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STAFF REPORT

Review of Los Angeles Department of Water and Power 2023 Integrated Resource Plan

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California Energy Commission

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ABSTRACT

Senate Bill 350 (De León, Chapter 547, Statutes of 2015), established Public Utilities Code Section 9622, which requires the California Energy Commission to review the integrated resource plans of identified publicly owned utilities to ensure they meet various requirements specified in the law, including greenhouse gas emission reduction targets and renewable energy procurement requirements.

Integrated resource plans are long-term planning documents that outline how publicly owned utilities will meet demand reliably and cost effectively while achieving state policy goals and mandates. Los Angeles Department of Water and Power submitted its *2023 Integrated Resource Plan* and supplemental information for review on February 23, 2024. The Los Angeles Department of Water and Power Integrated Resource Plan filing includes detailed technical analysis performed in partnership with a consultant and was developed with input from a public stakeholder process. This staff paper presents the results of the California Energy Commission staff review of the *Los Angeles Department of Water and Power 2023 Integrated Resource Plan*.

Keywords: Publicly owned utility, integrated resource plan, Los Angeles Department of Water and Power, demand, resources, portfolio, generation, transmission, distribution, Renewables Portfolio Standard, forecast, energy efficiency, transportation electrification, demand response, greenhouse gas, GHG, emissions, system reliability

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EXECUTIVE SUMMARY

Senate Bill 350 (De León, Chapter 547, Statutes of 2015) requires publicly owned utilities with an annual electrical demand exceeding 700 gigawatt-hours to adopt an integrated resource plan. Those plans must meet certain requirements, targets, and goals, including greenhouse gas emission reduction targets and renewable energy procurement requirements identified in Public Utilities Code (PUC) Section 9621. The California Energy Commission's *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines* require the utilities to file an integrated resource plan with data and supporting information sufficient to demonstrate that they meet these requirements and the targets and planning goals from 2018 to 2030. Under PUC Section 9622, the California Energy Commission must review the integrated resource plans for consistency with the requirements of PUC Section 9621.

Los Angeles Department of Water and Power prepared and submitted its *2023 Integrated Resource Plan* to align with California's clean energy goals set by Senate Bill 100 (De León, Chapter 312, Statutes of 2018) and Senate Bill 1020 (Laird, Chapter 361, Statutes of 2022). This plan reflects a scenario of its *2022 Strategic Long-Term Resource Plan*, which sets a more ambitious target of reaching 100 percent clean energy by January 1, 2035. The *2023 Integrated Resource Plan* documents Los Angeles Department of Water and Power's planning analysis, modeling efforts, and resulting strategic plan for meeting the requirements of PUC Section 9621.

Los Angeles Department of Water and Power's planning analysis provides an overview of its power system, including its generation, transmission, and distribution resources, and demand forecast, including customer demand, energy efficiency, building electrification, and transportation electrification. The utility's modeling efforts were two-phase: capacity expansion and production cost modeling. Running a capacity expansion model provided various portfolios that determine which resources and at what quantities should be built. Running the production cost model simulated economic dispatch of the system, while taking into consideration operational constraints and weather. This produced a profile of resource procurement that maintains reliability and resource adequacy, while meeting state mandates. The outputs of planning and modeling result in a strategic plan that allows Los Angeles Department of Water and Power to produce forecasted metrics such as total portfolio cost, greenhouse gas emissions, and retail rates.

In reviewing the *Los Angeles Department of Water and Power 2023 Integrated Resource Plan* and determining consistency with the requirements of PUC Section 9621, California Energy Commission staff relied on the four standardized reporting tables and narrative descriptions in the integrated resource plan filing, as well as analysis and verification of the materials submitted. Staff presents the following conclusions in accordance with the requirements:

- *Achieving Greenhouse Gas Emissions Targets and Renewables Portfolio Standard Requirements:* The utility plans to meet the greenhouse gas emission reduction requirements of PUC Section 9621(b)(1) and the renewable energy procurement requirement of PUC Section 9621(b)(2). The single largest measure that helps Los Angeles Department of Water and Power achieve this target is Intermountain Power

Project's switching fuel from coal to natural gas in 2025. LADWP's planned procurement of large quantities of wind and solar plus storage resources continue to reduce emissions over the planning period.

- *Meeting Planning Goals:* The utility intends to meet planning goals related to retail rates, reliability, transmission and distribution systems, as set forth in PUC Section 9621(b)(3). Over the planning period average rates increase 4.8 percent annually over today's rates, with a total increase in 2035 of approximately 84 percent over today's bill.
- *Considering Peak Needs:* The utility has considered the role of existing renewable generation, grid operational efficiencies, energy storage, and distributed resources (including energy efficiency) in helping ensure the utility's energy and reliability needs in the hours that encompass the peak hour as set forth in PUC Section 9621(c). Los Angeles Department of Water and Power is planning to invest heavily in the development of solar and storage resources, as well as maintaining in-basin natural gas-fired generation required to meet peak energy and reliability needs.
- *Addressing Resource Procurement Types:* The utility addressed the procurement requirements for energy efficiency and demand response, energy storage, transportation electrification, portfolio diversification, and resource adequacy as set forth in PUC Section 9621(d). In the near-term, Los Angeles Department of Water and Power's demand is expected to decline due to its success with energy efficiency and demand response measures. In the long-term, investments in renewable energy and energy storage help meet growing electricity demand from transportation and building electrification.

CHAPTER 1:
Demand Forecast and Procurement

Introduction

Senate Bill 350 (De León, Chapter 547, Statutes of 2015) requires publicly owned utilities (POU) with an annual electrical demand exceeding 700-gigawatt-hours (GWh) to develop integrated resource plans (IRPs).[1] IRPs are electricity system planning documents that describe how utilities plan to meet their energy and capacity resource needs while achieving policy goals and mandates, meeting physical and operational constraints, and fulfilling other priorities such as reducing impacts on customer rates. SB 350 requires the governing board of a POU to adopt an IRP and a process for updating it at least once every five years starting no later than January 1, 2019.[2]

Public Utilities Code (PUC) Section 9622 requires the California Energy Commission (CEC) to review POU IRPs to ensure they achieve PUC Section 9621 provisions.[3] If the CEC determines an IRP is inconsistent with the requirements of PUC Section 9621, the CEC shall provide recommendations to correct the deficiencies. The CEC adopted the *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines* (*Guidelines*) to govern the submission and review of the POUs' IRPs.[4]

This chapter outlines the CEC's review process and provides an overview of the LADWP and its IRP development process. In addition, the chapter addresses the *Guidelines* requirements that POUs provide a demand forecast and a procurement plan as part of its IRP. In compliance with SB 350, LADWP filed its initial IRP with the CEC in 2019, which was found consistent with SB 350 and the requirements of PUC Section 9621.

