cooling) in Burbank**.**
6. **Derive value from innovation** through the continued proactive investigation and deployment of new technologies, including both utility-scale and small-scale energy storage technologies.

With this approach, reviewed and refined with the BWP Board and the Burbank City Council, BWP can position itself to provide *reliable*, *affordable*, and *sustainable* electric service to Burbank for decades to come.

Chapter 9 – Appendices

Appendix 1. Generation

Power Made in Burbank

Natural Gas-Fired Generation

Burbank has had local generation facilities for more than 80 years. BWP's current local generation resources are natural gas-fired units that went into service between 1959 and 2005.

BWP's On-Site Natural Gas Power Sources

NAME	TYPE	POWER LOAD TYPE	CAPACITY (MW)	IN-SERVICE DATE
Magnolia	Combined-Cycle	Base Load & Load Following	75.6* | 244	2005
Lake	Combustion Turbine	Peaking	45	2002
Olive 2	Steam	Base Load	50	1964
Olive 1	Steam	Base Load	40	1959

* BWP has a 31% interest in this SCPPA owned plant located in Burbank.

Figure 9.1 - BWP's On-Site Natural Gas Power Sources
Source: BWP

Lake One (Peaking)
The Lake One unit, a 47MW General Electric LM-6000 simple-cycle combustion turbine, went into service in 2002. At the time, the unit represented "best of class" combustion turbine technology.

Lake One is a peaking power plant. It often generates during hot summer days when loads are high and it serves as a reserve when it sits idle. The expected annual output of this unit for retail load is approximately 25,000 MWh per year or about 2.1% of BWP's net energy load.

Magnolia Power Plant (Base-load/Load-Following)
In 2002, BWP participated in a Southern California Public Power Authority (SCPPA) combined-cycle generating plant that was built in and operated by Burbank known as the Magnolia Power Plant (Magnolia). In September 2005, this unit went into service using "best in class" natural gas combined-cycle technology. This unit can be used for either base-load or load-following power.

Magnolia is based on a General Electric 7FA combustion turbine. The term combined-cycle refers to how the plant recycles the waste heat from the combustion turbine, by turning it into steam and using it to power the steam turbine. The nominal output of the plant is 242 MW but for limited periods, it can be augmented with supplemental firing (similar to afterburners on military aircraft) and steam injection to produce up to 310 MW.

Burbank hosts and operates the plant and has an entitlement to 31% of the plant's output, approximately 75 MW (or up to 95 MW with afterburners). The efficiency of the facility is very high. Magnolia's availability factor for 2014 was 96.6%. The availability factor of a power plant is the percentage of the time the unit is actually able to operate. Magnolia generally always runs when available, while other plants may not. When compared to other utilities, Magnolia's 96.6% availability factor is excellent.

Olive 1 and 2 (Reserves)
The Olive 1 and 2 steam generating units are BWP's oldest existing units, and went into service in 1959 and 1964, respectively. Since 2012, Olive 1 and 2 have been placed in "dry-layup" for long term preservation of the boiler, condenser, turbine and related piping. The consequence is that these units would require at least 45 days of repair and refurbishment prior to starting again. Olive 1 and 2 are no longer included in BWP's power supply planning but the units can be restarted for use if needed.

BWP is investigating options to replace Olive 1 and 2, however at this time it is unknown when or how the capacity will be replaced. BWP has studied replacing the units with combustion turbines similar to Lake One, renewables, storage (such as batteries), or a mix of technologies that could yield the flexibility required to operate in the future.

Power Generated Outside of Burbank

Nearly all of the power imported into Burbank is generated outside of California. BWP enters into long-term contracts for this power or jointly owns them with other municipal partners. This enables economies of scale needed to procure power at favorable prices, fund large projects, and obtain the most favorable financing rates.

BWP often participates with other municipally owned electric utilities in Southern California through a Joint Powers Authority called the Southern California Public Power Authority (SCPPA) to develop and participate in new generation and transmission projects. SCPPA has been used by BWP to finance participation in the Southern Transmission System (STS), Palo Verde, Magnolia and Hoover. A similar agency based in Utah called the Intermountain Power Agency (IPA) was used to develop Intermountain with the State of Utah.

Hoover Dam (Load-Following/Peaking/Reserves)
Location: On the Colorado River along the Nevada-Arizona border.
Capacity: 20 MW (of Hoover's 2,080 MW aggregate capacity).
Energy: 26,600 MWh per year, plus the potential for a portion of any additional excess energy that might be available from high stream flows. In 1983, the Hoover uprating project allowed Burbank to add about 5 MW of capacity to Burbank's existing 15, for a total of 20.
Owner: U.S. Government, through the U.S. Bureau of Reclamation.
Operator: Western Area Power Administration. The energy is received via a contract with SCPPA.
Term: This contract remains in effect until September 30, 2017. The parties taking power from this facility are currently negotiating the terms and conditions of receiving power from this facility after 2017.

Palo Verde Nuclear Generating Station (Base-load)
Location: South of Phoenix near Wintersburg, Arizona.
Capacity: 9.5 MW, which is 4.4% of SCPPA's 216.5 MW interest (of Palo Verde's 4,010 MW aggregate capacity).
Energy: Approximately 70,000 MWh per year.
Operator: Arizona Public Service Company.
Term: This contract remains in effect until 2047.

Intermountain Power Project (Base-load and Transmission)
Location: Delta, Utah.
Capacity: Approximately 74 MW (about 4% of the plant's 1,900 MW aggregate capacity).
Energy: 576,000 MWh per year.
Owner: Intermountain Power Agency, an instrumentality of the State of Utah.
Operator: Intermountain is operated by the Los Angeles Department of Water and Power (LADWP) through an independent corporation called the Intermountain Service Corporation.
Term: The original term runs through July 15, 2027.

Intermountain is comprised of three assets:

1. 1,900 MW coal-fired, two-unit power plant located in Delta, Utah;
2. 490-mile 500 kilovolt (kV) direct current transmission line which transmits the electricity generated by the power plant in Delta to Southern California, known as the STS; and,
3. two alternating current transmission lines which transmit the electricity from the power plant in Delta to delivery locations elsewhere in Utah (and a portion of Nevada), known as the NTS.

Intermountain has operated since the mid-1980s and serves 36 different municipal utilities in Utah and California, including Anaheim, Burbank, Glendale, Los Angeles, Pasadena, and Riverside (the purchasers). Los Angeles Department of Water and Power (LADWP), as the operating agent, operates and maintains Intermountain, the STS, and the NTS. LADWP purchases the majority of Intermountain's output. BWP's share of Intermountain is approximately 74 MW of electricity generation, 108 MW (north to south) of STS capacity, and

27 MW (north to south) of NTS capacity. BWP's share of the Intermountain is about 4%. The current power sales contracts will expire in 2027.

Intermountain Renewal Contract Negotiations

BWP and the other California and Utah purchasers have been working for a number of years to determine Intermountain's future after the termination of the existing power sales contracts (i.e., post-2027). Under the existing Intermountain power sales contracts, that decision must be made unanimously by all 36 purchasers. A renewal of Intermountain was proposed in 2006. At the same time, a new California law, SB 1338, mandated that electric utilities will not be allowed to import power into the state that exceeds a fossil fuel emissions cap after their current contracts expire.

Since 2006, other approaches to produce energy that use considerably less carbon-based fuels have been considered. Most of the approaches, many of which at first appeared promising, were found to be too costly. In that context, IPA and LADWP had proposed in 2012, that Intermountain be replaced with a 1,200 MW combined-cycle natural gas-fired power plant (the "Gas Repowering"), with rights to STS and NTS transmission capacity again linked to power purchases from the new generating facility. IPA and LADWP have proposed that 1) this natural gas power plant begin commercial operation in 2025 and run to 2077 and 2) the coal plant be retired simultaneously, two years earlier than the current (coal-based) contracts expire.

Under this plan, LADWP would continue to be the major purchaser of Intermountain's output and major decision-making control regarding Intermountain would continue to rest with IPA and LADWP. There are two principal enabling agreements involved with the replacement of the coal plant with a gas-fired power plant:

1. An amendment of the current power sales agreement for the coal plant, called the "Second Amendatory Power Sales Contract," ("Second Amendatory PSC"), along with a renewal power sales contract for the gas-fired plant, called the "Renewal Power Sales Contract," ("Renewal PSC"); and
2. An agreement for the purchase of excess power, called the "Agreement for Sale of Renewal Excess Power" ("Renewal Excess Power Agreement").

