SMUD Rate Costing Study ("2024 Rate Study")

Prepared by the Pricing Division of SMUD's Revenue Strategy Department
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The Revenue Strategy Department provides fiscal and electric policy information, forecasting and advice to the Board of Directors and Executives of the Sacramento Municipal Utility District.

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1 | Introduction

The Sacramento Municipal Utility District's (SMUD) proposed rate structure as defined by the Chief Executive Officer & General Manager's Report and Recommendation on Rates and Services is influenced by SMUD's Marginal Cost. Marginal costs are the additional costs SMUD incurs to provide electric service to a new customer or a new load, or the savings expected from not serving that customer or load. These costs vary by the voltage at which electricity is delivered to the customer.

To provide electric service, a utility must acquire power, maintain transmission and distribution systems to deliver the power, and provide customer service. Each of these basic functions has several components.

- Acquiring power – SMUD provides power to a marginal customer from its marginal resource in the market. In addition to buying power for its customers, SMUD must provide ancillary services such as regulation and three types of reserves (spinning, non-spinning, and replacement), and transmission services.
- Delivering power – requires a physical system of towers and poles, cables and wires, substations, transformers, and other electrical equipment. These are the transmission, distribution, and distribution facilities systems; and
- Customer service – includes a whole array of activities which range from the initial connection of the customer to the electrical system to answering questions about a customer's bill. In general, these activities include gathering data from the customer's meter for usage, billing, maintaining customer records, operating, and maintaining meters and part of the distribution system, and providing information and responding to customers' inquiries.

SMUD's 2024 marginal cost reflects the current state of California's power markets and SMUD operations. It uses hourly allocation factors applied to all marginal cost components for assessing resource alternatives. The numbers presented in this study do not include losses. Marginal transmission and distribution (T&D) capacity costs reflect SMUD's costs to support additional load growth in SMUD's service area while maintaining T&D reliability. Marginal customer costs reflect the capital, software and personnel required to provide a high level of customer care. This Rate Costing Study reflects the 2024 marginal cost which is a foundation to design rates.

2 | Marginal Cost Components

While marginal cost is described in the singular sense, it is made up of several components, as listed in Table 2.1 below.

Table 2.1 – Classification of Marginal Cost Components

Category	Component	Description	Breakdown	Unit of Measure
Generation	Generation	Electricity production, ancillary services, line loss	Energy	$/kWh
	Capacity	Capital costs, fixed O&M for power generation	Demand	$/kW-year
	GHG Compliance	Cost for GHG compliance	Energy	$/kWh
	Renewable Portfolio Standard	Cost for Renewable Portfolio Standard compliance	Energy	$/kWh
Transmission and Distribution	Transmission	230 kV lines and infrastructure	Demand	$/kW-year
	Subtransmission	115 & 69 kV lines and infrastructure	Demand	$/kW-year
	Distribution	21, 12 and 4 kV lines and infrastructure	Demand	$/kW-year
Customer	Distribution Facilities	Line extensions and step-down transformers	Customer	$/customer-year
	Metering	Meter, installation, O&M, and meter reading	Customer	$/customer-year
	Services	Billing and customer information	Customer	$/customer-year

Each category is associated with energy-related, demand-related, or customer-related investment criteria for SMUD expenditures. Energy-related refers to expenses incurred when SMUD supplies energy services. Demand-related refers to the costs incurred when SMUD provides generation, distribution, or transmission capacity. Customer-related investment is associated with connecting new customers to SMUD's distribution system and providing billing and other services. Finally, the table indicates major characteristics associated with each category. The following sections present a more detailed summary of each marginal cost component.

3 Marginal Costs for Energy

SMUD's 2024 marginal cost calculates generation marginal costs by forecasting long-term California energy and capacity markets. It includes:

- Energy costs; and
- Ancillary services; and
- Capacity for Northern California.

Essentially, the market prices for these products are SMUD's marginal costs for energy, ancillary services, and generation capacity.