Los Angeles Department of Water and Power

LADWP is the nation's largest municipal utility with a service territory of approximately 473 square miles that is home to 4 million residents. LADWP supplies water and power to 1.55 million residential and business customers, mostly within the boundaries of the City of Los Angeles, in addition to more the 5,100 customers in Owens Valley. LADWP's power system served its highest instantaneous peak demand of 6,502 megawatts (MW) on August 31, 2017, and supplied 20,936 GWh during the 2020-2021 fiscal year. Roughly 63 percent of electricity

1 PUC Section 9621.

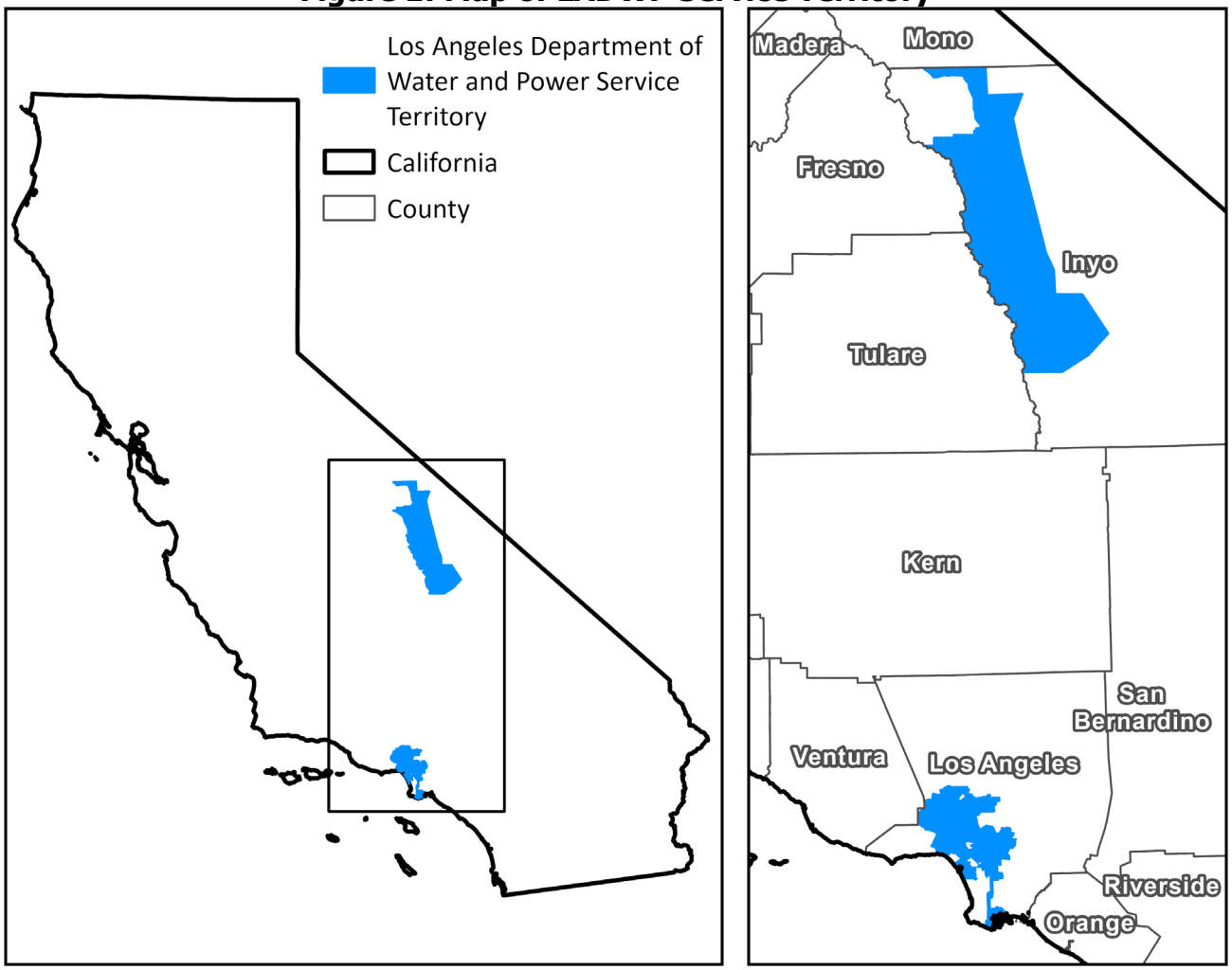
2 PUC Article 16 (commencing with Section 399.11) of Chapter 2.3 of Part 1 of Division 1.

3 PUC Section 9622.

4 *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines*, https://www.energy.ca.gov/publications/2022/publicly-owned-utility-integrated-resource-plan-submission-and-review-guidelines.

consumed in Los Angeles is by commercial, industrial, and governmental customers. The general location of LADWP's service territory in the Los Angeles area and Owens Valley is shown in Figure 1.

Figure 1: Map of LADWP Service Territory



Source: CEC

To serve its customers, LADWP owns vertically integrated power generation, transmission, and distribution systems that span over five states. LADWP owns four "in-basin" natural gas-fired generating stations that ensure local reliability. LADWP also owns and operates the Castaic Power Plant, a pumped-storage hydroelectric generation facility located in Castaic, California. LADWP contracts for out-of-state power including portions of generating capacity from Intermountain Power Project, Hoover Dam, and Palo Verde Generating Station. LADWP also owns and has power purchase agreements (PPAs) with a diverse range of renewable energy generating facilities including solar, wind, and small hydroelectric facilities in California's Owens Valley, wind facilities located in Utah, New Mexico, Oregon, Wyoming, and Washington State, and geothermal and solar facilities in California and Nevada. To deliver this power, LADWP has 4,040 miles of overhead transmission circuits and 135 miles of underground

transmission circuits. On the distribution side, LADWP has 7,265 miles of overhead distribution lines, 3,807 miles of underground distribution cables, and 167 distribution substations. The general locations of these generation and transmission resources are shown in **Figure 2**.

Figure 2: LADWP's Generation and Transmission Resources

Source: LADWP's Generation and Transmission Resources, *LADWP 2023 IRP*, pg. 85.

LADWP is a balancing authority and also serves this role for its neighbors, the City of Glendale's and City of Burbank's electric utilities. As a balancing authority, LADWP participates in the California Independent System Operator's (California ISO) Western Energy Imbalance Market.

LADWP Planning Process

LADWP developed its *2023 IRP* to provide a comprehensive roadmap for meeting the future energy needs, regulatory mandates, and clean energy goals for the City of Los Angeles while maintaining reliable and affordable power for its customers. LADWP included an advisory group comprised of various community members and stakeholders to ensure that its plans reflect the input of its communities and customers. LADWP's *2023 IRP* also synchronizes with its annual budget process, which helps minimize adverse ratepayer impacts. The *2023 IRP* summarizes the steps taken to create the roadmap, particularly the simulation of power system operations using computer modeling. The modeling consisted of a two-step process: capacity expansion modeling and production costs modeling. LADWP then used the outputs of the models to assess a variety of metrics, including projected costs, impacts to rates and customer bills, fuel consumption and emissions, reliability, and curtailment. LADWP's *2023 IRP* is part of its larger Strategic Long-Term Resource Plan, which sets a more ambitious target of reaching 100 percent clean energy by January 1, 2035.[5]

Energy and Peak Demand Forecast, Method, and Assumptions

The *Guidelines* (Chapter 2.E.1) identify the need for a forecast of energy and peak demand to determine whether a POU's IRP is consistent with the requirements of PUC Section 9621.[6] The *Guidelines* also state that the POU must provide information on the method used in developing the demand forecast if a POU uses a forecast other than the CEC's adopted demand forecast.[7] The demand forecast and supporting information provided present an adequate representation of future energy and peak demand that meets the *Guidelines* requirements.

LADWP's 2023 IRP uses its official 2021 Load Forecast of customer demand for electricity over the next 20 years.[8] The forecast divides customer sales into six classes, which are modeled separately. Econometric models are used to forecast sales in the Residential, Commercial, and Industrial classes. Trend models are used to forecast sales in the Streetlight and Owens Valley classes. LADWP uses the CEC's Electric Vehicle (EV) Forecast for the Transportation

5 LADWP Power System Strategic Long-Term Plan, https://www.ladwp.com/who-we-are/power-system/strategic-long-term-resource-plan.