Under the terms of this proposal, purchasers (including BWP) must enter into these enabling agreements for the renewal now in order to participate in the renewal in 2025. As such, these enabling agreements include mechanisms whereby a purchaser's share of renewal generation (and, by formula, capacity on the STS and NTS) will be determined by a subscription process.

In 2015, though renewable energy became the single largest source of Burbank's electrical supply for the first time ever, Intermountain still provides approximately 31% of the electricity that BWP provides to its customers. The other Intermountain participants also use Intermountain to provide a large part of the requirements for their customers as well.

In addition, as a coal-fired generator, Intermountain faces regulatory pressure of its own. As a result, BWP staff has supported renewal but with concerns that the renewal proposed by IPA and LADWP would not adequately address BWP's needs in planning for continued reliable, affordable, and sustainable electric service. To facilitate a renewal that meets BWP's needs, BWP actively participated in negotiations with LADWP, IPA, and the other California purchasers to revise the terms of the IPA/LADWP proposal. These negotiations resulted in new Intermountain Renewal Documents.

Under the new Intermountain Renewal Documents, BWP and the other California purchasers (except LADWP) have an option to reduce (including to zero) its share of generation and transmission in Intermountain on or before November 1, 2019. The California purchasers also received a non-binding assurance from LADWP that if a California purchaser reduced its share of the new power generation to zero, LADWP would enter into an agreement with such California purchaser to provide at least 50% of that California purchaser's Intermountain participation-linked transmission rights from the southern end of the STS – at Adelanto, California – to each California purchaser's electrical system.

Intermountain Renewal Summary
These agreements preserve important power resource planning options for BWP at the Intermountain site, including the option to participate in future power generation projects at Intermountain. Without these agreements, it would be difficult (if not impossible) and certainly more expensive for BWP to benefit from participation in projects, at Intermountain.

Valley Pumping Plant (Base-load)
In 2002, BWP installed a small micro-hydro system to take advantage of a required pressure reduction where the City's water facilities interface with the Metropolitan Water District of Southern California (MWD) at the Valley Pumping Plant. Peak output of the facility is approximately 550 kW. The micro-hydro system is used when BWP purchases water from MWD.

Ameresco Landfill Gas to Energy (Base-load)
In 2010, BWP began to receive 1.7 MW from the Ameresco Landfill Gas to Energy project pursuant to a long-term contract. This project produces energy by using landfill gas (methane) from the Chiquita Canyon Landfill, which is located approximately five miles west of the City of Santa Clarita along State Highway 126.

The facility consists of two small combustion turbines and produces approximately 10,500 MWh per year, which corresponds to nearly 1% of Burbank's annual requirements.

BWP's contract with Ameresco expires in November 2026.

Pleasant Valley Wind (Intermittent)
In 2006, BWP signed a 16-year power purchase contract with PPM Energy, Inc. to purchase 5MW of wind power from Pleasant Valley Wind Project, located in Southwest Wyoming. The project is owned by Florida Power & Light and marketed to BWP by PacifiCorp. The energy from this project amounts to 14,500 MWh annually, approximately 1.2% of BWP's energy requirements.

The power sales agreement will expire in June 2022.

Milford Wind I (Intermittent)
In 2009, BWP began receiving 10 MW of wind power from the Milford I Wind Project, located near Intermountain, under a long-term-contract. The 10 MW under this contract will supply 26,500 MWh annually, which is approximately 2.2% of BWP's energy requirements.

BWP has the option to purchase the Milford Wind I Project on the 10th or 20th year anniversary date after commercial operation began, i.e. 2019 and 2029.

The power sales agreement will expire in November 2029.

Pebble Springs Wind (Intermittent)
In 2009, BWP began receiving 10 MW of wind power from the Pebble Springs Wind Project, located in northern Oregon, under a long-term-contract. Pebble Springs provides approximately 2.4% of BWP's energy requirements, or 29,000 MWh annually.

BWP has the option to purchase the Pebble Springs Wind Project on the 10th anniversary of the start of commercial operation, or 2019.

The power sales agreement will expire in November 2027.

Tieton Hydro (Base-load)
In March 2009, BWP began receiving 50% of the output of the Tieton Hydropower Facility, located in south-central Washington State. Then, in the fall of 2009 the Cities of Burbank and Glendale purchased the facility via SCPPA. Burbank's 50% share in the facility provides approximately 24,000 MWh annually to Burbank, which is about 2% of BWP requirements.

Don A. Campbell I Geothermal (Base-load)
In March 2013, BWP received Council approval to enter into a 20-year contract for geothermal power from a new development called Wild Rose Geothermal Project. Wild Rose has since been renamed Don A. Campbell. The project was built by global geothermal project developer, owner and operator Ormat Technologies, Inc. in Mineral County, Nevada. The facility went into commercial operation in November 2013. Burbank has rights to 15.4% of the output, about 2.49 MW nominally and receives approximately 19,000 MWh annually.

The power sales agreement will expire in November 2033.

Copper Mountain Solar 3 (Intermittent)
In December 2012, BWP received City Council approval to enter into a 20-year contract for solar PV power from Copper Mountain. The project was built by Sempra U.S. Gas and Power near Boulder City, Nevada. The facility went into commercial operation in November 2013. Burbank has rights to 16% of the output, about 40 MW nominally, and receives approximately 86,000 MWh annually.

The power sales agreement will expire in November 2033 and BWP has the option to purchase the facility at the 10th, 15th or 20th year anniversary date after commercial operation began.

Biomethane (Base-load/Load-Following)
In 2011, Burbank signed four separate contracts for a supply of pipeline quality biogas, referred to as biomethane, in support of BWP's RPS obligations.

Biomethane is a renewable form of natural gas, produced from landfills and sewage treatment plants. BWP burns this "green natural gas" in Magnolia in place of conventional natural gas. As such, biomethane is an important component of BWP's RPS compliance strategy, using the very efficient Magnolia right here in Burbank, without the need to utilize BWP's finite transmission resources to bring power from distant resources.

Each of these biomethane supply agreements runs for 10-years at a fixed cost. Under the contracts, BWP is expected to receive 3,000 Dth/day, generating approximately 150,000 MWh of renewable energy in a year or about 13% of Burbank's power supply.

Appendix 2. BWP's Transmission Rights

Pacific Northwest DC Intertie ("DC Intertie")
Description: Double pole +/- 500 kV DC transmission system and extends a total of 850 miles. It has a maximum rating of 3,100 MW.
Location: From Celilo in northern Oregon to Sylmar, California.
BWP Share: 115 MW of transmission capacity on a 580 mile segment of the line from the Nevada/Oregon Border (NOB) to Sylmar, California.
Use: The DC Intertie is primarily used to bring energy from Burbank's renewable resources in the Pacific Northwest region to Burbank, as well as make purchases or sales of energy to or from the region as available.

Southern Transmission System ("STS")
Description: 488 mile long, double pole +/- 500 kV DC transmission system.
Location: From Intermountain in Central Utah to the Adelanto Switching Station near Victorville in Southern California.
BWP Share: 108 MW (4.5%) of capacity on the STS based upon a line rating of 2,400 MW. STS is part of Intermountain described previously.
Use: The line is primarily used to bring Burbank's power entitlements from Intermountain as well as power from Milford Wind to the Los Angeles Basin. The line has secondary uses of bringing economy energy from Utah and Nevada to the L.A. basin.

Northern Transmission System ("NTS")
Description: Two, 50-mile long, 345 kV AC lines.
Location: From Intermountain to Mona Substation in Utah and to the Gonder Substation in Nevada.
BWP Share: Up to 38 MW of firm capacity and energy on the NTS. NTS is also part of Intermountain described previously.
Use: The line was built to move Intermountain power to Utah entities. However when those entities signed the Excess Power Sales Agreement they had no use for a portion of the line, so the California entities involved in the project were able to acquire the rights. These lines are primarily used for wholesale trading and buying short-term power from the market when it is attractively priced.

McCullough –Victorville Line 2
Description: 180-mile 500 kV AC transmission line.
Location: From the McCullough transmission hub near Las Vegas to Victorville, California.
BWP Share: In 1980, Burbank acquired a 2.5% entitlement, which corresponds to 25 MW of capacity based on the line's current rating and continues until May 31, 2030.
Use: Burbank uses this line to make power transactions with entities in Nevada, New Mexico, and Arizona.

