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# Resource Planning Report

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Integrated Resource Plan filing report  
to the California Energy Commission  
.....

September 2022



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# 1. Executive Summary

We developed our 2030 Zero Carbon Plan using an integrated resource planning process as directed in SMUD Board Strategic Direction-9 Resource Planning.<sup>1</sup> This plan was adopted as our updated Integrated Resource Plan by our governing Board on June 16, 2022.

This Resource Planning Report provides supporting information and background regarding our 2022 IRP update. It includes underlying data, methodologies and analyses supporting our 2030 Zero Carbon Plan as required in Public Utilities Code section 9621 and as elaborated upon in the CEC’s IRP Guidelines.<sup>2</sup> This report is organized as follows:

- IRP Process, which addresses our approach to long-term planning, our 2018 and 2022 IRPs and future plans.
- Underlying assumptions, which include scenarios considered, standardized tables and demand forecast for our IRP.
- SMUD’s resource plan, which addresses our diversified resource portfolio, renewable and zero-carbon procurement, energy efficiency and demand response, transportation electrification, system and local reliability, greenhouse gas impacts, rates, transmission and distribution and local air quality.

The following table was prepared to aid CEC staff in their review of SMUD’s 2022 IRP Filing and to illustrate how we have addressed requirements in Public Utilities Code and the CEC IRP Guidelines. While this table captures most substantive discussions relating to each topic, many of these matters are addressed in several areas within this Filing. Thus, the citations are not exhaustive and additional relevant details may be found elsewhere in the reports, plans and tables included herein.

CEC guidelines chapter	IRP Filing Reference Document	Page or Location
<b>2A Planning horizon</b>	2030 Zero Carbon Plan	9, 56
	Resource Planning Report	3(a)
<b>2B Scenarios and sensitivity analysis</b>	2030 Zero Carbon Plan	73, 92-93
	Resource Planning Report	3(c)
<b>2C Standardized tables</b>	Standardized tables	Enclosure D
	Standardized tables	Enclosure D
<b>2D Supporting information</b>	As referenced	N/A
	As referenced	N/A
<b>2E Demand forecast</b>	Reporting requirements	Enclosure D
	Reporting requirements	3(e)
	Demand forecast methodology and assumptions	2030 Zero Carbon Plan
	Demand forecast methodology and assumptions	50-52
	Load Forecast Methodologies report	Enclosure C

<sup>1</sup> See <https://www.smud.org/en/Corporate/About-us/Company-Information/Strategic-Direction>. Last accessed 7/27/2022.

<sup>2</sup> Vidaver David, Melissa Jones, Paul Deaver, and Robert Kennedy. 2018. Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines (Revised Second Edition). California Energy Commission. Publication Number: CEC-200-2018-004-CMF.

	Demand Forecast – other regions	Resource Planning Report	3(e)
<b>2F</b>	<b>Resource procurement plan</b>		
	Diversified procurement portfolio	2030 Zero Carbon Plan	48-50, 65-66, 91-94, 98-103
		Resource Planning Report	4(a)
		Renewable energy procurement plan	Enclosure B
		Standardized tables	Enclosure D
	RPS planning requirements	2030 Zero Carbon Plan	84-85, 92
		Resource Planning Report	4(b)
		Renewable energy procurement plan	Enclosure B
		Standardized tables	Enclosure D
	Energy efficiency and demand response resources	2030 Zero Carbon Plan	33-39, 51-55, 97-102-106
		Resource Planning Report	3(e)(i), 4(c)
		Standardized tables	Enclosure D
	Energy Storage	2030 Zero Carbon Plan	52-53, 74-75, 83-95, 97-105
		Resource Planning Report	4(d)
	Transportation electrification	2030 Zero Carbon Plan	35, 50-55, 102-106
		Resource Planning Report	4(e), 4(h)(i)
<b>2G</b>	<b>System and local reliability</b>		
	Reliability criteria	2030 Zero Carbon Plan	47-48, 69-70, 94
		Resource Planning Report	4(f)(i)
		SMUD 2018 IRP Filing – Chapter 8.2	78
		Standardized tables	Enclosure D
	Local reliability area	SMUD 2018 IRP Filing – Chapter 8.1.1	77
		Resource Planning Report	4(f)(i)
	Addressing net demand in peak hours	2030 Zero Carbon Plan	84-86, 91-96, 126
		Resource Planning Report	4(f)(i)-(ii)
<b>2H</b>	<b>Greenhouse gas emissions</b>		
	ARB targets	Resource Planning Report	4(g)
		2030 Zero Carbon Plan	71, 91-95
		Standardized tables	Enclosure D
<b>2I</b>	<b>Retail rates</b>		
	Minimize rate impacts	2030 Zero Carbon Plan	55, 104-106, 107-112
		Resource Planning Report	4(h)
<b>2J</b>	<b>Transmission and distribution systems</b>		
	Bulk transmission system	2030 Zero Carbon Plan	46, 126
		Resource Planning Report	4(i)(i)-(iii)
	Distribution system	2030 Zero Carbon Plan	46, 126
		Resource Planning Report	4(i), 4(i)(iv)-(vi)
<b>2K</b>	<b>Localized air pollutants and disadvantaged communities</b>		
	DACs	2030 Zero Carbon Plan	10-11, 27, 32-43, 70-73
		Resource Planning Report	4(j)(i)
	Localized Air Pollutants	2030 Zero Carbon Plan	70-73
		Resource Planning Report	4(j)(ii)

## 2. SMUD’s IRP Process

### a. Long-Term Resource Planning at SMUD

SMUD’s Board of Directors regularly reviews and provides guidance concerning our long-term resource plans, as set forth in SMUD Board Policy SD-9. The latest version of this Policy,

approved by the SMUD Board in April 2021, is provided in Enclosure E, Board Strategic Direction on Resource Planning (SD-9).