6 POU IRP Guidelines, Chapter 2, E., pgs. 5–6.

7 The most recently adopted demand forecast is for the California Energy Demand Forecast 2023–2040.

8 The 2021 Load Forecast is LADWP's official Power System load forecast. This forecast is used as the basis for LADWP Power System planning activities including, but not limited to, strategic long-term resource planning, integrated resource planning, transmission and distribution planning, and wholesale marketing. The forecast is a public document that uses only publicly available information.

Electrification sales class. The drivers in the econometric models include weather, population, employment, construction activity, and personal consumption and income. The customer sales forecasts are then adjusted for programs that affect behind-the-meter consumption, such as energy efficiency (EE) and net-metered solar generation. These six classes are summed into a single sales forecast.

The COVID-19 pandemic affected retail sales starting in the first quarter of 2020, which is also the third quarter of LADWP's fiscal year. Sales for the fiscal year of 2020, which ended June 30, 2020, were 21,115 GWh. This is 3.9 percent lower than sales of 21,961 GWh for the previous fiscal year. While the pandemic has passed and economic growth and activity has returned, the 2021 Load Forecast projects a decrease in 2025 before gradually increasing. This decrease is driven by EE and customer-installed solar photovoltaic (PV), which are encouraged by LADWP's EE and solar distributed generation programs. Energy demand increase is largely driven by new load from light duty electric vehicle charging.

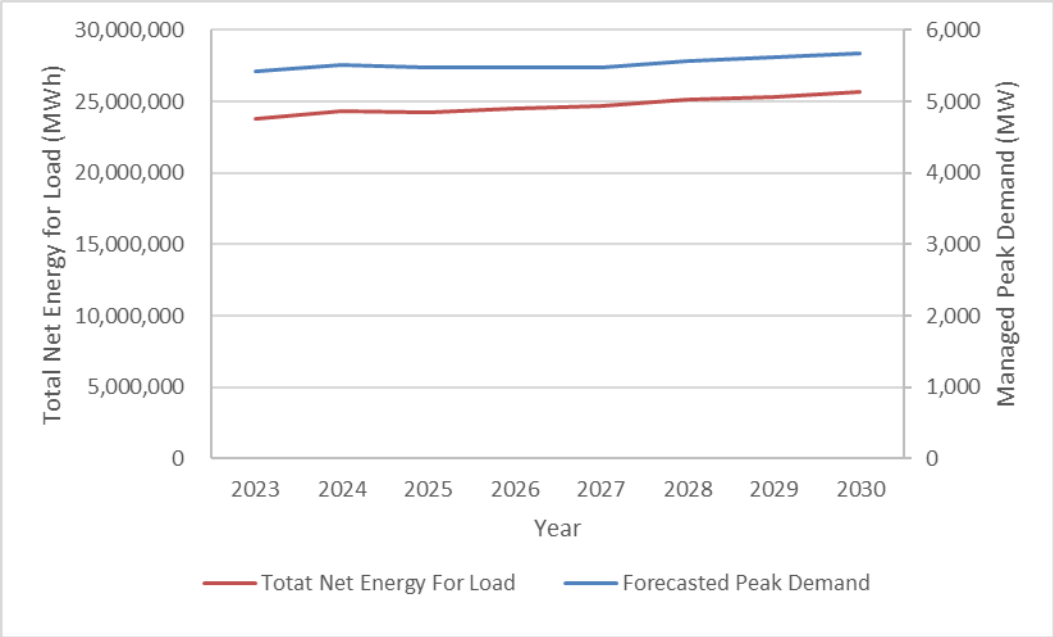
A net energy for load forecast is developed by applying a loss factor of 12 percent to the sales forecast. This increases the total amount of energy production necessary to serve retail sales by including distribution and line losses.

Peak demand is part of the net energy for load forecast. This is done using an econometric model to forecast peak demand due to weather. This weather response model includes the drivers of temperature, heat buildup, and time of the summer. The peak demand is also affected by changing behind-the-meter consumption factors, such as EE, rooftop solar, residential lighting efficiency, and EV charging.

Peak demand is projected to decrease between 2024 and 2027 before gradually increasing. This, like retail sales, is also due to EE and solar PV programs. Likewise, new light duty electric vehicle charging during peak hours is the main driver for the increase. Demand response (DR) is not included in the peak demand forecast, rather it is considered as a resource to serve peak demand. Beyond this, peak demand is forecasted to increase over time.

Figure 3 shows LADWP's total net energy for load and forecasted peak demand through 2030.

Figure 3: LADWP's Total Net Energy for Load and Forecasted Peak Demand



Source: CEC analysis of LADWP's 2024 IRP.

Staff compared LADWP's forecasted peak demand and total net energy for load to the CEC's California Energy Demand 2023-2040 Baseline Forecast.[9] LADWP's forecasted peak demand is below the CEC's 1-in-2 peak demand through 2029, and between the 1-in-2 and 1-in-5 peak thereafter. This comparison does not include the substantial quantity of reserve capacity procured by LADWP. LADWP's total net energy for load is nearly the same as the CEC's forecast for managed retail sales to end use customers, roughly 0.1 percent larger over every year of the forecast period.

Resource Procurement Plan

The *Guidelines* require that POUs report the mix of resources they plan to use to meet demand through 2030.[10] POUs are also required to provide an IRP with data and supporting information sufficient to demonstrate that the POUs' plan to meet the various targets and goals. Staff has determined that LADWP's IRP filing meets these requirements. The following is a discussion of the utility's existing resources, procurement strategy, the portfolio analysis underlying resource selections, and the resources in 2030 identified in the standardized reporting tables.

9 California Energy Demand 2023-2040 Baseline Forecast. https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2023-integrated-energy-policy-report/2023-1.

10 POU IRP Guidelines, Chapter 2.F., pg. 6.

Existing Resources

LADWP maintains a policy of owning or controlling transmission and generation resources to serve its customer loads. Generation assets not wholly owned by LADWP are entitlement rights from interests in facilities jointly owned with other utilities. At times, LADWP makes purchases from the electricity market to ensure reliability. LADWP's generation resources include hydroelectric, nuclear, coal, natural gas, geothermal, biofuels, wind, and solar.

LADWP's hydroelectric resources include two large facilities, Castaic Pumped-Storage Hydroelectric Plant (Castaic) and Hoover Dam, and a series of smaller ones. LADWP owns Castaic, a pumped hydro plant located in Castaic, California, which consists of seven units totaling 1,175 MW of dependable capacity. LADWP also has a PPA with the Western Area Power Administration for 352 MW of dependable capacity from the Hoover Dam, located on the Arizona-Nevada border. LADWP owns a network of several small hydroelectric generating resources, referred to as the Owens Gorge and Owens Valley Hydroelectric Generation. These plants use water resources from the Los Angeles Aqueduct and three creeks along the eastern Sierra Nevada Mountains to provide about 100 MW of dependable capacity.

LADWP nuclear resources include contractual entitlements totaling approximately 387 MW of dependable capacity from the Palo Verde Nuclear Generating Station located near Phoenix, Arizona. This facility's current operational permit runs through 2045.

LADWP has one remaining contractual arrangement from a coal fired resource, Intermountain Power Project (IPP). IPP, located near Delta, Utah, provides up to 1,142 MW of dependable peak capacity. LADWP and other owners of IPP have reached an agreement for IPP to switch fuels to natural gas-fired combined cycle power plant in 2025. IPP is being repowered at a lower capacity of 840 MW rather than full replacement of the 1,900 MW coal facility. This will decrease the amount of dependable capacity LADWP receives from the facility, starting at 226 MW in 2025 and increasing to 717 MW in 2035.