Hoover Transmission Service Agreement with LADWP
Description: An agreement with LADWP to bring Hoover power from the plant to Burbank.
Location: LADWP's transmission system between Southern Nevada to the Los Angeles basin.
Ownership: January 1992, BWP entered into a firm transmission service contract with LADWP for the delivery of BWP's total Hoover entitlement of 20 MW of firm capacity to Receiving Station E ("RS-E").
Use: BWP brings Hoover power into the LADWP System through this service agreement for delivery to Burbank. The contract expires on September 30, 2017, coincident with the expiration of Burbank's Hoover entitlement agreements. Negotiations are underway to renew this contract.

Intermountain Transmission Service Agreement with LADWP
Description: This is a contract with LADWP to provide 84 MW of firm transmission service.
Location: Power is received at the 500 kV bus of Adelanto Switching Station and delivered to RS-E.
Ownership: This contract expires on June 15, 2027, coincident with Burbank's Intermountain entitlement contract expiration.
Use: This contract allows a path for BWP's Intermountain entitlement, as well as some extra firm transmission capacity for transactions with other utilities in Utah and Nevada.

Victorville-Receiving Station E ("RS-E") Transmission Service Agreement with LADWP
Description: This contract with LADWP provides 25 MW of firm transmission service.
Location: Power is received at the 500 kV bus of the Adelanto Switching Station or the 500 kV bus of the Victorville Switching Station and delivered to RS-E.
Ownership: This contract will expire on May 31, 2030, coincident with the expiration of Burbank's rights and entitlement in the McCullough-Victorville line 2.
Use: BWP uses this arrangement to match BWP's rights and entitlement in the McCullough-Victorville line 2.

Marketplace-Adelanto Transmission Service
Description: A 500 kV transmission line.
Location: The Marketplace-Adelanto 500 kV transmission line runs from the new Marketplace Substation, approximately 17 miles southwest of Boulder City, Nevada, to the vicinity of Adelanto, California.
Ownership: The line is rated at 1,200 MW and BWP has an entitlement to 11.5% of the 67.9% interest held in the project by SCPPA, which results in approximately 94 MW of capacity for BWP.
Use: In addition to this entitlement, the transmission arrangement also provides Burbank access to the McCullough Substation, which is connected by a short tie-line to the Marketplace Substation. It provides for greater flexibility by allowing BWP to conduct transactions from both locations.

Adelanto-Receiving Station E ("RS-E") Transmission Service Agreement with LADWP for Mead-Adelanto Project

Description: This Agreement provides up to 94 MW of transmission service over the LADWP Transmission System.

Location: The RS-E Agreement provides an arrangement between Adelanto and Burbank for power transmitted over the Marketplace-Adelanto project.

Ownership: Under the Agreement, Burbank can adjust the amount of transmission capacity it receives up to a total of 94 MW.

Use: This contract is open-ended and can continue at Burbank's discretion as long as the Marketplace-Adelanto transmission line remains in-service.

Marketplace-Mead 500/230 kV-Westwing Transmission Service

Description: This agreement provides for transmission service between the Westwing Substation in Arizona near Phoenix, to the Mead Substation in Nevada near Las Vegas, to the Marketplace Substation which is also located in near Las Vegas.

Location: This transmission service is comprised of three different legs incorporating the Marketplace Substation, the Mead and McCullough Substations, and the Westwing and Perkins Substations northwest of Phoenix, Arizona.

Ownership: In the Marketplace to Mead 500 kV leg, Burbank has rights to 70 MW of firm capacity, which corresponds to 16.9% of SCPPA's 22.4% interest in this section.

In the Mead Substation portion, Burbank has rights to 35 MW corresponding to 15.9% of SCPPA's 17.8% interest.

In the Mead to Westwing section, which goes through the Perkins Substation, Burbank has the majority interest with 35 MW derived from a 14.7059% interest in SCPPA's 18.3077% ownership in this section.

Use: The line is used to bring BWP's Palo Verde entitlements home and also for acquiring short-term power purchases from the region whenever it is economic do so.

Sylmar-Receiving Station E Transmission Service Agreement with LADWP for the Pacific Northwest DC Intertie

Description: This agreement provides for transmission service on the LADWP Beltline transmission system between Sylmar and Burbank.

Use: Burbank uses it to bring up to 100 MW of transmission service associated with the DC Intertie from the Sylmar DC facilities to RS-E substation. Burbank has negotiated an agreement with LADWP to restore Burbank's access rights to CAISO's market through this Sylmar substation. That agreement became effective in January 2016.

Appendix 3 Type of Resources and GHG in Metric Tons

Resource	Coal	Large Hydro	Nuclear	Natural Gas	Spot Market	Renewables	Total	GHG in metric tons	Metric tons/MWh of GHG
2001	573,000	27,000	76,000	51,000	461,000		1,188,000	750,292	0.63
2002	525,000	26,000	77,000	97,000	426,000		1,151,000	718,398	0.62
2003	543,000	24,000	79,000	76,000	506,000		1,228,000	756,787	0.62
2004	596,000	23,000	71,000	115,000	448,000		1,253,000	803,167	0.64
2005	589,000	18,000	71,000	124,000	446,000		1,248,000	801,185	0.64
2006	579,000	23,000	59,000	267,000	387,000		1,315,000	813,058	0.62
2007	570,000	23,300	73,400	422,600	260,800	10,900	1,361,000	798,733	0.59
2008	557,000	22,000	73,400	440,100	248,600	14,500	1,355,600	788,940	0.58
2009	501,800	21,200	79,600	465,900	177,300	31,000	1,276,800	718,059	0.56
2010	541,600	19,600	78,400	490,100	39,300	49,700	1,218,700	703,290	0.58
2011	417,600	21,600	83,600	338,900	193,300	100,900	1,155,900	598,298	0.52
2012	473,000	23,000	82,500	363,100	118,600	223,700	1,283,900	625,803	0.49
2013	472,500	21,100	69,500	148,400	250,100	233,500	1,195,100	598,069	0.50
2014	466,200	21,700	64,900	267,800		332,800	1,153,400	531,204	0.46
2015	443,900	20,100	65,600	291,400		344,900	1,165,900	519,170	0.45
2016	402,366	17,829	60,935	263,569		390,369	1,135,068	474,106	0.42
2017	385,767	19,102	61,193	275,453		385,123	1,126,639	463,764	0.41
2018	385,767	19,102	61,193	275,453		385,123	1,126,639	463,764	0.41
2019	385,767	19,102	61,193	275,453		385,123	1,126,639	463,764	0.41
2020	385,767	19,102	61,193	275,453		385,123	1,126,639	463,764	0.41
2021	365,767	19,102	61,193	275,453		405,123	1,126,639	445,504	0.40
2022	345,767	19,102	61,193	275,453		425,123	1,126,639	427,244	0.38
2023	325,767	19,102	61,193	275,453		445,123	1,126,639	408,984	0.36
2024	305,767	19,102	61,193	275,453		465,123	1,126,639	390,724	0.35
2025	275,767	19,102	61,193	275,453		495,123	1,126,639	363,334	0.32
2026		19,102	61,193	531,220		515,123	1,126,639	215,144	0.19
2027		19,102	61,193	511,220		535,123	1,126,639	207,044	0.18
2028		19,102	61,193	491,220		555,123	1,126,639	198,944	0.18
2029		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17
2030		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17
2031		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17
2032		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17
2033		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17
2034		19,102	61,193	471,220		575,123	1,126,639	190,844	0.17

* 2001-2015 are actual data and 2016-2034 are forecasted data
* Forecast load to be flat beyond 2017
* Renewable resources will be added gradually and as current contracted resources expire