SMUD's long-term resource plans, including our 2030 Zero Carbon Plan (2030 ZCP), are living documents intended to guide efforts to supply clean electricity in an environmentally responsible and cost-effective manner through planning strategies that achieve policy goals. Our resource plans are regularly refreshed to address staff recommendations for additional study and to reflect legislative, regulatory, market and technology changes. This filing is a snapshot in time that reflects our latest Board-adopted plan.

### **b. SMUD's 2018 Integrated Resource Plan**

We adopted our previous IRP in 2018 and filed it with the CEC in April 2019, in accordance with the CEC's IRP Guidelines.<sup>3</sup> In 2019, the CEC confirmed that SMUD's 2018 IRP Filing "is consistent with the requirements of Public Utilities Code (PUC) § 9621, and meets California's energy, climate and other policy goals."<sup>4</sup> The CEC called the Plan "an ambitious road map for lowering greenhouse gas emissions in the Sacramento region while maintaining low rates and reliability."<sup>5</sup>

### **c. SMUD's 2022 Integrated Resource Plan Update**

In 2020, SMUD's Board of Directors declared a climate emergency within our service territory and beyond.<sup>6</sup> As part of this declaration, the Board asked SMUD staff to prepare a plan to achieve an ambitious carbon reduction goal: Carbon neutrality in our electric supply by 2030 while maintaining affordable rates, reliable electric service, equitable offerings, and maximizing benefits for our customers, community and the Sacramento region.

This resulted in our 2030 ZCP — a comprehensive, flexible resource plan that puts SMUD on track to eliminate carbon emissions from our electric generation supply by 2030.

When we developed our 2030 ZCP, we undertook a robust public outreach and consultation process that involved engaging with our customers and community. At SMUD, we know we cannot achieve our ambitious climate goals alone. We need to partner with our entire community to make sure we deliver solutions that are reliable, affordable and beneficial to our entire region.

As noted in our 2018 IRP Filing, section 2.5.1, we anticipated our next update would be adopted in 2023 and filed with the CEC by April 2024. However, in light of our Board's declaration of a climate emergency, we advanced the completion date of our planning cycle from 2024 to September 2022, not only to satisfy our obligation to update our IRP at least once every five

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<sup>4</sup> California Energy Commission Letter to Mr. Bryan Swann – SMUD.

<https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=18-IRP-01> . Last accessed 8/23/2022.

<sup>5</sup> Mathias, John, Melissa Jones, Paul Deaver, and Mark Kootstra. 2019. Staff Paper: Review of Sacramento Municipal Utility District's 2018 Integrated Resource Plan. California Energy Commission. Publication Number: CEC-200-2019-014.

<sup>6</sup> 2020 Climate Emergency Declaration, Resolution No. 07-16-2020.

years, but also to be responsive to our changing environment and priorities established by our locally-elected Board.<sup>7</sup>

On June 16, 2022, our Board formally adopted our 2030 ZCP as our 2022 Integrated Resource Plan update, for filing with and review by the CEC pursuant to PUC § 9621-9622 and in alignment with the CEC's IRP Guidelines. In short, our 2030 ZCP is now, officially, our 2022 Integrated Resource Plan update, as well.

In December 2021, as a courtesy, SMUD staff notified CEC staff that this filing would be submitted following Board action in the second half of 2022.

#### **d. Future Updates to SMUD's IRP**

Consistent with PUC § 9621, SMUD's Board of Directors will adopt the next update to our IRP at least once before June 16, 2027. We anticipate this study will be underway in 2026. Our next, and future, update to our IRP will follow the same process described in Sections 2.5-2.6 of SMUD's 2018 IRP Filing and our Board's Strategic Direction 9, Resource Planning (SD-9).<sup>8</sup>

### **3. Underlying Assumptions of SMUD's 2022 IRP**

#### **a. Objective: A Community-focused Approach to Clean Power**

SMUD's goal is to eliminate GHG emissions from our electric generation supply by 2030.<sup>9</sup> As part of the resource planning process, we focused on decarbonization strategies to achieve our clean energy target while also meeting relevant statutory and regulatory requirements governing reliability, GHG emissions, RPS requirements and energy efficiency. Consistent with the IRP Guidelines, SMUD's 2022 IRP Filing describes how SMUD will achieve these various goals and targets through 2030.

Our 2030 ZCP focuses on advancing demand response and energy efficiency programs, procuring renewable and other zero carbon generation resources, and accelerating local vehicle and building electrification to achieve significant GHG reductions over the planning horizon. Increased investments in renewable energy and enhanced electrification in our region represent promising areas to achieve additional GHG reductions beyond efforts already underway by SMUD and other entities in the Sacramento region. We know that to reach our 2030 goal, we must continue to develop programs, improve infrastructure, employ new technologies and conduct research that supports electric transportation and buildings.

#### **b. Key Study Areas**

Our customers and community are at the heart of all we do, and our goal is to enhance the quality of life for all our customers and to improve vitality in all the communities we serve. This goal cannot be achieved with a single standalone strategy – our consideration of disadvantaged communities (DACs), our sustainable communities, and our low-income households is at the forefront of each of the focus areas listed below. We don't want to just "bring others along" in

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<sup>7</sup> Public Utilities Code § 9621(b).

<sup>8</sup> <https://www.smud.org/-/media/Documents/Corporate/About-Us/Directives/Strategic-Direction/SD-9.ashx>

<sup>9</sup> See <https://www.smud.org/en/Corporate/Environmental-Leadership/2030-Clean-Energy-Vision>. Last accessed 7/27/2022.



our journey to sustainability and zero carbon. Instead, we're working internally and with our communities to assess each strategy's impact on our more vulnerable customers and communities and to strive for an equitable share of the benefits or impacts.