Market Prices for Energy and GHG Compliance

SMUD prepares long-term forecasts for its hourly energy supply costs which includes costs based on forecasts of market prices for energy and the cost of complying with California's cap and trade program (AB32) to use as the marginal energy cost.

Market Prices for Ancillary Services

The marginal costs for energy deliveries to SMUD customers also include the market prices of ancillary services. Ancillary services provide the operating reserves necessary for stable and reliable energy delivery. The market prices for these ancillary services relate directly to market prices for energy. National and regional reliability councils establish the amount of ancillary services that SMUD and other California utilities must provide as a percent of generation output. The current requirement for SMUD averages the percent of the annual energy delivered to SMUD's transmission system stated as a cost which has been levelized over the next 20 years. SMUD's marginal cost for energy and ancillary services is shown in Table 3.1, column [a].

Renewable Portfolio Standard (RPS)

The California Renewable Energy Resources Act, established by Senate Bill X1-2 and the Clean Energy and Pollution Reduction Act of 2015, enacted by Senate Bill 350 require that SMUD meet 33% of its retail sales from RPS-eligible renewable resources by 2020 and 50% of its retail sales from RPS-eligible renewable resources by 2030. Senate Bill 100 accelerates the RPS targets and establishes a new 60% target by 2030. The bill also creates a planning goal to meet all of the State's retail electricity supply with a mix of RPS-eligible and zero-carbon resources by December 31, 2045.

As shown in Table 3.1 column [b], the RPS Cost adder is the additional cost for energy related to RPS compliance and relies on a consultant developed average cost of renewable power (primarily provided by utility scale solar and wind technologies) and conventional energy price forecasts to calculate annual RPS premiums per kWh.

Marginal Cost of Capacity with Generation

The marginal cost of generation capacity represents the costs faced by SMUD for securing firm capacity through contracts or market purchases. Marginal generation capacity costs represent SMUD's costs for procuring firm-dispatchable generation capacity through contracts with power producers to meet resource adequacy targets. The generation capacity costs are summarized in Table 3.1, column [c].

Table 3.1 – Generation Marginal Costs by Time-of-Day Period (2024$)

	[a]	[b]	[c]	[d]
Time-of-Day	Energy + Ancillary ($/kWh)	RPS ($/kWh)	Capacity ($/kWh)	Total ($/kWh)
Summer Peak	$ 0.0494	$ 0.0193	$ 0.1903	$ 0.2591
Summer Off-Peak	$ 0.0422	$ 0.0193	$ 0.0195	$ 0.0810
Non-Summer Peak	$ 0.0660	$ 0.0193	$ 0.0649	$ 0.1502
Non-Summer Off-Peak	$ 0.0665	$ 0.0193	$ 0.0048	$ 0.0906
Non-Summer Off-Peak Saver	$ 0.0425	$ 0.0193	$ 0.0064	$ 0.0682
Average	$ 0.0540	$ 0.0193	$ 0.0239	$ 0.0972

4 Demand-related Marginal Costs

Demand-related costs include the installed capital costs, financing, and operation and maintenance (O&M) expenses to maintain SMUD's marginal investments in the transmission, subtransmission and distribution systems. Additions to transmission and subtransmission systems are based on growth in the system's peak load.

Marginal T&D Capacity Costs

SMUD's 230 kV transmission system allows SMUD to access power from energy markets. Marginal transmission investments represent the forward-looking capital costs and O&M expenses of high voltage transmission facilities, interconnection facilities, and voltage support equipment. Marginal subtransmission (at 69/115 kV) investments include the costs associated with bulk substations and the lines that connect the transmission system to the distribution system. Distribution system investments include the low voltage substations and the 21 kV, 12 kV, and 4 kV primary feeders that emanate from these distribution substations.