Renewable Resources

Renewables	Wind	Solar	Small Hydro	Biomethane	Other Renewable (Exchanges)	Geothermal	New Renewables
2007	10,892	3	921	1,284			
2008	12,651	6	882	990			
2009	24,905	5	5,212	847			
2010	34,195	2,815	12,198	531			
2011	61,276	2,807	30,733	6,049			
2012	64,718	2,822	29,076	116,705	10,400		
2013	60,022	2,111	24,662	95,479	51,192		
2014	58,462	3,792	28,134	175,895	51,368	15,119	
2015	52,061	75,007	27,337	113,579	51,828	25,117	
2016	62,943	92,809	26,126	136,971	51,600	19,921	
2017	59,022	106,980	26,126	119,088	51,600	22,307	
2018	59,022	106,980	26,126	119,088	51,600	22,307	
2019	59,022	106,980	26,126	119,088	51,600	22,307	
2020	59,022	106,980	26,126	119,088	51,600	22,307	
2021	59,022	106,980	26,126	119,088	51,600	22,307	20,000
2022	59,022	106,980	26,126	119,088	51,600	22,307	40,000
2023	59,022	106,980	26,126	119,088	51,600	22,307	60,000
2024	44,830	106,980	26,126	119,088	51,600	22,307	94,192
2025	44,830	106,980	26,126	119,088	51,600	22,307	124,192
2026	44,830	106,980	26,126	119,088	51,600	22,307	144,192
2027	44,830	106,980	26,126	119,088	51,600	22,307	164,192
2028	22,608	106,980	26,126	119,088	51,600	22,307	206,414
2029	22,608	106,980	26,126	119,088	51,600	22,307	226,414
2030		106,980	26,126	119,088	51,600	22,307	249,022
2031		106,980	26,126	119,088	51,600	22,307	249,022
2032		106,980	26,126	119,088	51,600	22,307	249,022
2033		106,980	26,126	119,088	51,600	22,307	249,022
2034		1,860	26,126	119,088	51,600		376,449

* 2007-2015 are actual data and 2016-2034 are forecasted data
* Other Renewable is exchange contract; type of resource received is at discretion of counterparty
* Renewable resources will be added gradually and as current contracted resources expire
* New Renewables are to be determined

EXHIBITS

EXHIBIT A

BWP's Fiscal Year 2014-15 Energy Efficiency Programs

FISCAL YEAR 2014-15 BWP ENERGY EFFICIENCY PROGRAMS Ranked by Estimated Energy Saved in FY 14-15					
Program Name	**Description**	**FY 14-15 Energy Savings* (in KWh)**	**FY 14-15 Peak Demand Savings* (in KW)**	**Gross Lifecycle Energy Savings (kWh)**	**Total Resource Cost (TRC)***
Energy Solutions	Rebate program open to all Burbank businesses.	6,193,036	1,193	79,958,904	2.88
Home Energy Reports	Report mailed quarterly to residents showing energy use compared to 100 similar Burbank homes.	3,494,000	0	6,988,000	4.28
Business Bucks	Direct install program for Mom & Pop to mid-sized businesses. Provides up to $5,000 in energy-saving installations.	1,498,610	512	13,584,389	2.53
LED Street Lighting Retrofit	Replacement of the community's older, inefficient street lights with brighter and more efficient LEDs.	865,549	0	9,521,034	3.49
Home Improvement Program	Direct install program open to all Burbank residents, no cost to participate. Provides attic insulation, duct sealing, A/C tune-ups, high efficiency light bulbs, showerheads, faucet aerators, and much more.	755,871	384	7,189,795	2.05
Air Conditioning Tune-Ups	Program ensures that Burbank businesses and residents get the highest performance possible from their tune-ups.	393,517	549	2,482,566	4.39

Home Rewards	Cash rewards for residents installing high-efficiency appliances and products.	312,449	133	4,159,010	0.92
LivingWise	Kits with energy and water saving devices provided to all 6th grade BUSD students.	128,902	0	1,160,118	1.85
Ice Bear Peak Shifters	Ice Bears are ice-making units that attach to commercial air conditioning units. During off-peak energy hours, electricity is used to create ice. During daily peak hours, the air conditioners' compressor can be turned off and the ice utilized for cooling. While mostly a peak shaving technology, some energy savings are also derived.	102,500	217	1,537,500	6.92
Refrigerator Round Up	BWP picks up and environmentally recycles second household refrigerators and provides the homeowner with $50.	85,624	17	428,120	1.82
Made in the Shade	Residential and business shade tree program designed to reduce air conditioning use and costs.	56,017	13	1,680,510	7.66
Refrigerator Exchange	Low-income residents may receive an Energy Star™ refrigerator in exchange for their old unit at no cost.	37,492	8	524,888	0.75

Non-Profit Demonstration	A pilot program to retrofit cash-strapped Burbank's community non-profits with lighting and HVAC upgrades.	36,804	18	368,040	0.56
Energy Savings from Water Programs	A huge percent of California's total energy use goes to transporting water. As we reduce water consumption, there is an associated energy savings.	31,588	0	157,942	n/a
Efficient Lighting Distributions	At events, BWP provides CFL and LED light bulbs.	8,579	1	42,895	2.14
TOTAL SAVINGS		**14,000,539**	**3,044**	**129,783,711**	**2.64**

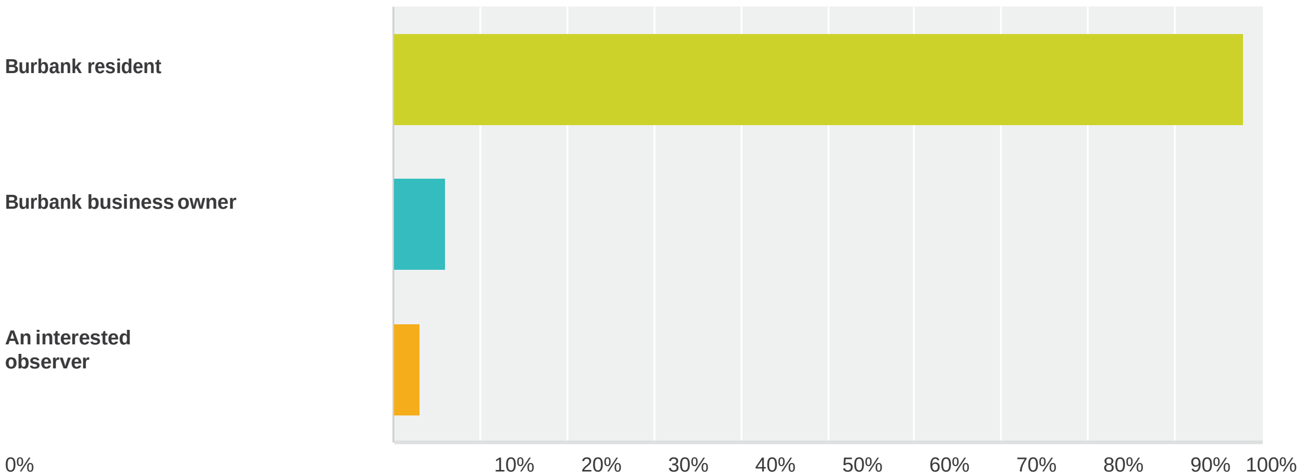
* TRC is a measure of an energy efficiency program's benefits to costs ratio. A program with a TRC of 1.0 is considered breakeven from an economic perspective. Programs with TRCs higher than 1.0 are considered good investments; those with TRCs lower than 1.0 are financially questionable.

EXHIBIT B

IRP Online Survey

Q1 I am a:

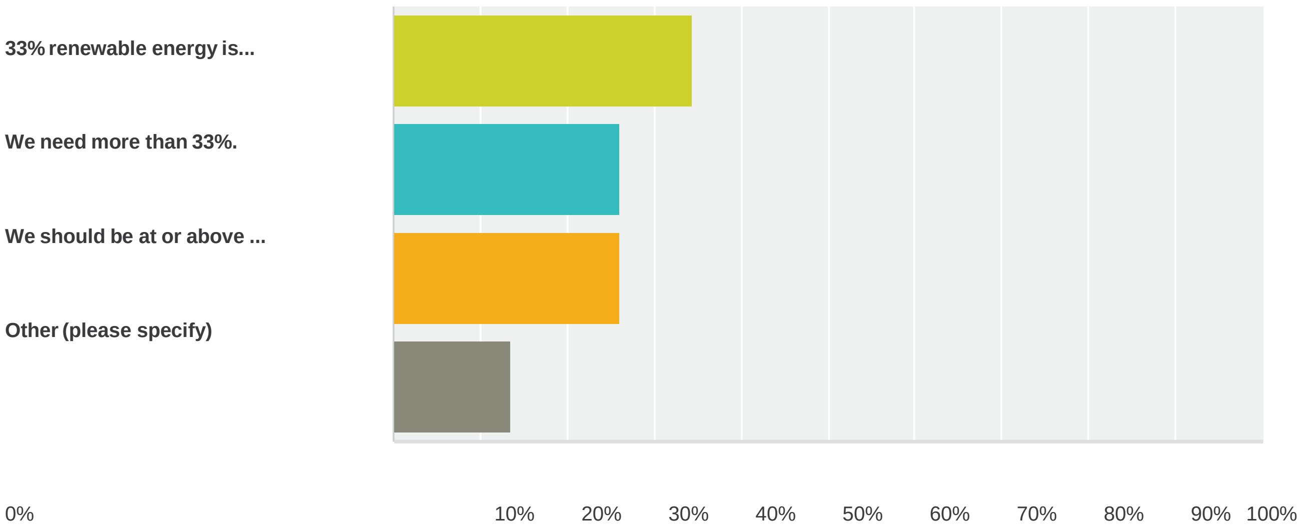
Answered: 98   Skipped: 2



Answer Choices	Responses	
Burbank resident	**97.96%**	96
Burbank business owner	**6.12%**	6
An interested observer	**3.06%**	3
Total Respondents:		98

Q2 Burbank will have 33% of our energy coming from renewable resources like wind and solar by 2016. Is this enough, or should we have more?