To achieve our zero carbon goals, we are focused on four main areas:

- **Natural gas generation repurposing:** Eliminating GHG emissions from our natural gas power plants is essential to reach our zero carbon goal. We are focused on reimagining our existing generation portfolio to eliminate GHG emissions by prioritizing retirement of our two natural gas plants located in DACs as well as by re-tooling and using renewable fuels in our remaining thermal assets.
- **Proven clean technologies:** These are carbon-free technologies available at utility-scale today and include solar, wind, geothermal energy and battery storage. We will significantly expand our investments in these technologies and adjust our plan as we progress in the other three areas.
- **New technologies and business models:** These are technologies that are either currently unknown or are not ready for large-scale adoption due to price, reliability or other factors. As part of our 2030 ZCP, we will launch pilot projects and programs to test and prove new and emerging technologies and will develop paths for prioritizing technology adoption and scaling.
- **Financial impact and options:** These help make sure achieving our zero carbon goal is possible at a reasonable cost that minimizes rate increases for our customers. We will do that by identifying savings and pursuing partnerships and grants that support our goals while maintaining reasonable rates.

While pursuing each of the four areas will be important through 2030, activities may accelerate or decline in individual areas based on overall progress or advancement in specific areas and in response to our evolving Government Affairs strategy, which will work to advance policies that support the changes and investments necessary for us to achieve our 2030 ZCP. For more information on our Government Affairs strategy or more generally on any of our focus areas, please see pages 65-115 of our 2030 ZCP.

### **c. Scenarios Considered**

Our resource planning process is collaborative, seeking input from across SMUD as well as input from our Board, energy industry experts and our community. The result of this planning process is an IRP that considers a wide range of available options in meeting IRP objectives. We also reviewed and discussed potential scenarios to research IRP study results and developed staff recommendations that were discussed with our Board and the public.

The pathway that became our resource plan includes a combination of supply and demand-side measures that, together with a focus on electrification, has the potential to bring our 2030 emissions to zero.

- **Adopted Scenario**, our chosen pathway, uses an hourly GHG emissions limit and is a multi-faceted plan to develop proven-clean technologies, repurpose our reliable thermal assets, integrate more distributed energy resources and new business models and emerging clean technologies to achieve our 2030 goal. The results of our plan include about 250,000 t (tonnes) GHG emissions left to be decarbonized by 2030. These

remaining emissions are the focus of our new technology research and demonstration plan and will be addressed following our in-depth clean emerging technology studies.

However, as part of our 2030 ZCP, we considered other scenarios, as well, such as:

- The **Reference Case**, which represents an updated least-cost plan to meet future energy and capacity needs of SMUD's system through 2030, in-line with our 2018 IRP, including a 60% renewable portfolio standard by 2030 and GHG emissions target of 1.35MMt (million metric tonnes) in 2030.
- The **Absolute Zero Hourly Case**, which reaches carbon neutrality by 2030 through the development of proven clean technologies, mostly solar and short-duration battery storage. In this case, all of our thermal power plants have been retired before 2030. The lack of firm generation in 2030 drives up the number of renewables and batteries required to meet system load in 2030 and the cost impacts to our customers. Despite the extensive resource build in this case, this scenario does not meet our basic reliability commitment to keep the lights on in all hours of the year.

For additional information, see our 2030 ZCP pages 73, 92, and 93.

#### **d. Standardized Tables**

The CEC IRP Guidelines require filing of various standardized tables. SMUD will file those tables separately and in the same docket as this 2022 IRP Filing. These tables include the Excel forms CEC109, CEC110, CEC111 and CEC112.

The following comments provide additional context relating to table CEC109, the Capacity Resource Accounting Table:

- The values for our thermal generators represent the net dependable capacity expected during July each year. Battery storage systems were assumed to have an effective load carrying capacity (ELCC equivalent) to 98% of their nameplate rating if local and 95% if located out of our service territory.
- Solar and wind resources provide variable load carrying capability. SMUD uses E3's RECAP tool to estimate the effective load carrying capability of the combined resource mix for each year. The values presented in this form represent the combined total for the resources disaggregated by generic and planned. In the future, batteries and other storage technologies will be included in the ELCC values. Disaggregation will no longer be possible.
- Our planning tools highlight resource diversification benefits. These benefits occurs when the portfolio of variable resources and energy limited storage projects allow for some redispatch characteristics. Having the ability, even if limited, to redispatch load and generation (through charging and discharging batteries) strengthens the overall value of the portfolio. Additionally, solar and wind diversification provides seasonal benefits. If a portfolio is not diversified, then we may see some negative impacts to the portfolio ELCCs. For example, we see this negative diversity in some winter months due to our high reliance on solar and wind when no large storage is active in our system. For an in

depth discussion of diversity benefits, see E3's report, on [Long-Run Resource Adequacy under Deep Decarbonization Pathways for California](#).<sup>10</sup>

#### **e. Demand forecast**

SMUD's demand forecast, which includes annual forecasted peak demand and annual retail sales that are used in our system modeling, are included as Enclosure C. Our demand forecast methodologies and assumptions for our modeling of our system and other regions are described below.

**SMUD System:** We use SMUD-specific internally developed forecasts of electricity sales and demand. Our demand model is based on expected (normal or 1-in-2) weather conditions and includes economic impacts to the region as well as changes in customer end uses, due to building code and technology developments. In the long-term, our load forecast includes effects from our outreach and other customer programs, electrification of buildings and transportation, customer-owned DERs (solar, storage, electric vehicles, etc.) and energy efficiency improvements. More information on our load forecast can be found in Enclosure C.

**Other Regions:** We do not utilize load forecasts for other utilities, regions or balancing authorities. SMUD's system modeling relies on nodal price forecasts to define our market interactions. Our system is much smaller than the surrounding CAISO and PNW systems we interact with, and our purchases are not likely to have a measurable impact on nodal prices. This is consistent with the industry standard practice for planning studies.

#### **i. Assumptions and impacts relating to energy efficiency, building electrification and electric vehicles**

Pursuant to PUC § 9505(b), every four years, the California Municipal Utilities Association (CMUA) is contracted to identify all potentially achievable cost-effective energy efficiency savings and to establish annual targets for a 10-year period. SMUD's energy efficiency market potential and targets were developed collaboratively with California's publicly-owned utilities (POUs).<sup>11,12</sup> These targets form the baseline of our energy efficiency and building electrification forecasts. Under SD-9, our Board direction is to maximize carbon reductions from buildings through our incentives in energy efficiency and building electrification. As such, our energy efficiency and building electrification forecast provides the highest GHG reduction value for the least cost to our ratepayers.