LADWP owns and operates four natural gas-fired power plants in the Los Angeles Basin: Valley, Haynes, Harbor, and Scattergood, of which the latter three are located along the coast. This in-basin firm and dispatchable generation must be maintained for LADWP to meet North America Electric Reliability Corporation reliability must run requirements. Combined, these four generators provide 3,378 MW of dependable capacity. In addition, LADWP also owns and operates the Apex Power Project, a 500 MW natural gas facility located north of Las Vegas, Nevada. By being located outside of Los Angeles, it is not dependent on the Aliso Canyon Natural Gas Storage Facility and provides system operational flexibility.

LADWP's three gas-fired facilities along the coast, Haynes, Harbor, and Scattergood, were sited there for access to ocean water, which has traditionally been used to cool various processes across the thermal power generation cycle. LADWP is required to eliminate the use of ocean water for cooling at the three coastal plants to comply with California's once-through-cooling policy. The first two modernization projects Haynes, Units 1 through 6; and Scattergood, Units CC3 and CT3, have been completed. LADWP is studying various hybrid clean energy options and working to modernize these plants for compliance with environmental regulations, improvements to efficiency, better integration of renewable

resources, and expanded transmission import capability. LADWP is also studying clean alternatives to repower the remaining units.

LADWP's renewable resources are primarily wind, solar, and geothermal, with smaller amounts of biomass and small hydroelectric (discussed previously in this section). In 2022, wind energy represented 38 percent of renewable energy production, solar was 34 percent, and geothermal was 25 percent. Small hydro only comprised three percent, and biomass was less than half of one percent. Wind energy is spread across 11 projects, with two owned by LADWP and the other nine under long-term contract. Four of LADWP's wind contracts expire prior to 2030. Solar energy is spread across 17 projects, two owned by LADWP, and the other 15 under long-term contract. The six geothermal projects and two biomass projects are all under long-term contracts. Existing geothermal production decreased substantially in 2022 due to the expiration of the contract with Hudson Ranch. Biofuels cease to be a part of LADWP's portfolio in 2024 when their contracts expire. Excluding the 100 MW capacity of the small hydro projects discussed previously, these renewable projects contribute 1,123 MW of capacity to meet LADWP's peak demand.

Resource Portfolio Evaluation

To evaluate its resource portfolio for this IRP, LADWP contracted with Ascend Analytics, to augment its existing computer modeling and simulation capabilities. Using software called PowerSIMM, LADWP developed resource portfolios using capacity expansion optimization, resource adequacy analyses, and production cost modeling.

LADWP started by defining the objectives, assumptions, and inputs for the capacity expansion model. The objective is to select a set of future resources capable of meeting the California's renewable portfolio standard targets. Assumptions and inputs include capacity values for renewable generation and duration-limited resources such as energy storage, the cost to build new resources, forecast of load, and constraints on carbon emissions. This model determines the least-cost and best-fit portfolio of generation and energy storage resources.

Portfolio outputs from the capacity expansion models are then analyzed for resource adequacy. If a portfolio cannot adequately serve load, additional resources must be added. The current portfolio was modeled for 2023 to establish the baseline loss of load hours, which translates to the number of hours across the year that total generation capacity cannot meet customer demand. Through resource adequacy modeling, LADWP showed that the portfolio was able to maintain reliability while transitioning to 100 percent clean energy.

Being resource adequate, LADWP then evaluated the portfolio in a production cost model. The production cost model used a Monte Carlo stochastic method with varying weather conditions. This model quantified how the LADWP Power System was dispatched hourly to serve customer load and the costs associated with operation. The outputs from the production cost model were used to determine metrics such as total system cost, amount of renewable and clean energy generation, fuel consumption, carbon emissions, and loss of load hours.

Procurement Strategy

In addition to meeting new demand, LADWP must also replace capacity and energy from expiring resource contracts and the reduction in energy and capacity from IPP. By 2030, nearly half of LADWP's renewable portfolio will be made up of new planned renewable resources. LADWP's IRP relies on energy from solar PV resources, wind resources, and smaller amounts of geothermal. Solar resources include local rooftop and other types of distributed solar, as well as utility-scale solar plus storage projects. Due to the intermittent nature of wind and solar, the capacity expansion model must overbuild these resources to ensure LADWP meets the 2045 mandate of 100 percent clean energy. While more energy is generated each year than is consumed by customers and line losses, this over-build by the capacity expansion model provides additional reliability to the system and minimizes total loss of load hours. LADWP must also meet California's interim target of ensuring that 90 percent of the retail sales of energy come from renewable and clean energy sources by 2035. This necessitates that the largest build of new renewable resources would occur within the next 10 years. The resulting modeled sum capacity of new utility-scale resources by 2035 is greater than 5,000 MW.

LADWP is planning to add substantial amounts of energy storage to make use of this abundance of renewable energy. Four planned projects are listed below in **Table 1**.

Table 1: LADWP's New Energy Storage Projects

Project	New Capacity (MW)	Energy (MWh)	Duration (hr)	Target Commercial Operation Date
Beacon II LDES	50	500	10	12/31/2026
RS-X Li-Ion	60	240	4	12/31/2027
Valley Flow	55	290	5.3	12/31/2029
Scattergood Flow	50	300	6	6/15/2030

Source: *LADWP 2023 IRP*

LADWP plans to retain most of its existing natural gas-fired generating fleet. LADWP has a planned demolition date of August 2025 for Valley Generating Station, Units 1-4. Harbor declines to less than half its current capacity in 2030, dropping from 403 MW to 188 MW, as the units that use ocean water for once-through cooling are shut down. Haynes Generating Station, Unit 8, will decrease capacity as it undergoes a cooling system retrofit to switch from once-through cooling to wet cooling, occurring in 2028 and 2030. LADWP has modernization plans for Scattergood Generating Station to install a new unit that can run on 30 percent hydrogen by volume by April 2029, although the IRP assumes it will run on 100 percent natural gas to provide a more conservative estimate of overall greenhouse gas (GHG) emissions. This will increase the dependable capacity of Scattergood from 798 MW to 890 MW.

Under SB 100, electrical energy losses, which arise primarily through resistive heating in transmission and distribution lines, can be served with fossil-fired generation. LADWP's Power

System averages approximately 12 percent electrical energy losses. Natural gas resources would largely be used to serve transmission and distribution losses, as well as other non-retail energy demands. The use of natural gas-fired generation helps minimize total cost, while maintaining in-basin reliability and flexibility to integrate renewable resources.

In summary, LADWP's projected dependable capacity increases from 8,536 MW in 2024 to 9,046 MW in 2030, as shown in **Table 2**. LADWP's projected total energy increases from 24,495 GWh in 2024 to 28,647 GWh in 2030, shown in **Table 3**.