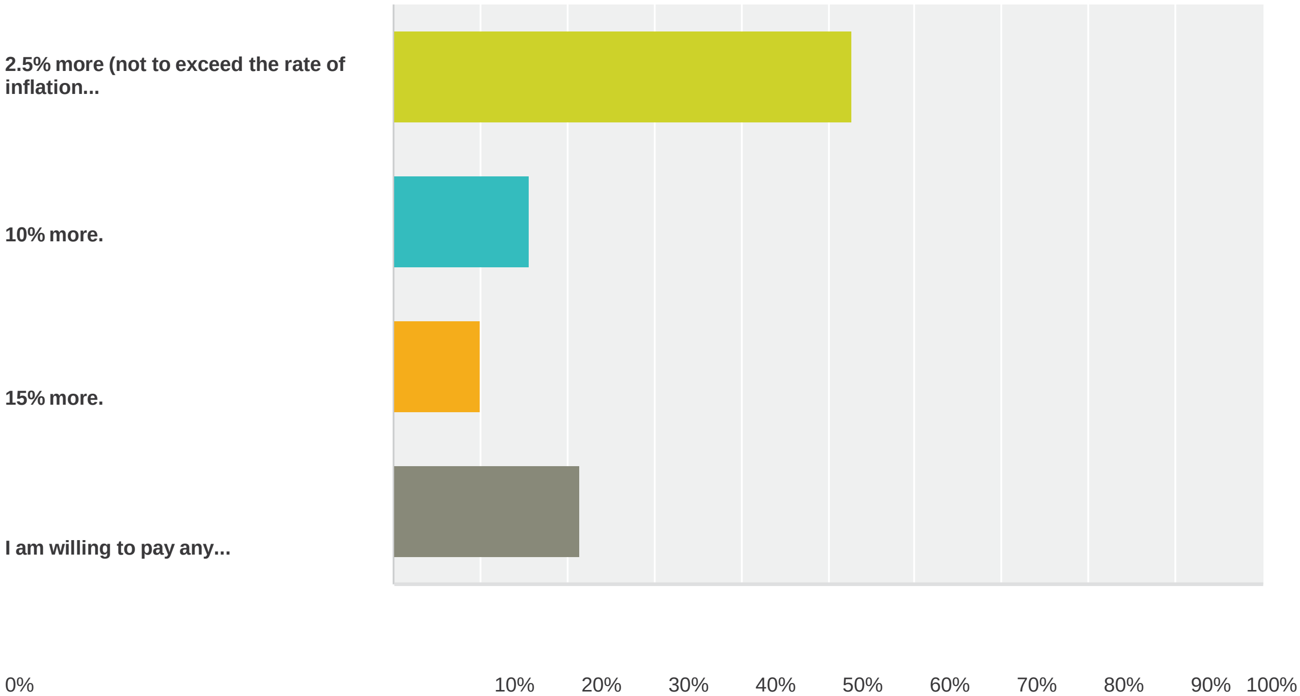
Answered: 96 Skipped: 4



Answer Choices	Responses	
33% renewable energy is sufficient.	**34.38%**	33
We need more than 33%.	**26.04%**	25
We should be at or above 50% renewable energy.	**26.04%**	25
Other (please specify)	**13.54%**	13
Total		**96**

Q3 If you want more than 33% renewable energy, how much more are you willing to pay for more renewable energy?

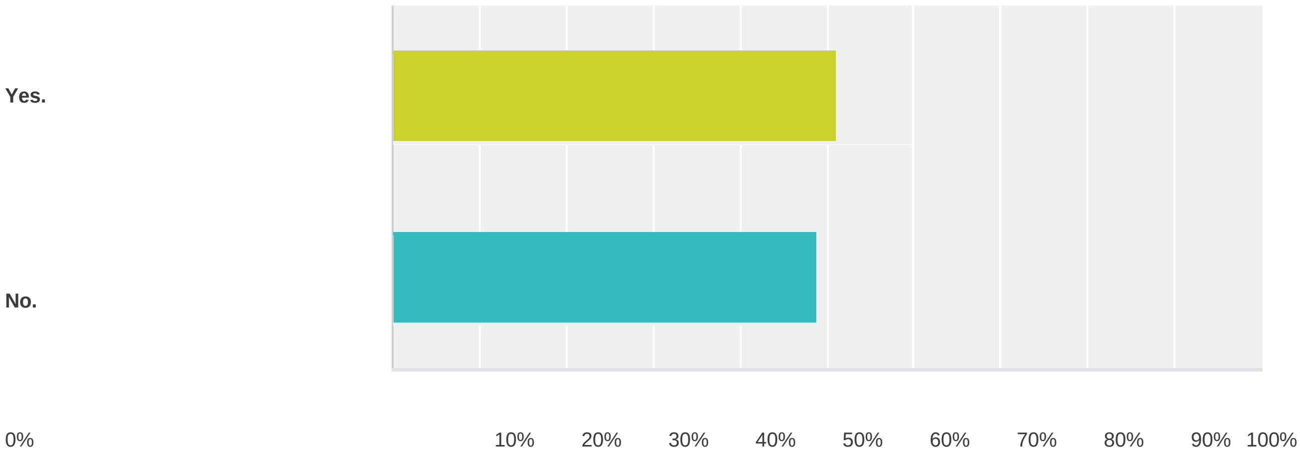
Answered: 70 Skipped: 30



Answer Choices	Responses	
2.5% more (not to exceed the rate of inflation).	**52.86%**	37
10% more.	**15.71%**	11
15% more.	**10.00%**	7
I am willing to pay any amount for more renewable energy.	**21.43%**	15
Total		**70**

Q4 Today, Burbank receives 40% of its energy from coal. Because of state laws, Burbank's coal contract will expire in 2027. Would you like Burbank to exit from coal earlier than 2027?

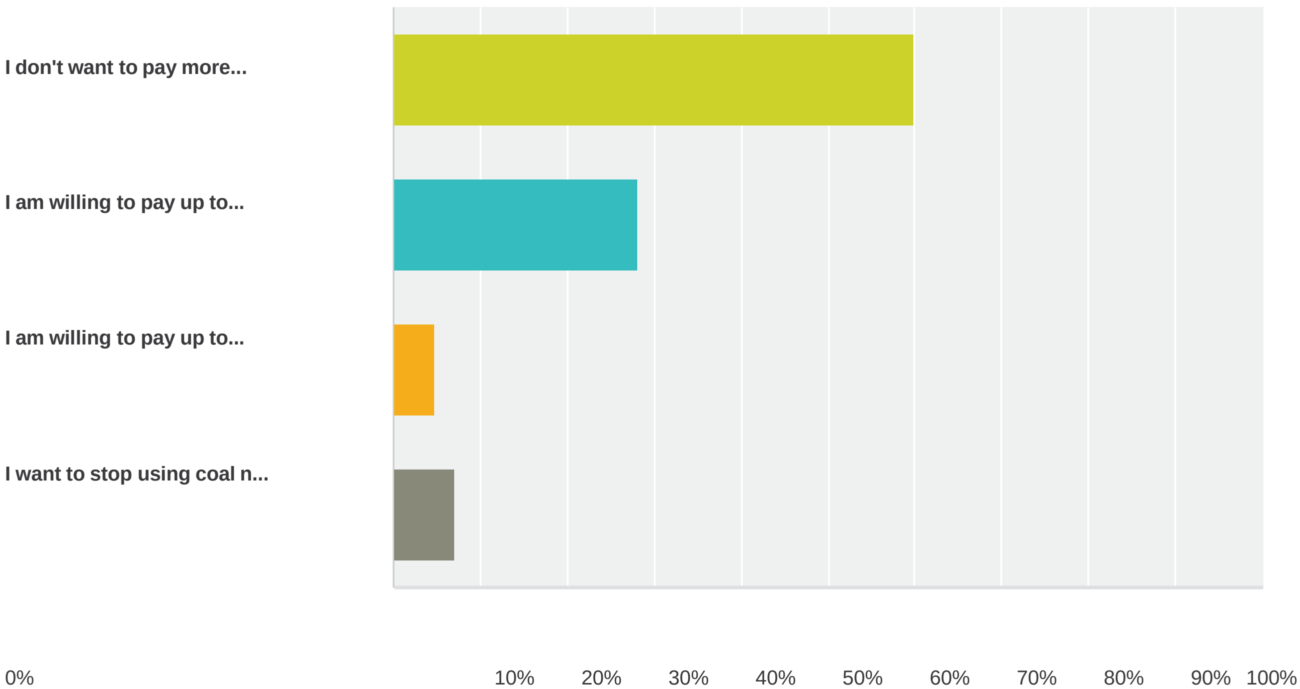
Answered: 88 Skipped: 12



Answer Choices	Responses	
Yes.	**51.14%**	45
No.	**48.86%**	43
Total		**88**

Q5 Recognizing that there are costs to exiting out of the coal contract prior to 2027, how much more would you be willing to pay for electric energy to exit out of coal early?