Our electric vehicle forecast is driven by our SD-9 target for reducing GHGs in Sacramento's transportation sector by the equivalent of 288,000 light-duty cars and trucks. SMUD will

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<sup>10</sup> For an in depth discussion of diversity benefits, see: [https://www.ethree.com/wp-content/uploads/2019/06/E3\\_Long\\_Run\\_Resource\\_Adequacy\\_CA\\_Deep-Decarbonization\\_Final.pdf](https://www.ethree.com/wp-content/uploads/2019/06/E3_Long_Run_Resource_Adequacy_CA_Deep-Decarbonization_Final.pdf). Page 38

<sup>11</sup> CMUA. "2022 Energy Efficiency Potential Forecast."

<https://www.cmua.org/files/CMUA%202020%20EE%20Potential%20Forecast.pdf>. Last Accessed: 22 August 2022.

<sup>12</sup> The latest report was submitted to the Energy Commission in April 2021 whereas our 2030 Zero Carbon Plan was completed in March 2021. As such, our IRP was developed using the previous forecast, submitted to the CEC in May 2017, showing a 2018-2027 cumulative goal of 1,669 GWh. See: Energy Efficiency in California's Public Power Sector: 11th Edition — 2017, Docket 17-IEPR-06.

continue to implement electric vehicle incentives, charging rates and infrastructure investments to achieve these goals. For more information, visit [SMUD.org](https://www.smud.org).<sup>13</sup>

Our 2030 ZCP and the CEC standardized tables provide further detail regarding load and energy impacts of our aggressive customer programs. See our Load forecast section in the Zero Carbon Plan, starting on page 50.

## **4. SMUD's 2030 Zero Carbon Roadmap: A Diverse and Flexible Resource Plan**

Our 2030 ZCP includes the flexibility to adjust to changing technology and customer preference. With the significant expansion of proven clean technologies we plan on adding as part of our 2030 ZCP, we expect to be able to reduce our carbon emissions by 90% without compromising reliability or our low rates. Eliminating the last 10% will be more challenging and will require SMUD to take bold actions and pioneer new technologies.

First, we explored the long-term role of SMUD's existing resources – including our thermal fleet and hydro resources – in keeping the lights on and maintaining competitive rates. After understanding the flexibility and limitations of our system, the study looked at GHG reduction operations both within our resource portfolio and more broadly across our region. Finally, we analyzed the costs and benefits of various potential alternatives to achieve a low-carbon pathway for SMUD.

Our IRP process integrates planning for distributed and supply-side resources. This allows us to maximize benefits and minimize costs as we transform our energy supplies to zero GHG emitting resources and work with our community to shape energy demand through demand response and load flexibility programs. Our process also incorporates benefits to our communities, including support for vulnerable populations in under-resourced communities.

### **a. SMUD's Adopted Resource Portfolio**

As described in Section 3(c) above, SMUD's Board adopted our 2030 ZCP with our Adopted Scenario defining our long-term planning resource portfolio (our "adopted portfolio"). The remainder of this section elaborates on the results of that portfolio.

Our adopted portfolio sets SMUD on a path to zero emissions by 2030 with a strong foundation of proven clean resources that reduce our emissions by 90% and a broad portfolio of new technology and business strategies requiring additional research before final implementation to address the remaining 10%. Prior to committing to new unproven technologies, we will conduct additional research, industry outreach and community consultation.

The Energy Balance Table (EBT) and Capacity Resource Accounting Table (CRAT) tables are submitted in the CEC's Standardized Tables; see Enclosure D. The tables demonstrate that the adopted portfolio represents a diversified resource portfolio that includes an increasing share of zero emission resources, renewables battery storage and demand-side resources. SMUD's Energy Balance Table shows the expected annual energy balance for the planning horizon

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<sup>13</sup> SMUD. "Is an EV right for you?" <https://www.smud.org/en/Going-Green/Electric-Vehicles/Residential>. Last Accessed: 22 August 2022.

(2022-2030) and the Capacity Resource Accounting Table illustrates the capacity balance (including a 15% planning reserve margin) for the same period.

Penetration of variable renewable energy within SMUD's system will increase dramatically within the next eight years. We plan to maximize utilization of solar assets through the development of battery storage co-located with these solar resources and potentially develop other energy storage systems. Any unused or otherwise unmarketable energy will be curtailed by SMUD system operators to balance loads and resources.

### **b. RPS and Zero-carbon Procurement**

SB100 requires that utilities procure at least 60% of our retail sales energy from eligible renewable resources by 2030. Our studies have found that thermal retooling within this plan has a dramatic positive impact on reliability and costs as compared to similar high-renewable energy focused scenarios. When including the retooling scenario, our zero carbon generation, including RPS-eligible renewables, hydro and thermal generation from RNG, totals approximately 105% of our retail energy sales. RPS-eligible renewables account for 90% of our retail sales, 30 percentage points more than the current state mandate of 60% in 2030.

Additional information regarding SMUD's RPS procurement targets and planned renewable resource procurement may be found in our most recent renewable procurement plan, included as Enclosure B, and on pages 84 and 92 of our 2030 ZCP. Our forecasted RPS procurement through 2030 is provided in the standardized reporting tables.

### **c. Energy Efficiency, Demand Response and Other New Technologies and Business Models**

SMUD has a long history of offering innovative, cost-effective, reliable and feasible energy efficiency programs and is continuing to iterate on these offerings to deliver products, programs and services that provide ideal solutions for our customers. For a full description of our current energy efficiency programs, see page 104 of our 2030 ZCP.

Our 2030 ZCP also considers emerging technologies, including new demand response programs, as key to achieving our 2030 goals – particularly to eliminate the remaining 10% of carbon resources. We're focused on four areas:

1. Electrification
2. Education and demand flexibility
3. Virtual power plants and vehicle-to-grid technology
4. New clean grid-scale technologies such as carbon capture and sequestration, clean emerging fuels and long duration energy storage.