Table 2: Dependable Capacity by Resource Fuel Type (MW)

Resource Fuel Type	2024	2025	2026	2027	2028	2029	2030
Coal	942	475	0	0	0	0	0
Natural Gas	3,921	4,147	4,378	4,378	4,488	4,834	3,891
Nuclear	387	387	387	387	387	387	387
Large Hydro	1,578	1,578	1,578	1,578	1,578	1,578	1,578
Small Hydro	91	91	91	91	91	91	91
Geothermal	274	274	274	239	239	239	239
Biomass	0	0	0	0	0	0	0
Wind	565	548	548	548	479	479	550
Solar	691	704	718	732	745	759	773
Storage	35	42	50	81	117	125	1,183
Solar Plus Storage	52	52	154	154	154	154	355
Total	**8,536**	**8,299**	**8,178**	**8,187**	**8,278**	**8,645**	**9,046**

Source: *LADWP 2023 IRP*

Table 3: Total Energy by Resource Fuel Type (GWh)

Resource Fuel Type	2024	2025	2026	2027	2028	2029	2030
Coal	3,884	1,851	0	0	0	0	0
Natural Gas	4,936	7,183	9,276	9,608	9,921	10,230	9,587
Nuclear	3,399	3,390	3,390	3,390	3,399	3,390	3,390
Large Hydro	1,028	1,017	1,021	969	968	983	860
Small Hydro	141	142	144	145	150	155	220
Geothermal	2,244	2,244	1,971	1,945	1,945	1,945	1,945
Biomass	0	0	0	0	0	0	0
Wind	3,126	3,687	4,252	4,125	4,100	4,100	4,773
Solar	5,427	5,469	5,821	5,867	5,912	5,958	7,873
Spot Market	310	0	0	0	0	0	0
Total	**24,495**	**24,983**	**25,875**	**26,049**	**26,397**	**26,762**	**28,647**

Source: *LADWP 2023 IRP*

CHAPTER 2:
Review for Consistency with PUC Section 9621 Requirements

This chapter summarizes the main elements of LADWP's 2023 IRP and provides staff's findings regarding the consistency of the IRP filing with PUC Section 9621 requirements, as well as the *Guidelines*. These findings include whether the utility meets GHG emission reduction targets and RPS energy procurement requirements, as well as planning goals for retail rates, reliability, transmission and distribution systems, net load, and disadvantaged communities. In addition, the IRP must address procurement of EE and DR, energy storage, transportation electrification and portfolio diversification.

Greenhouse Gas Emission Reduction Targets

POUs are required to meet the GHG targets established by the California Air Resources Board (CARB), in coordination with the CEC and the California Public Utilities Commission.[11] The initial GHG targets set by CARB reflect the electricity sector's percentage in achieving the economywide GHG emission reductions of 40 percent from 1990 levels by 2030.

The 2030 electricity sector GHG planning target range was brought into alignment with CARB's *2022 Scoping Plan for Achieving Carbon Neutrality* (2023 CARB Update) adopted in September 2023.[12,13] This electricity sector GHG planning target range of 30–38 million metric tons of carbon dioxide equivalent ($MMTCO_2e$), retains the lower bound of 30 $MMTCO_2e$ from CARB's *2020 Update* but reduces the upper bound from the 53 $MMTCO_2e$ to 38 $MMTCO_2e$. [14]

The 2020 planning target range for LADWP was 2,655,000–4,691,000 metric tons of carbon dioxide equivalent ($MTCO_2e$), while the 2023 planning target range is 2,655,000-3,363,000 $MTCO_2e$. The 2023 CARB Update was published after LADWP completed its 2023 IRP analysis. LADWP's modeled scenario used the 2020 CARB GHG target and the corresponding results are reported on the GHG emissions accounting in the standardized reporting tables. The GHG emissions associated with LADWP's modeled scenario are summarized in **Table 4**.

11 PUC Section 9621(b)(1).

12 Senate Bill 350 Integrated Resource Planning Electricity Sector Greenhouse Gas Planning Targets: 2023 Update, https://ww2.arb.ca.gov/sites/default/files/2023-09/sb350-final-report-2023.pdf.

13 CARB's *2022 Scoping Plan for Achieving Carbon Neutrality*, https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents.

14 CARB's *Senate Bill 350 Integrated Resource Planning Electricity Sector Greenhouse Gas Planning Targets: 2020 Update*, https://ww2.arb.ca.gov/sites/default/files/2021-04/sb350-final-report-2020.pdf.

Table 4: Greenhouse Gas Emissions from LADWP Resource Portfolio

Power Source	Fuel Type	GHG Intensity (MT CO2e/MWh)	Total Emissions (MT CO2e) 2023	Total Emissions (MT CO2e) 2025	Total Emissions (MT CO2e) 2030
Harbor	Natural Gas	0.711	33,000	105,000	182,000
Haynes	Natural Gas	0.502	111,000	293,000	636,000
Scattergood	Natural Gas	0.429	941,000	954,000	517,000
Valley	Natural Gas	0.436	317,000	339,000	208,000
Apex	Natural Gas	0.438	895,000	792,000	623,000
Intermountain Power Project	Coal	0.983	4,339,000	1,819,000	NA
Intermountain Power Project	Natural Gas	0.395	NA	583,000	1,247,000
Scattergood (New Unit)	Natural Gas	0.400	NA	NA	655,000
Net Spot market purchases (sales)	System	0.428	248,000	0	0
Total Portfolio Emissions*	**NA**	**NA**	**6,883,000**	**4,885,000**	**4,068,000**

*Total Portfolio Emissions do not sum exactly due to rounding.

Source: CEC, Energy Assessments Division, Based on LADWP 2023 IRP filing

LADWP's modeled scenario includes some spot market purchases through 2024, but none after that. IPP switches fuels from coal to natural gas in 2025, with both the old and new units running for part of that year. LADWP plans for a new thermal resource to start providing power in-basin in 2029. LADWP continues to rely on its in-basin natural gas fired generators to provide grid reliability to and beyond 2030. These resources are estimated to have a total portfolio emissions of 4,068,000 $MTCO_2e$ in 2030. This amount is within the 2020 planning target cap for LADWP of 4,691,000 $MTCO_2e$ but exceeds the 2023 planning target cap of 3,363,000 $MTCO_2e$.

CEC staff reviewed the GHG emissions associated with LADWP's portfolio of resources in 2030, as identified in its IRP and standardized reporting tables. Staff independently assessed the emission factors associated with various resources in LADWP's portfolio to ensure consistency with other data available. Staff finds that LADWP plans to achieve the CARB-established GHG emission target range of 30–53 MMT CO_2e, which was what was published when LADWP performed their analyses. LADWP's modeled portfolio does not, however, reach the amended 38 MMT CO_2e target. In 2030, LADWP's resource portfolio results in roughly 4,068,000 $MTCO_2e$, consistent with the requirement of PUC Section 9621(b)(1).

Renewables Portfolio Standard Planning Requirements

PUC Section 9621(b)(2), as established by SB 350, requires that POU IRPs ensure procurement of at least 50 percent renewable energy resources by 2030, consistent with Article 16 (commencing with Section 399.11) of Chapter 2.3 of Part 1 of Division 1 of the PUC. In 2018, Senate Bill 100 (De León, Chapter 312, Statutes of 2018) increased the RPS

requirement for 2030 from 50 to 60 percent.[15] Staff reviewed the renewable procurement table, the discussion in the IRP filing, and the renewable procurement plan submitted. Staff finds that LADWP's plans are consistent with the RPS procurement requirements and all interim compliance periods, as well as the requirements of PUC Section 9621(b)(2).

LADWP's renewable procurement plans include increasing levels of renewable generation through its forecast. LADWP anticipates that RPS-eligible renewables will meet the required 60 percent of retail sales in 2030. These new renewable resources are wind and solar plus storage resources, which increase through the planning period.

Retail Rates

SB 350 (PUC Section 9621(b)(3)) requires POUs to develop IRPs that enhance each POU's ability to fulfill its obligation to serve its customers at just and reasonable rates, minimizing impacts to ratepayer bills, as required in PUC Section 454.52 (a)(1)(C)-(D). Staff reviewed the analysis and information LADWP presented in its IRP filing on the rate and bill impacts from different resource portfolios they evaluated. Staff finds the LADWP IRP is consistent with the rates discussion, as required in PUC Section 9621(b)(3).