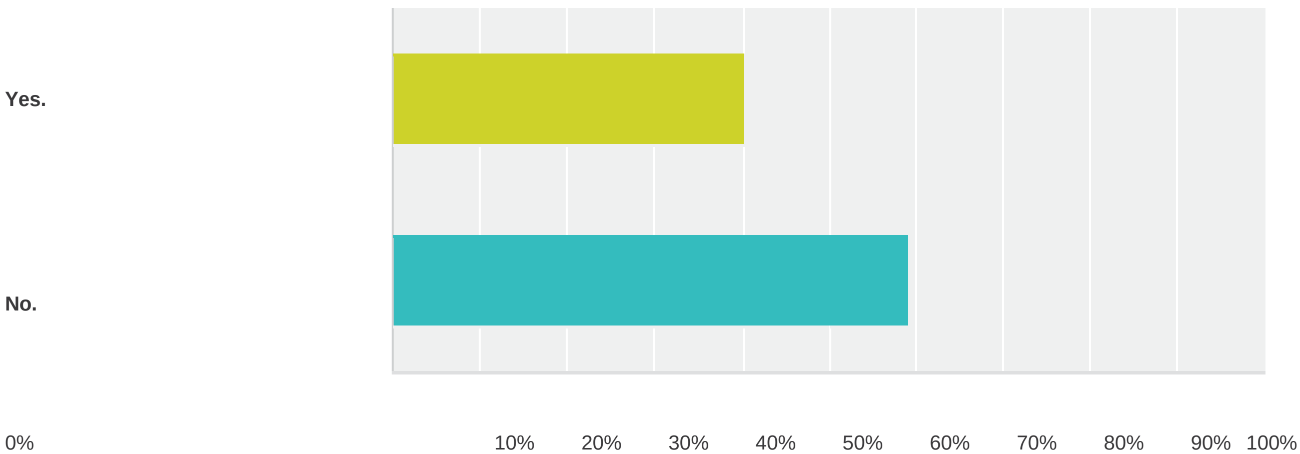
Answered: 85 Skipped: 15



Answer Choices	Responses	
I don't want to pay more than I pay now.	60.00%	51
I am willing to pay up to 10% more.	28.24%	24
I am willing to pay up to 25% more.	4.71%	4
I want to stop using coal now, regardless of cost.	7.06%	6
Total		**85**

Q6 Currently, each customer who does not have rooftop solar is paying about $8 annually to subsidize or support those that do have solar. Are you okay with non-solar customers subsidizing other customer's solar energy?

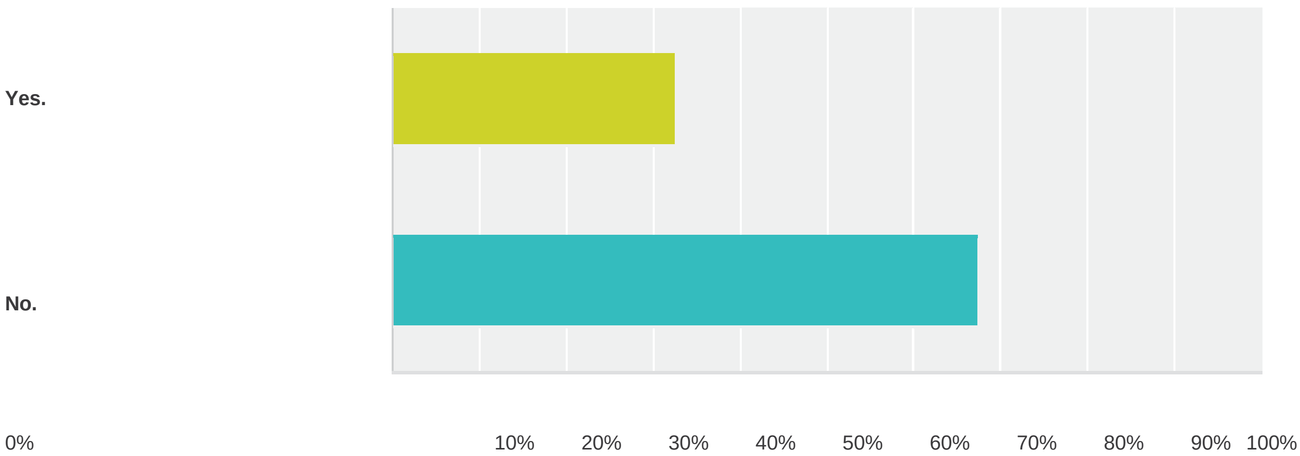
Answered: 93 Skipped: 7



Answer Choices	Responses	
Yes.	**40.86%**	38
No.	**59.14%**	55
Total		**93**

Q7 As more solar systems are forecasted to be installed in Burbank, the cost to each customer that does not have solar power is expected to reach $40 annually. Do you view this additional cost as acceptable?

Answered: 95 Skipped: 5



Answer Choices	Responses	
Yes.	**32.63%**	31
No.	**67.37%**	64
Total		**95**

Q8 What else would you like to share with us related to setting Burbank’s energy future?

Answered: 51 Skipped: 49

Q9 I would like to stay informed about this planning process. Here is my email address so that BWP can include me in upcoming correspondence, updates and meeting notices.

Answered: 44 Skipped: 56

EXHIBIT C

BWP's Glossary

Advanced Metering Infrastructure (AMI) – An integrated system of smart meters, communications networks, and data management systems that enable two-way communication between utilities and customer.

Alternating Current (AC) - An electric current that reverses its direction many times a second at regular intervals, typically used in power supplies.

Alternative Energy - Energy as solar, wind, hydro, nuclear or other, that can replace or supplement traditional fossil-fuel based sources of energy as coal, oil, and natural gas.

Ancillary Services - The services in addition to electric supply that are required to deliver electricity to end-users and to maintain system reliability. These include automatic generation control, reserves, voltage support and black start.

Annual Usage - The total amount of electricity consumed in a year by a given end-user.

Balancing Authority – The responsible entity that integrates resource plans ahead of time, and balances energy load, transfers, and generation within a Balancing Authority Area in real time.

Base-load - Electricity usage that is constant through a specified time period. Also used to refer to the generating units that run all 24 hours of the day to serve a system's base-load demand.

Battery - A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power

Biodiesel - A biofuel intended as a substitute for diesel.

Capacity - The maximum electric power output of a generating unit (measured in MW) or the maximum amount of power that lines or equipment can safely carry.

Carbon Footprint - The amount of CO_2 and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc.

Climate Change - A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric CO_2 produced by the use of fossil fuels.

Cogeneration - The use of fuel to produce electricity as well as another product such as steam or hot water.

Commercial Customer - An end-user that uses power to create a service. Sometimes also used by utilities to refer to manufacturing customers smaller than 500 kW.

Commodity - A standardized product or device that is easily traded among market participants. Also used to refer to electric supply.

Compressed Air Energy Storage - CAES is essentially a large mechanical battery that takes an intermittent resource and turns it into a controllable resource. When electricity is generated and not needed, that electricity is used to pump air into an underground cavern at very high pressure where the air can be stored. When electricity is needed, the air is fueled by a small amount of natural gas to re-heat the air. The re-heated air then runs through a turbine and turns a generator, thereby producing electricity.

Congestion Charge - A charge by an ISO to market participants who utilize a congested path.