In preparation for new DERs, we're working to develop a Distributed Energy Resource Management System (DERMS) to enable us to aggregate distributed resources like solar and storage to provide grid services and enhance shared benefits of these resources with all customers. More information, data and program forecasts appear on pages 33-39, 51-55 and 97 of our 2030 ZCP and in Enclosure D, Standardized Tables.

#### **d. Energy Storage**

As described in our 2030 ZCP in 2017, SMUD's Board adopted an energy storage procurement target of 9 MW by December 31, 2020, which we achieved.<sup>14</sup>

Our 2030 ZCP considers proven energy storage technologies, including batteries, thermal storage and pumped hydro. We anticipate needing between 700 and 1,100 MW of energy storage in our resource mix by 2030. For more information, see pages 84-93 and 97-105 of our 2030 ZCP and Enclosure D, Standardized Tables.

#### **e. Transportation Electrification**

SMUD has promoted the use of electric transportation technologies for over three decades and we continue to do so in this plan. We forecast significant energy and distribution needs from transportation electrification will significantly increase through 2030. We also anticipate that electric vehicle charging will be one of the most flexible customer loads that are sensitive to price signals. We are looking at this as a potential future resource under our New Technology and Business strategy.

SMUD offers customers a discounted EV charging rate<sup>15</sup> as well as incentives to encourage EV adoption. Passive rate instruments, such as our nighttime EV charging rate, have been effective at changing seasonal system-wide load shapes. For more information see pages 35, 51, and 53-55 of our 2030 ZCP as well as Section 4.h.i, below.

Our 2030 ZCP acknowledges that despite the many benefits of electrification, customer awareness and adoption still have significant opportunity to grow.. To further encourage adoption, SMUD will continue to run integrated marketing and advertising campaigns, offer online EV purchasing tools, and provide community education and hands-on driving demonstrations to reach customers in all of our communities. We also plan to increase our investments across our communities, including through work with community partners to expand access to all customer households. For further details regarding our current and future outreach efforts, including our work with nonprofits and other community partners, see our 2030 ZCP at pages 35, 40, 45.<sup>16</sup>

#### **f. System and Local Reliability**

##### **i. Reliability criteria and local reliability area**

SMUD ensures its long-term ability to serve electricity demand under all conditions by following federal, State and NERC requirements and standards for reliability and operations. For planning purposes, we plan to have sufficient resources to meet 1-in-2 peak load conditions plus a 15% planning reserve margin to account for extreme weather, operating reserves and unexpected

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<sup>14</sup> 2030 Zero Carbon Plan, page 52

<sup>15</sup> SMUD's TOD rate offers a plug-in EV discount of \$0.0150/kWh. This discount is for residential customers with a licensed passenger battery electric plug-in or plug-in hybrid electric vehicle and applies to all electricity usage charges from midnight to 6 AM, daily. For more information on our residential time-of-day service rate schedule, see [R-TOD](#).

<sup>16</sup> Additional information is available on SMUD's website, including at <https://www.smud.org/en/Going-Green/Electric-Vehicles/Residential> and <https://www.smud.org/en/In-Our-Community/Workshops-and-education-resources/Residential>.

outages. This level is consistent with the Western Electricity Coordinating Council's (WECC's) planning criteria.

With respect to SMUD's Local Reliability Area, our planning assumptions have not changed since our 2018 IRP, and we incorporate by reference the discussion and technical details in our 2018 Resource Planning Report, Section 8.<sup>17</sup>

#### **ii. Reliability: Addressing Net Peak Demand**

As part of the analysis supporting our 2030 ZCP, we consider how existing renewable generation, grid operational efficiencies, energy storage and distributed generation resources, including energy efficiency, will meet energy and reliability needs during the hours of net-peak demand. For a robust discussion of our considerations, see our 2030 ZCP section on our - Proven Clean Technologies strategy starting at page 84.

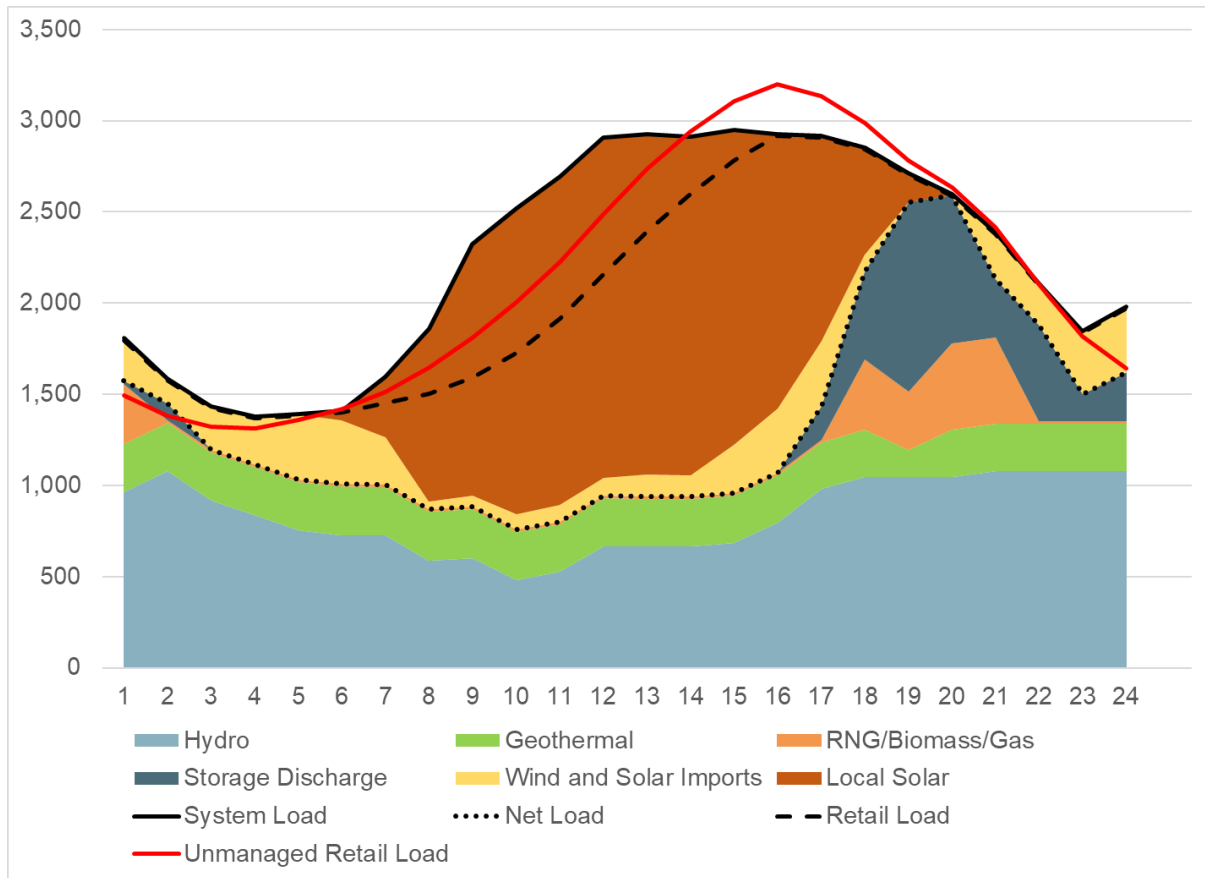
The following describes how new and existing renewable resources, grid operational efficiencies, multi-hour energy storage and distributed energy resources, including energy efficiency, were considered for meeting energy and reliability needs during the net-peak hours. For this discussion, we are highlighting the peak load day in 2030. However, our modeling analyses carries these considerations throughout the year to ensure energy is served in all hours of the planning horizon.