LADWP estimated future electricity bills by estimating its overall total costs spread over its overall retail sales. The overall total portfolio costs decrease on a per unit basis when more power is sold, caused by measures such as building and transportation electrification. Conversely, the overall total portfolio cost increase on a per unit basis when less power is sold, caused by measures such as net-metered solar and EE.

LAWDP used its current rate structure to estimate volumetric electric retail rates per unit of power sold for the years 2030 and 2035. LADWP then estimated the average monthly electric retail bill for two levels of consumption: an average residential apartment dwelling that consumes 300 kWh/month, and an average single-family home that consumes 700 kWh/month.

LADWP forecasted the average retail electricity rate to be $0.30/kWh in 2030 and $0.38/kWh in 2035. In 2035, the bill for an average residential apartment dwelling is estimated to be $112, while the bill for an average single-family home is estimated to be $262. This represents an average rate increase of 4.8 percent annually over today's average retail rates, and a total increase of approximately 84 percent over today's average retail bill.

System and Local Reliability

SB 350 requires filing POUs to adopt an IRP that ensures system and local reliability and addresses resource adequacy requirements.[16] Staff reviewed the LADWP's IRP filing capacity reporting table and discussion and finds that LADWP has planned for sufficient resources to

15 PUC Section 399.11(a).

16 PUC Section 9621(b)(3).

maintain a reliable electric system. In addition, LADWP's selected portfolio of resources contains sufficient capacity to meet anticipated resource adequacy requirements in 2030. Staff finds that the IRP is consistent with the SB 350 reliability requirements in PUC Section 9621(b)(3) and resource adequacy requirements in PUC Sections 9620 and 9621(d)(1)(E).

System Reliability

LADWP is its own balancing authority and as such is responsible for operating its electricity system in real-time. This is done by finely balancing power system demand and supply while ensuring reliability. This includes controlling generation and transmission of electricity within its control area, as well as between other balancing authorities, such as the California ISO.

LADWP requires a minimum quantity of firm, dispatchable, and readily available generation to support transmission reliability. This dispatchable generation must withhold the ability to ramp up power output on short notice to mitigate any contingencies such as an unexpected outage of a major transmission line. LADWP used a production cost model to ensure such constraints are met at all times. LADWP then used Monte Carlo simulations to estimate its planning reserve margin on achieving loss of load hours at or below 2.4 hours per year, the same as the 1-day-in-10-year industry standard. This resulted in capacity procurement at least 48.6 percent more capacity than its forecasted peak demand between now and 2030.

Local Capacity Needs

In general, LADWP's system brings renewable energy from outside the basin via transmission lines and has gas-fired generation in-basin for ensuring reliability. Thus, LADWP needs a significant amount of in-basin firm and dispatchable capacity to meet reliability requirements.

A firm-capacity resource can provide effectively constant power regardless of customers' demand patterns and the mix of other technologies deployed on the grid. A firm-capacity resource also can generate electricity on demand within minutes and run for uninterrupted periods in the range of hours to weeks.

These units are predicted to be used infrequently compared to today and are meant to serve load during periods of peak demand and emergency events. They also provide valuable reserve capacity even when they are not running.

LADWP's local capacity includes the gas-fired generators Harbor Generating Station, Haynes Generating Station, Scattergood Generating Station, and Valley Generating Station. LADWP is planning to add four energy storage projects in-basin before 2030, for a total of 215 MW of new capacity, that will help meet local and peak capacity needs.

Flexible Capacity Needs

In addition to the firm and dispatchable in-basin resources that can also provide flexible capacity, LADWP can also rely on Apex Generating Station and Castaic Pumped Storage Power Plant. Castaic provides enhanced operational flexibility and integration of variable renewable energy as water can be pumped uphill during off-peak hours and discharged during peak hours.

Transmission and Distribution Systems

SB 350 (PUC Section 9621(b)(3)) requires filing POUs to adopt an IRP that achieves the goal of strengthening the diversity, sustainability, and resilience of the bulk transmission and distribution systems and local communities, as further specified in PUC Section 454.52(a)(1)(G). Staff determined that the LADWP's *2023 IRP* demonstrates plans to maintain and enhance its transmission and distribution systems. Staff finds that LADWP is planning for enough transmission to adequately deliver resources to its service area to meet the requirement as discussed below. Staff also finds that the LADWP's *2023 IRP* demonstrates progress toward increasing the capacity and reliability of its distribution system. As such, staff finds the IRP is consistent with the transmission and distribution requirements set forth above.

LADWP owns and/or operates an extensive transmission system consisting of over 15,000 miles of transmission and distribution circuits with operating voltages ranging from 120 volts to 500 kilovolts (kV). LADWP buys and sells excess electricity using its transmission in California and the Western Electricity Coordinating Council. LADWP also offers surplus transmission capacity for sale to other parties when it is available. LADWP annually performs a Ten-Year Transmission Assessment Plan in compliance with the North American Electricity Reliability Corporation (NERC) Compliance Enforcement Program. LADWP's *2022 Ten-Year Transmission Assessment Plan* identified transmission improvements that are needed to maintain reliability and increase access to renewable resources located in areas distant from the City of Los Angeles.

LADWP completed the Barren Ridge Renewable Transmission Project in 2016. This project increased transmission capacity to allow for access to roughly 1,000 MW of wind and solar power and enhanced operational flexibility and integration of variable renewable energy.

LADWP, along with the other utilities participating in the Pacific Direct Current Intertie (PDCI), have signed a letter of agreement with the Bonneville Power Administration (BPA) to implement an initial 120 MW capacity increase of the PDCI if the cost is reasonable. BPA and LADWP have made the preliminary upgrades required to pursue this eventual transmission expansion.

LADWP is planning upgrades to the Haskell Canyon–Olive Transmission Line and adjoining switching stations. This project will maintain system reliability and increase the transfer capability from the new Haskell Canyon Switching Station to the Los Angeles Basin transmission system. It will assist with supporting 1,700 MW of renewables coming from Owens Valley.

LADWP identified various infrastructure projects in their transmission system between the Victorville area and the Los Angeles Basin. These projects include upgrades at substations, circuit reconductoring, installing capacitors at strategic locations, and replacing transformers, circuit breakers, and disconnect switches. These projects will allow LADWP to add up to 500 MW of transfer capacity, subject to operational requirements.

LADWP is also planning infrastructure improvements on key segments of the Los Angeles Basin transmission system to prevent potential overloads on critical components. These projects

include upgrading circuits and replacing transformers at receiving stations, reconductoring 230kW circuits, and installing reactors.[17]

While modeling performed for the IRP does not involve simulating the flow of electricity on LADWP's lower voltage distribution system, it does include cost estimates for upgrades to the distribution system. These upgrades are necessary to alleviate circuit and feeder overloads, as well as increasing distribution system capacity that will be necessary to accommodate higher levels of distributed energy resources, including distributed energy storage and solar PV, and electrification of the transportation and building sectors. This includes replacement of overloaded distribution transformers, worn underground cables, deteriorated overhead poles, and fatigued substation equipment.

Disadvantaged Communities and Localized Air Pollutants

LADWP is making efforts to minimize localized air pollutants and GHG emissions with early priority on disadvantaged communities, consistent with the statutory requirements of PUC Section 454.52(a)(1)(I) established by SB 350. LADWP's IRP includes reducing the combustion of fossil fuel-fired generation, which will also reduce air pollution in communities near power plants, including disadvantaged communities.