Congestion Management - The process of allocating transmission capacity when congestion occurs.

Congestion - A condition that occurs when the amount of requested transactions across a transmission path exceeds the physical capacity of the path.

Contingency Reserve Requirement - Reserve power which can be made available within 10 minutes of an outage to replace the lost resource.

Cost of Service - The total amount of money, including return on invested capital, operation and maintenance costs, administrative costs, taxes, and depreciation expense required to provide a utility service.

Current - Is the flow of charged particles through a conducting medium, such as a wire.

Customer Choice - The ability of an end-use customer to choose their electricity supplier.

Dekatherm (Dth) - A standard unit of measure of natural gas, equal to ten therms, which is approximately the energy equivalent of burning 1,000 cubic feet of natural gas.

Demand Charge - The portion of a rate that is based on the maximum demand recorded over a specified period of time.

Demand Response - Economic programs that offer end-use customers the opportunity to modify their electric usage in response to wholesale market price signals. Emergency Demand Response programs involve situations where demand will outstrip supply; in a critical peak day, measures are taken to maintain grid reliability.

Demand Side Management (DSM) - The act of reducing energy consumption or moving energy use from peak to off-peak periods in order to reduce overall energy costs.

Demand - The total amount of electricity used at any given moment in time usually measured in kW or MW.

Direct Current - An electric current flowing in one direction only.

Distributed Generation - Generation located at an end-use customer's facility.

Distribution - One of the three parts that makes up the electric grid. The delivery of electricity over low to medium voltage lines to end-use consumers. Distribution is owned and represented by the consumer's local distribution company (LDC), and is state regulated.

Duck Curve – The phenomenon where customer solar PV generation creates over generation during the afternoon and is followed by a steep ramp up in load demand during the evening when solar generation is not available.

Electricity - A type of energy derived by the transfer of electrons from positive and negative points within a conductor.

End-user - The ultimate consumer of electricity.

Energy Efficiency - The act of using less electricity to perform the same amount of work or to get the same end value.

Energy Services Company (ESCO) - A company that provides services to end-users relating to their energy usage. Common services include energy efficiency and demand side management.

Federal Energy Regulatory Commission (FERC) - The federal body that regulates wholesale electric services.

Flywheel - A heavy revolving wheel in a machine that is used to increase the machine's momentum and thereby provide greater stability or a reserve of available power during interruptions in the delivery of power to the machine.

Forward Market - A market where delivery of the item purchased is at some future point in time.

Fossil Fuel - A natural fuel such as coal or gas, formed in the geological past from the remains of living organisms.

Fuel Cell - A cell producing an electric current directly from a chemical reaction.

Futures Contract - A supply contract between a buyer and seller where the buyer is obligated to take delivery and the seller is obligated to provide delivery of a fixed amount of commodity at a predetermined price and location at a specific period in time. Futures are bought and sold through an exchange such as NYMEX.

Generation - One of the three parts that make up the electric grid.

Generator – Is used synonymously with the term power plant. (Although technically, the generator is the part of the power plant that converts the mechanical power of a spinning shaft to electricity).

Geothermal - Energy obtained by tapping underground reservoirs of heat, usually near volcanoes or other hot spots on the surface of the Earth.

Geothermal Power - Energy derived from heat within the Earth's interior.

Global Warming - The warming of the earth's atmosphere due to increased concentrations of greenhouse gases.

Green Power - Electricity generated from renewable resources.

Greenhouse Effect - The trapping of the sun's warmth in a planet's lower atmosphere due to the greater transparency of the atmosphere to visible radiation from the sun than to infrared radiation emitted from the planet's surface.

Greenhouse Gas - A gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., CO_2 and chlorofluorocarbons

Grid - Usually used to describe the interconnected transmission system.

Hedge - The initiation of a transaction in a physical or financial market to reduce risk.

Hydro Power - Power that is derived from the weight or motion of water, used as a force to drive a turbine or other machinery.

Imbalance - The discrepancy between the amount of electricity an entity delivers into the grid and the actual amount the entity consumed.

Independent Power Producer (IPP) - A generation company that is not part of a regulated, vertically-integrated utility company that sells output under a long-term contract.

Independent System Operator (ISO) - Synonymous with RTO - An independent entity that provides system operation functions including managing system reliability and transmission access.

Industrial Customers - An end-user that uses power for the manufacturing or production of a product.

Intermittency – Alternately ceasing and beginning again. For example, intermittency is a characteristic of solar and wind energy, since these sources are inconsistent in generating power.

Investor-Owned Utility - A regulated monopoly utility that is owned by shareholders and run as a for-profit entity.

Kilowatt (kW) - A unit of energy equal to 1,000 watts: equivalent to approximately 1.34 horsepower. A measured of 1,000 watts of electrical power.

Kilowatt-hour (kWh) - A unit of energy equal to 1,000 watts over the course of 1 hour. The kWh is most commonly known as a billing unit for energy delivered to consumers by electric utilities.

Lighting Retrofit - The practice of replacing lighting components in a facility with counterparts that make it use energy more efficiently.

Load Factor - An indicator of how steady an end-user electrical load is. It is measured by dividing the average power by the peak power over a period of time.

Load Power Supplied - The electricity that an electric utility instantaneously delivers to a customer when devices using electricity are switched on.

Load Profile – The variation of electrical load over a period of time.

Load Serving Entity (LSE) - An entity that sells electric supply to an end-user.

Load - An amount of end-use demand.

Local Distribution Company (LDC) - A regulated utility that provides distribution services to end-users.

Losses - Energy lost or wasted during the transmission of energy from the generator to the end-user.

Megawatt - A unit of power equal to one million watts.

Megawatt (MW) - A unit of energy equivalent to 1,000 kW or 1,000,000 watts.

Megawatt-hour (MWh) - A unit of energy equivalent to 1,000 kilowatt-hours or 1,000,000 watt-hours.

Meter - A device used to measure the amount of electricity flowing through a point on the system.

Monopoly - A marketplace characterized by only one seller.

Municipal Utility - Also known as "muni." A utility-owned and operated by a municipality.

Native Load - The end-use customer load of a specific utility.

Natural Gas - Flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.

Nuclear Energy - The energy released during nuclear fission or fusion, especially when used to generate electricity.

Off-peak - The hours during the day when demand is at its lowest.

Option - A contract that gives the holder the right, but not the obligation, to purchase or sell a commodity at a specific price within a specified time period in return for a premium payment.

Over Generation – An excess of power produced exceeding load demand.

Peak Demand - The maximum demand for electricity in a given period of time.

Peak - The hours during the day when demand is at its highest.

Peaking Units - Generating units run only during times of peak demand on a system.

Photovoltaic (PV) - The process of converting radiation from sunlight directly into electricity using specially designed silicon cells.

Plug-in Electric Vehicle (PEV) – An electric vehicle that utilizes rechargeable batteries, or another storage device, that can be restored to full charge by connecting the vehicle to an external electric power source.

Power Purchase Agreement (PPA) - A contract for the sale or purchase of electricity.

Power Quality - A measure of the level of voltage and/or frequency disturbances.

Power - A synonym for electricity or energy.

Public Utility Commission (PUC) - The state agency that regulates the activities of investor-owned utilities (and also municipal utilities in some states).

Public Utility - A regulated entity that supplies the general public with an essential service such as electricity, natural gas, water or telephone.

Rate Base - The net investment in facilities, equipment and other property a utility has constructed or purchased to provide utility services to its customers.

Rate Case - The regulatory proceeding in which a utility's rates are determined.

Rate Designed - The development and structure of rates for regulated electric services.

Rate - A regulated price charged by a regulated entity such as a utility.

Regulation - The multitude of rules or orders issued by state or federal agencies that dictate how electric service is provided to customers. Also used in system operations to describe ramping a generating unit up or down to match supply to demand in real time.

Regulator - The governmental entity that sets the rules and orders that make up regulation.

Reliability - A measure of how often electrical service is interrupted.

Renewable Energy Credit (REC) - Tradable non-tangible energy commodities in the United States that represent the environmental attributes of electricity generated from an eligible renewable energy resource.

Renewable Fuel - A fuel that is naturally replenished such as wind or solar.

Reserves - Generation capacity that is available to the system operator if needed, but that is not currently generating electricity.

Residential Customer - An end-user that uses power in a home.

Retail Access - The opportunity for an end-user to buy electric supply from someone other than his regulated utility distribution company.

Retail Competition - The opportunity for multiple electric suppliers to compete to sell electric supply service to end-use customers.