Today, our peak load generally occurs between 4 and 6 p.m. (Pacific Standard Time) during the summer following several days of temperatures over 100 degrees. With no operational efficiencies and retail load management programs, our unmanaged retail load peak is expected to sharpen to the 4 to 5 p.m. hour (shown by the solid red line in figure 1). Load management programs and continued implementation of our distributed energy management system is expected to lower our retail peak load significantly (shown by the dashed black line). With aggressive development of battery storage systems within our service territory and inclusion of other system energy needs, total system load (shown by the solid black line) is expected to peak at noon and remain relatively flat until 7 p.m.

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<sup>17</sup> SMUD's 2018 IRP Filing with the California Energy Commission. See <https://efiling.energy.ca.gov/getdocument.aspx?tn=227887>. Last accessed July 25, 2022.

Figure 1. Resource contributions to the 2030 net peak load



By 2030, the adopted portfolio includes over 1,800 MW of grid-scale solar (see ZCP for BTM solar assumptions) coupled with over 500 MW of storage within SMUD’s service territory, a significant shift away from conventional resources.<sup>18</sup> Additionally, we expect to build and continue operating wind and solar resources within the CAISO, Pacific Northwest and Desert Southwest. Our adopted portfolio also includes 160 MW regional storage located within the CAISO, helping to capture our excess solar and wind generation and delivering to load when needed. The total capacity of intermittent resources within SMUD’s territory and those imported, shifts our net system peak out to hour 20.<sup>19</sup>

The net load is relatively flat for most of the peak day, and from hour 2 to 16, is served mostly by our hydro and geothermal resource. To meet our net load ramping needs, hours 16 to 19, we are relying on our thermal power plants (fueled by both RNG and fossil NG until replaced by a clean alternative as detailed above) as well as a fleet of storage projects planned to be located within our service territory.

<sup>18</sup> Our 2030 Zero Carbon Plan also contemplates augmenting natural gas generators with 400 MW of 1-hr duration batteries to limit cycling. This is in addition to the grid-scale batteries discussed here. Reliability assessments performed in 2021 indicate the need for 4-hour minimum duration. These results will be evaluated in terms of long-term resource optimization in the next IRP.

<sup>19</sup> Net system peak is the system peak minus contributions from intermittent resources directly serving our load.



## **g. Greenhouse Gas Emissions**

In its 2018 report on GHG planning targets for the electricity sector, the California Air Resources Board set a GHG emissions range for SMUD of 1.1 to 1.9 MMt by 2030. SMUD's goal is to eliminate GHG emissions from our power supply by 2030, exceeding CARB's GHG planning target range. Using the CEC and ARB accounting, our 2030 emissions are negative, indicating that our excess zero emission generation has the potential to displace GHG emissions when sold into the broader market. See our 2030 ZCP pages 91-96 and Enclosure D, standardized tables.

## **h. Retail Rates and Financial Impacts**

SMUD is committed to ensuring just and reasonable rates for our customers and minimizing ratepayer impacts while achieving our 2030 Zero Carbon Vision. The extent to which our Board considered average system rate impacts under the adopted scenario are presented in the financial analysis section of our 2030 ZCP.

Changes to SMUD rates require staff to conduct a formal public rate action with recommendations to be adopted by SMUD's Board of Directors. SMUD typically reviews and sets rates on a two-year cycle. Our Board provides direction on our approach to rate setting in the Board's Strategic Direction 2, Competitive Rates. SMUD continues to maintain our commitment to keeping our rates low, both at a system level and by rate class and intends to maintain rates below those of neighboring PG&E and are among the lowest in California.

### **i. EV charging rate**

SMUD promotes electric vehicle adoption and home charging by offering our customers a discounted EV charging rate,  $-\$0.0150/\text{kWh}$ , between midnight and 6 a.m., which encourages customers to charge their vehicles during off-peak hours. This credit is for residential customers with a licensed passenger battery electric plug-in or plug-in hybrid electric vehicle and applies to all electricity usage charges from midnight to 6 a.m., daily.<sup>20</sup> At the end of 2021, approximately 60% of Residential EV households participated in our EV rate credit program. This discounted rate may be reevaluated as electric vehicle adoption increases to ensure we are targeting optimal charging time(s) while promoting greater adoption. Information on our EV charging rate and incentives can also be found in our 2030 ZCP (see, for example, Electric transportation incentive programs on page 35 and Enhanced electricity rates on page 55)

We offer up to \$1,000 toward EV charging equipment and installation costs. See [SMUD.org](https://www.smud.org) for more details regarding our incentive program details, rate discounts, and customer education and outreach efforts.<sup>21,22</sup>

### **ii. Minimizing rate impacts associated with achieving our 2030 ZCP goals**

We've identified the need for sustained and ongoing savings to help offset the costs of our plan and have developed a robust financial strategy to target operational savings and by pursuing

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<sup>20</sup> For more information on our residential time-of-day service rate schedule, see [R-TOD](#).