LADWP is also developing and implementing programs to target disadvantaged communities with energy efficiency and electrification programs that will further lower natural gas consumption and improve local air quality. One such program, the Home Energy Improvement Program, is a comprehensive direct install whole-house retrofit program. It offers residential customers a full suite of free products and services to improve the home's energy and water efficiency by upgrading and retrofitting the home's envelope and core systems. While not limited to low-income customers, its priority is to serve the most disadvantaged customers.

LADWP ensures that at least 30 percent (increasing to 50 percent in 2024) of Low Carbon Fuel Standard funds are used in disadvantaged communities and/or low-income communities. While LADWP offers incentives for installation of EV charging at apartment buildings, parking lots, mixed-use buildings, and commercial retail spaces, it offers additional incentives for installation of EV charging if the site is in a disadvantaged community. LADWP offers additional used EV and EV charging station rebates to low-income residential customers to address barriers for EV adoption and increase participation within these communities. LADWP's priority for increased electrification and supporting the transition to EVs is consistent with the requirement.

Net Energy Demand in Peak Hours

Senate Bill 338 (Skinner, Chapter 389, Statutes of 2017) requires POUs to consider existing renewable generation, grid operation efficiency, energy storage, distributed energy resources, and energy reduction measures to reduce the need for new or additional gas-fired generation

17 Reactors are large inductors that regulate the voltage and reactive power of the power system.

and distribution and transmission resources.[18] LADWP's IRP discusses how renewable resources, grid equipment upgrades, energy storage (both in front-of and behind-the-meter), and distributed energy resources, including energy efficiency and DR, were considered for meeting energy and reliability needs during the net-peak hours. LADWP's IRP is consistent with the requirement set forth above.

LADWP's *2023 IRP* included a discussion of the potential role of energy storage, distributed energy resources, and energy reduction in helping to meet net peak demand when selecting its resource portfolio. To understand how increasing levels of renewable resources affect the electricity system, LADWP evaluated the operational challenges from changes in net load. As previously mentioned, LADWP originally designed its electricity grid to accommodate imports from other geographic regions (coming from east and north of the service territory). As a result, local thermal generating units in the southern portion of its grid to provide voltage and frequency support, as well as to balance and ensure the reliability of the system. In the near-term, these local dispatchable natural gas resources are critical to system operations. In the longer term, LADWP will look for opportunities to deploy viable clean resource alternatives as they become technically and economically feasible.

Additional Procurement Goals

SB 350 (PUC Section 9621(d)(1)) requires filing POUs to address procurement of energy efficiency and DR, energy storage, transportation electrification, and a diversified portfolio, which are discussed in the next section. The resource adequacy provisions of this code section are discussed in the system reliability section above.

Energy Efficiency and Demand Response Resources

CEC staff finds that LADWP's IRP is consistent with the requirement in PUC Section 9621(d)(1)(A), as it includes a discussion of energy efficiency and DR programs it plans to implement and quantifies the amount of EE savings it plans to achieve.

Energy efficiency is a key strategic element in LADWP's resource planning efforts. Energy efficiency programs have reduced consumption by approximately 3,275 GWh per year. If LADWP continues its same pace that it has over the past decade through 2030, it will achieve its EE doubling goal as put forth by SB 350. LADWP is committed to implementing comprehensive energy efficiency programs with measurable, verifiable goals as well as maintaining an overall cost-effective energy efficiency portfolio. LADWP's suite of energy efficiency programs include the following:

- Comprehensive Affordable Multifamily Retrofits: energy efficiency retrofits, building electrification measures and on-site solar installation for low-income tenants and affordable housing property owners.

18 PUC Section 9621(c).

- Efficient Product Marketplace: point-of-sale credit option to customer's online purchases of energy efficient products, which eliminates the need for rebate application.
- Food Service Program: instant rebate for eligible energy efficient commercial food service equipment.
- Customer Performance Program: cash incentives for energy savings achieved through the implementation and installation of various energy efficiency measures and equipment that meet or exceed Title 24 or industry standards.
- Commercial Lighting Incentive Program: customers incentives to install newly purchased energy-efficient lighting and controls.
- Commercial Direct Install Program: offers free direct-install for businesses incorporating energy-efficient and electrification technologies into new commercial building construction or major renovations.
- Home Energy Improvement Program: direct install retrofit program that focuses on energy and water efficiency upgrades by retrofitting residential home envelope and core systems.
- Refrigerator Exchange Program: free refrigerator replacement program for low-income, seniors, multi-residential, and non-profit customers.
- LED Streetlight Program: loan to the City of Los Angeles to install highly energy efficient LED streetlight and reduce its consumption.

LADWP also performs program analysis and development, which covers support activities related to the energy efficiency portfolio not included in the previous listed individual programs. These include developing new programs, conducting special studies and pilot programs, participation in technical professional groups, and investing in external studies.

LADWP is focused on DR resources that are proven and cost-effective. The utility hired Navigant Consulting to help develop a Demand Response Strategic Implementation Plan, which serves as a roadmap and program guide as well as providing details on estimated DR resources, and measurement and verification methods for load and billing impacts. This plan is updated annually and incorporated into LADWP's IRP. While all customer classes are eligible to participate in DR in some form, most load curtailment is provided by the following programs:

- Commercial, Industrial, and Institutional Curtailable: provides monthly capacity payments for reduced load when requested.
- Residential and Small Commercial Direct Load Control: annual payment based on ability to reduce high-power consumption equipment, such as air-conditioning units and pool pumps.
- Critical Peak Pricing: provides dynamic rate structures to all customer classes that encourages deferred use during periods of exceedingly high demand.
- EV Rider: provides discounted rate for allowing curtailment during DR events.
- Alternative Maritime Power: allows disconnection of electrically connected maritime vessels during instances of system-wide emergencies.

Energy Storage

Staff finds that LADWP's IRP is consistent with the requirement in PUC Section 9621(d)(1)(B) to address procurement of energy storage as it discussed the potential role of energy storage on its system. Assembly Bill 2514 (Skinner, Chapter 469, Statutes of 2010) also requires POUs to evaluate the potential of energy storage systems as a resource and establish procurement targets, if appropriate.

LADWP sees energy storage as essential to integrate the quantity of renewable energy necessary to meet the 2030 RPS requirements of 60 percent. LADWP looks to increase energy storage deployment to reduce curtailment from variable energy resources, namely solar and wind. Energy storage would capture energy that cannot be absorbed by the electric system and dispatch the energy later when it is needed. LADWP's procurement modeling includes gradual procurement of energy storage between now and 2029, followed by more than 1,000 MWs added in 2030, and more gradual procurement thereafter. LADWP's IRP lists two in-basin battery energy storage projects coming online in the near-term: Beacon II Long Duration Energy Storage, and RS-X Li-Ion. Beacon II is a 10-hour 50 MW project (500 MWh) with a target operation of by the end of 2026. RS-X Li-Ion is a 4-hour 60 MW project (240 MWh) with a target operation of by the end of 2029.

LADWP is also looking at the potential for using normally curtailed renewable energy for electrolytic green hydrogen production, where surplus renewable energy could be used to power an electrolyzer that splits water molecules into oxygen and hydrogen. This would be considered green hydrogen as it would be produced only using renewable energy. LADWP views this as a form of "seasonal" energy storage as it could be stored for long durations on the scale of weeks or months. LADWP's new and retrofitted in-basin generating stations are anticipated to be capable of running on 30 percent green hydrogen by volume, but these emission savings are not assumed in the IRP, which provides a more conservative estimate of total emissions.

LADWP is currently investigating microgrid control solutions and potential to demonstrate their ability to provide grid operators more visibility and control of DERs including energy storage, while simultaneously acting as a DR asset.