Scheduling - The process of determining which generating units will be generating or on reserve status for a specific hour. Also the process of determining which requested transactions across a transmission line will be allowed to occur.

Service Territory - The geographical area served by a utility.

Smart Grid - Hardware, software and other upgrades added to the power system to enhance responsiveness to events that impact the electrical power grid and optimize day-to-day operational efficiency.

Smart Meter - An advanced electric meter that records consumption in intervals of an hour or less and communicates that information back to the utility for monitoring and billing purposes.

Solar Panel - A panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

Solar Power - The generation of electricity from sunlight. This can be done directly as with PV, PVI or indirectly asking concentrated solar power (CSP).

Spot Market - The short term market for electricity - usually refers to day-ahead, hour ahead and real-time markets.

Stranded Costs - Utility costs that result from assets acquired under prior regulatory rules that are in excess of the market value of those assets.

Substation - A facility containing switches, transformers and other equipment used to adjust voltages and monitor circuits.

Sunlight - Light from the sun.

Supply - Electricity available to the grid.

Sustainable - Able to be maintained at a certain rate or level.

System Peak - The recorded point in time at which the maximum load on an electrical system is reached.

Time-of-Use (TOU) – Energy rates that are volumetric ($/kWh) which vary based on the time of day, season, and observation of holidays.

Transmission - The transport of electricity over high-voltage power lines from generations to the interconnection with the distribution system. Transmission is under the jurisdiction of the Regional Transmission Organization (RTO) and is regulated by FERC.

Transportation Electrification (TE) – A utility strategy to use clean electric energy to fuel people's transportation needs, resulting in a reduction in the use of petroleum-based fuels such as gasoline, diesel, and natural gas.

Utility - An entity that generates transmits and/or distributes electricity from facilities that it owns and operates.

Volt - The difference of potential that would drive one ampere of current against one ohm resistance.

Wind Power - Power obtained by harnessing the energy of the wind.

Exhibit D

BWP's Historical Timeline

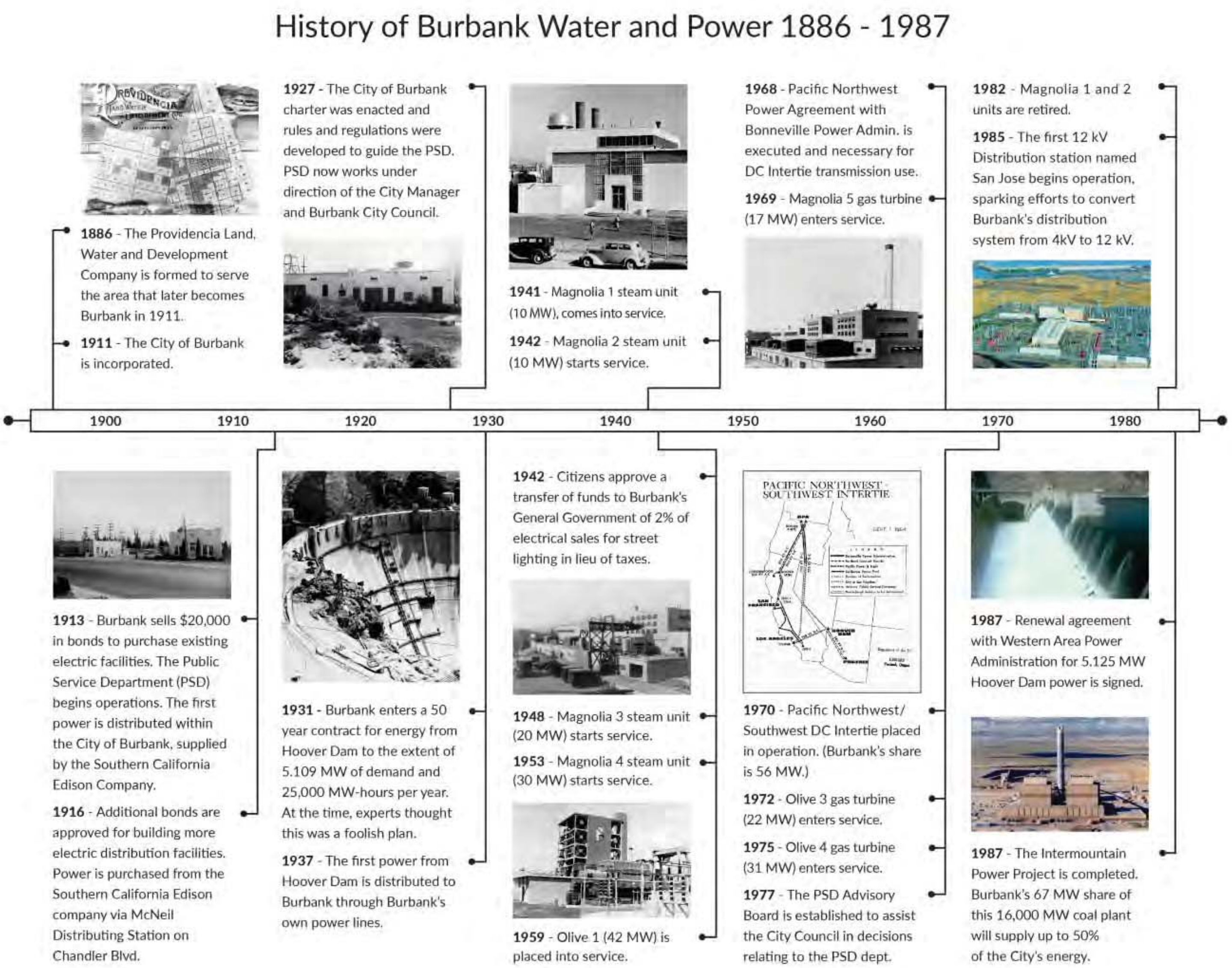


Figure D.1 - BWP History 1886-1987

Source: BWP

History of Burbank Water and Power 1988 - 2005

1988 - Burbank executes a 20-year, 40 MW power agreement with Bonneville Power Administration for continued DC Inertie use.

1988 - A 25 year Power Sales agreement is signed with Portland General Electric for 10 MW of capacity and exchange energy.

1989 - DC Intertie expanded to 3,100 MW. Burbank's line capacity is now 105 MW.

1996 - The initial Citywide Fiber Optic System is placed into operation.

1997 - The first dual purpose electric station is completed, serving both Walt Disney and surrounding neighborhoods. It is the 12,470-volt, 60 MVA Keystone Distributing Station.

2001 - BWP unveils the first commercial landfill power plant using Capstone microturbine technology that runs on landfill gas, producing 300 KW of renewable energy.

2002 - BWP installs 2 hydro generators at the Valley Pumping Plant. High pressure water is used to run two turbine generators, producing enough renewable electricity to run up to 200 households.

1988 1990 1992 1994 1996 1998 2000 2002 2004

1991 - Natural gas pipeline capacity is acquired on the PGT/PG&E Pipeline Expansion Project.

1992 - The new "Supervisory Control and Data Acquisition" (SCADA) system is completed. PSD completes a revenue bond sale of $17 million for the expansion of electric capital facilities and $10 million for the expansion of domestic and reclaimed water systems.

1993 - Natural gas pipeline capacity is acquired on the El Paso Pipeline System.

1996 - The Mead/Phoenix and Mead/Adelanto Transmission Projects placed in operation. Burbank's share is 35 MW & 94MW, respectively.

1996 - AB 1890 deregulating California's electric industry is approved.

1997 - Fiber Optic System interconnected with Los Angeles Department of Water and Power.

1998 - Magnolia 3 is retired from service.

2000 - The Magnolia Power Project is created. A major construction project of the Southern California Public Power Authority, this 310 MW combined cycle generating unit will serve the cities of Burbank, Anaheim, Glendale, Pasadena, Cerritos and Colton.

2001 - The Public Service Department (PSD) changes it's name to Burbank Water and Power.

2002 - BWP begins an industry first treatment of reclaimed water by installing an innovative Reclaimed Water Treatment System for our on-site power plants. This system produces ultra pure water, displacing all need for potable (drinking) water in BWP power plants.

2002 - Lake One, a 47 MW peaking unit, is placed in operation. The import capacity of Victorville Receiving Station is more than doubled.

2005 - An upgrade and expansion of landfill power plants takes place, resulting in total production of 550 KW of energy produced from a renewable resource.

Figure D.2 - BWP History 1988-2005

Source: BWP

Figure D.3 - BWP History 1988-2005

Source: BWP