<sup>21</sup> <https://www.smud.org/en/Going-Green/Electric-Vehicles/Residential>

<sup>22</sup> <https://www.smud.org/en/In-Our-Community/Workshops-and-education-resources/Residential>

partnerships and grants. We will work closely with community organizations, industry partners, government agencies and regulators to jointly develop and finance innovative solutions and pave the way for cost reductions in new and emerging technologies.

Our financial strategy is based on taking action across many areas to help ensure that our 2030 ZCP is achievable while keeping annual rate increases at or below the rate of inflation. This will require a mix of strategies, summarized below. See page 107 of our 2030 ZCP for further details.

- Our **financial strategy** will seek out opportunities to accelerate benefits by reducing commodity and borrowing costs, increasing operational efficiencies and optimizing partnership and grant funding strategies.
- Our **partnership strategy** explores ways to work with the community at large to pool resources and mitigate risks as we explore new technologies and pursue large-scale projects.
- As part of our **grant strategy**, we've implemented new approaches to improve the efficiency of our internal grant identification and application process allowing us to be prepared with quick, yet comprehensive resources to react as new funding is announced.

#### **i. Transmission and distribution systems**

SMUD has a long history of performing detailed planning for its system to ensure reliability for customers and to meet requirements from the state, NERC and FERC. We do not anticipate reliability concerns over the 2022-2030 period for the transmission and distribution systems. However, our transmission and distribution plans include significant new investments to ensure continued high reliability while integrating more DERs. Our grid modernization plans also include a focus on visibility, remote control and data that will help prepare for a more decentralized two-way flow of energy on our distribution system. Our 2030 Zero Carbon Plan also calls for additional studies to ensure the adequacy and reliability of SMUD's transmission and distributions systems. For additional information and a snapshot of our current energy delivery system, see 2030 ZCP starting on page 126.

Our transmission plans cover up to 10 years ahead and our distribution system plans provide a five-year outlook. This section summarizes our most recent transmission and distribution plans and provides an overview of how our resource plan is integrated with transmission and distribution plans.

#### **i. Bulk transmission system overview**

The SMUD transmission system consists of a network of 115 kilovolt (kV) and 230 kV overhead and underground lines and cables that are interconnected to the adjacent PG&E and WAPA transmission systems via 230 kV interties and substations. The 115 kV portion of the transmission system serves customer load in the downtown area of Sacramento while the 230 kV portion serves the remainder of our service territory.

We have generation resources directly connected to our transmission system, namely hydroelectric power plants that are part of the Upper American River Project (UARP) in the Sierra Nevada, five thermal power plants in the Sacramento Valley and a 160 MW solar power facility connected directly to a 230 kV substation. The combined net dependable summer

capacity (NDC) of the hydro and thermal units are 673 MW and 1,012 MW, respectively. We also own 230 MW of the Solano Wind Farm that is directly connected to PG&E's transmission system with an interconnection point situated such that the location does not influence the reliability of the SMUD transmission system.

With a local generation capacity of 1,845 MW (excluding all distributed resources) and forecasted 1-in-10 peak demands that range from 3,176 to 3,230 MW across the 10-year planning horizon, SMUD relies on our transmission system to reliably serve customer load during peak demand scenarios.

## **ii. Transmission system reliability**

SMUD is one of several members of the Balancing Authority of Northern California (BANC), which provides reliable grid operation consistent with FERC, NERC, and WECC standards. The reliability of our transmission system is evaluated annually as part of the BANC Planning Coordinator's 10-Year Transmission System Assessment. This annual assessment evaluates the reliability of the SMUD transmission system under near- and long-term planning horizons considering a variety of system conditions and factoring in a wide range of contingencies. This assessment, which also follows and complies with the NERC TPL-001 Reliability Standard, evaluates the reliability of the transmission system by measuring the system performance following various contingencies against all applicable NERC, WECC and SMUD performance criteria. It includes various power system analyses, such as steady state, voltage stability, transient stability, short circuit and spare equipment unavailability analyses, to ensure the reliability of the transmission system and to comply with the standard.

The 10-Year assessment is primarily performed with the General Electric Positive Sequence Load Flow (PSLF) software, which is an industry standard tool and is widely used throughout the WECC region. The PSLF system models used as assessment inputs are updated to reflect the expected generation dispatch, real and reactive load forecasts, changes to existing facilities and any new planned facilities. SMUD uses our 1-in-10 demand forecast for peak scenarios to produce the most severe results and to better identify potential system deficiencies.

The 2022 10-Year Transmission System Assessment demonstrated that SMUD's transmission system meets all required NERC, WECC and SMUD performance criteria. A P1 criteria violation was revealed that would occur between 2027 and 2030 and mitigation measures are proposed until a new 115 kV substation is completed in year 2030 that will eliminate the criteria violation. This substation was already a proposed and approved project prior to the current assessment. Other transmission lines were found to be overloaded during certain N-1-1 contingencies, but these could be mitigated with operator intervention, which is allowed under the TPL-001 NERC reliability standard.

In addition to the 10-Year assessment, we performed a steady state contingency analysis on our transmission system model on scenarios that represented an altered transmission system using a generation dispatch with projects from SMUD's interconnection queue based on our 2030 ZCP as well as proposed load growth in the 115 kV system. The model was developed using the summer peak model developed as part of the 10-Year Transmission assessment as base case. The study findings did reveal a need for a higher rated 230/115 kV transformer at one of the SMUD substations due to combination of the 2030 ZCP and 115 kV system load growth. A project is underway to replace this transformer with a larger transformer.