Transportation Electrification

Staff finds that LADWP's IRP is consistent with the requirements of PUC Section 9621(b)(4) and (d)(1)(C) as it addresses transportation electrification, projecting for light-duty EV growth. LADWP included EV adoption and transportation electrification in their demand forecast, noted in Chapter 1. LADWP estimates that by 2030, the City of Los Angeles will have 750,000 EVs. LADWP estimates that these vehicles will consume 1,622,000 MWh and increase peak demand by 170 MW in 2030. To support the charging needs of these vehicles, LADWP is targeting 45,000 and 120,000 commercial charging stations by 2025 and 2030, respectively.

LADWP is implementing a broad and substantial set of programs to reduce the barriers to charging availability. Elements of LADWP's Electric Transportation Program include:

- Education and outreach through social media, car dealers, other utilities, and ride and drive events.
- Ensuring equitable transportation electrification by offering additional used EV and EV charging station rebates to low-income residential customers.
- Residential charging rebates including LADWP's "Charge up L.A.!" residential rebates and Smart Charge Rewards Program, which help offset the purchase of EVs.
- Residential EV charging station rebate program to help offset the cost of purchasing and installing eligible charging stations for EVs.
- Commercial charger installation rebates, which provide rebates for charger installation at multi-unit dwellings, workplaces, and public spaces.
- Time of use rate pilot program for commercial EV users that offers reduced demand charges and better aligns with today's grid needs.
- Rebate for Level 2 charging for customers with large publicly accessible parking lots, including apartment buildings, parking lots, mixed-use buildings, and commercial retail spaces, with additional funding if the site is located in a disadvantaged community.
- Direct Current Fast Charging rebate for commercial customers that provides rebates for charging sites that are publicly available.
- Medium-duty and heavy-duty rebates for commercial customers interested in AC and DC charging solutions for medium-duty and heavy-duty EVs.
- Expanding medium-duty and heavy-duty fleet charging at the Port of Los Angeles and Port of Long Beach through increased electrification of locomotives, ships, harbor craft, cranes, transportation refrigeration units, and various types of cargo handling equipment.
- Electrification of all new light duty and transit vehicles for the City of Los Angeles by 2028 where technically feasible.
- Expanding EV charging infrastructure by installing curbside and parking lot public chargers, City Fleet Chargers, City DC Fast Chargers, and City workplace chargers throughout Los Angeles.

Portfolio Diversification

PUC Section 9621(d)(1)(D) requires that POUs address the procurement of a diversified portfolio of resources consisting of both short-term and long-term electricity, electricity-related, and demand-response products. LADWP's IRP and LADWP's standardized tables demonstrated use of modeling and reliability analyses to balance a diverse resource portfolio including new resource procurement. The resource mix contains an array of zero-emission resources, including solar, wind, geothermal, nuclear, battery storage, and large and small hydroelectric generation. Resource development is spread throughout the planning period and includes both in-state and out-of-state resources, adding geographical diversity. Based on staff's review, LADWP's IRP meets this portfolio diversification requirement.

ACRONYMS

Acronym	Term
CARB	California Air Resources Board
California ISO	California Independent System Operator
CEC	California Energy Commission
DR	Demand Response
EE	Energy Efficiency
EV	Electric vehicle
GHG	Greenhouse gas
GWh	Gigawatt-hours
IPP	Intermountain Power Project
IRP	Integrated resource plan
LADWP	Los Angeles Department of Water and Power
MMTCO2e	Million metric tons of carbon dioxide equivalent
MTCO2e	Metric tons of carbon dioxide equivalent
MW	Megawatt
MWh	Megawatt-hour
POU	Publicly owned utility
PPA	Power purchase agreement
PUC	Public Utilities Code
PV	Photovoltaic
SB 100	Senate Bill 100 (De León, Chapter 312, Statutes of 2018)
SB 1020	Senate Bill 1020 (Liard, Chapter 361, Statutes of 2022)
SB 350	Senate Bill 350 (De León, Chapter 547, Statutes of 2015)

APPENDIX A: Glossary

Term	Definition
Behind-the-meter resources	Generation and storage located at the customer site. More generally, it can refer to any device located at the customer site that affects the consumption of grid-provided energy (appliance control systems, for example)
In front-of-the-meter resources	Generation and storage located on the utility side of the meter.
California Air Resources Board (CARB)	The "clean air agency" in California government. CARB's main goals include attaining and maintaining healthy air quality, protecting the public from exposure to toxic air contaminants, and providing innovative approaches for complying with air pollution rules and regulations.
California Energy Commission (CEC)	The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's seven major areas of responsibilities are: • Forecasting statewide energy demand. • Licensing of power plants and transmission lines sufficient to meet those needs. • Promoting energy conservation and efficiency measures. • Promoting the development of renewable energy. • Promoting the transition to clean transportation fuels. • Investing in energy innovation. • Planning for and supporting the state's response to energy emergencies. Funding for the Commission's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.
Demand forecast	A forecast of electricity demand served by the electric grid, measured by peak demand and energy consumption. Some factors that determine load forecast include economics, demographics, behind-the-meter resources, and retail rates.

Term	Definition
Demand response	Providing wholesale and retail electricity customers with the ability to choose to respond to time-based prices and other incentives by reducing or shifting electricity use, particularly during peak demand periods, so that changes in customer demand become a viable option for addressing pricing, system operations and reliability, infrastructure planning, operation and deferral, and other issues.
Distributed energy resources	Small-scale power generation technologies (typically in the range of 3 to 10,000 kilowatts) located close to where electricity is used (for example, a home or business) to provide an alternative to or an enhancement of the traditional electric power system.
Greenhouse gas (GHG)	Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).
Integrated resource plan (IRP)	A plan adopted by the governing board of a POU under PUC Section 9621.
IRP filing	An IRP adopted by the filing POU's governing board that is electronically submitted to the Energy Commission, along with the standardized tables and supporting Information, by the filing POU or authorized representative.
Plug-in electric vehicle (EV)	A vehicle that uses one or more electric motors for propulsion. Electric vehicles include battery-electric and plug-in hybrid vehicles.
Public Utilities Code (PUC)	The set of laws that regulates public utilities in California, including natural gas, telecommunications, private energy producers, and municipal utility districts.
Renewable Portfolio Standard (RPS)	A regulation that requires a minimum procurement of energy from renewable resources, such as wind, solar, biomass, and geothermal.
Senate Bill 350 (De León, Chapter 547, Statutes of 2015)	Also known as the Clean Energy and Pollution Reduction Act, this bill established clean energy, clean air, and greenhouse gas reduction goals, including reducing greenhouse gas to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050. The California Energy Commission is working with other state agencies to implement the bill.
Standardized Tables	The four tables that are required with the IRP filing submitted to the Energy Commission. These tables include information and data necessary to help staff determine if the IRP is consistent with PUC Section 9621. The four standardized tables are Capacity Resource Accounting Table (CRAT), Energy Balance Table (EBT), Renewable Procurement Table (RPT), and Greenhouse Gas Emissions Accounting Table (GEAT).

Term	Definition
Western Electricity Coordinating Council	A non-profit corporation, approved by the Federal Energy Regulatory Commission, as the regional entity that exists to assure bulk electric system reliability in the geographic area known as the Western Interconnection.
Western Energy Imbalance Market	A real-time energy market run by the California Independent System Operator that allows trading across participating balancing authorities in the Western Interconnection.
Zero-emission resources	An engine, motor, process, or other energy source, that emits no waste products that pollute the environment or disrupt the climate.