**iii. Transmission system upgrades**

SMUD’s transmission system plans include upgrades to integrate renewable resources and to strengthen and improve reliability of the bulk transmission system. In 2024, a new solar generation and battery storage facility will be constructed within the SMUD system that will provide up to 250 MW of solar power to the SMUD transmission system. In addition to projects required for SMUD to meet all performance requirements, we continuously evaluate reliability enhancing options and have several approved projects that will increase the reliability of the bulk transmission system. These projects are listed below in Table 1.

**Table 1. Transmission Projects**

Project Name	Description	Expected In-service Date
Hurley 230 kV Bus-tie Breaker	Install a bus-tie breaker to reduce risk of station clearing outage.	2022
Coyote Creek (SVEC) Solar & Battery Plant	A new 250 MW solar and battery storage plant will be constructed and connected to the SMUD transmission system.	2024
Elverta 230/115 kV TX#2 Replacement	Replace the currently existing 140 MVA 130/115 kV transformer at the Elverta Substation with a 250 MVA transformer.	2028
Station J 115 kV Substation	Construct a new 115 kV substation in the SMUD transmission system.	2030

**iv. Distribution system reliability**

Achieving our 2030 goals will require upgrades to our distribution system to ensure reliability and facilitate increasing levels of DERs. SMUD’s distribution planning criteria requires that facilities do not exceed 100% of their rated capacity during normal operating conditions. Additionally, we require that the system has sufficient capacity to serve 100% of the load during N-1 operating conditions. These two criteria are key for modeling distribution system reliability and for determining the need for new investments in the distribution system.

Our 5-Year Distribution System Capacity Plan – 2022-2026 provides a road map of capital projects and expected investments over the next five years to ensure our distribution system continues to have the capacity to serve existing and forecasted demand in a safe, reliable, and cost-effective manner. The plan evaluates past performance and anticipates future system needs based on an array of criteria in alignment with our vision and goals.

**v. Distribution system upgrades**

The distribution plan includes many projects and upgrades with approximately 90 line projects proposed through 2026. This would add approximately 89 miles in new distribution lines (69-, 21- and 12 kV). The plan also includes 24 substation projects that will add approximately 492 MVA in transformer capacity.

**vi. Grid modernization and integration of DERs**

One-way power flow starting at central station generation (like from SMUD’s Cosumnes Power Plant) and moving through the transmission and distribution wires to customers is being

increasingly supplemented with DERs such as rooftop solar, EVs, fuel cells and customer-owned micro grids as well as utility-scale solar and storage interconnected with our distribution system. For SMUD, this means we need to update our system to safely and reliably operate and orchestrate distributed, 2-way power flow.

Our 2030 ZCP further drives the need to modernize our distribution system and transform it to a bi-directional grid that facilitates increasing penetration levels of DERs and building/transportation electrification. In addition to the distribution line and substation capital investments discussed above, we see the following three initiatives as key in our efforts to transform the distribution system to a bi-directional grid that facilitates increasing penetration of DERs.

- **Advanced Distribution Management System (ADMS):** The implementation of an advanced distribution management system (ADMS) is a foundational step to operating the distribution system as a 2-way system and will help the distribution operators optimize resources. This project is underway and scheduled for completion in 2022. This initiative is led by Distribution Planning & Operations and IT.
- **Substation Automation:** SMUD will continue to retrofit our remaining 12.5MVA distribution substations (approximately 28) with multiple distribution feeders that have full SCADA functionality over a 15-year period. The smaller substations with single distribution feeders were retrofitted with smart meters to provide near real-time remote monitoring for the distribution operators and engineers. All new distribution substations will be designed with full SCADA functionality.
- **Line Automation:** SMUD will also install automated switches to provide real-time remote monitoring and control for the distribution operators, including voltage regulators and capacitors on our 21kV and 12kV systems to ensure we operate within power quality and reliability standards, and prepare the system for higher levels of DER penetration.

For a more detailed discussion of SMUD's distribution system plan, our 5-Year Distribution System Capacity Plan – 2022-2026 is available upon request.

## **j. Disadvantaged Communities and Localized Air Pollutants**

### **i. Disadvantaged communities**

As we work toward our 2030 goal, we will continue to empower our communities to work with us and take the lead in developing place-based strategies. Together we will make sure that Sacramento communities are livable, resilient and ready to embrace a low carbon future.

In our 2030 ZCP, we have a section on building resilient customers and communities that provides a more detailed overview of our Sustainable Communities and income-eligible customer strategies. However, throughout our 2030 ZCP, we remain focused on ensuring all programs are inclusive and equitable for customers in historically under-resourced communities

For example, our Natural gas generation repurposing strategy provides a more detailed overview of our outlook on localized air pollution and the steps we are taking to improve local air quality as part of our natural gas transition strategy. Other discussions of our work to support under-resourced communities, various SMUD programs, partnerships and outreach efforts,

along with the tools we have developed to identify areas in our region that need our help the most can be found on pages 10-11, 27, 38-43 of our 2030 ZCP.

#### **ii. Air quality impacts**

One of the goals of our analysis of our thermal power plants was to find tools that can be used to minimize the adverse impacts on under-resourced communities and other sensitive groups.

In addition, as noted in our 2030 ZCP, studies show that criteria pollutant emissions, such as Nitrogen Oxide (NOx), from fuel combustion in buildings and light-duty passenger vehicles present higher health risk concerns in Sacramento than SMUD's power plants. Electrifying homes and buildings will result in significantly improved regional air quality and SMUD is working diligently with community partners to help ensure that all of our communities benefit from building and transportation electrification.

For more information, see pages 38-43 and the discussion starting on page 70 of our 2030 ZCP.

## **5. Conclusion**

SMUD appreciates the opportunity to submit this filing with the CEC. If you have any questions or additional information is required, please contact Bryan Swann, Director of Resource Strategy, at [Bryan.Swann@smud.org](mailto:Bryan.Swann@smud.org).