Marginal capacity costs include the installation costs, replacement costs from early retirements, O&M, general plant, administrative and general expenses (A&G), and working capital. The installed capital costs are annualized over the expected life of the equipment. Marginal capacity costs are measured in dollars per kilowatt-year of peak demand. Table 4.1 presents the marginal transmission, subtransmission and distribution capacity costs allocated to time periods and presented as cost per kilowatt-year. Distribution marginal cost includes cable and pole replacement. The values for total equipment costs, cable and pole replacement, and O&M are based on the 2022 Marginal Cost study and were escalated to 2024 dollars using the Handy Whitman index.

Table 4.1 – Marginal T&D Capacity Costs

(2024$)

System	$/kW Year
Transmission	$11.58
Subtransmission	$54.36
Distribution	$57.98
Total	$123.92

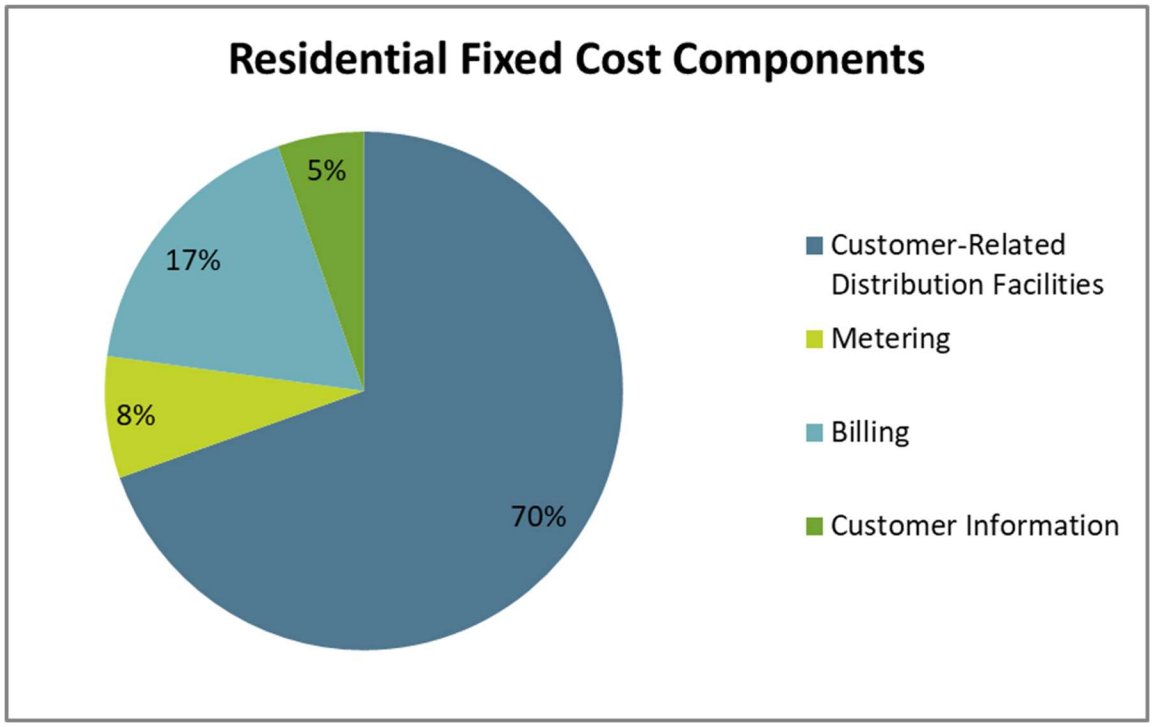
5 Customer-related Marginal Costs

Customer related costs are grouped into three major components

- Distribution facilities that connect the customer to the distribution system; and
- Installed meter costs; and
- Customer services.

The distribution facilities costs are calculated in dollars per customer-year. Facility installations are designed and built to accommodate customer specific capacity and voltage level requirements and are fixed regardless of demand. In that respect, the marginal costs can be stated as a dollars per kilowatt. Other customer costs are stated as dollars per customer and thus do not vary with customer energy usage or demand. These costs vary by the number of customers and must be recouped by SMUD. The numbers in this section are in 2024 dollars. As an example, Figure 5.1 shows a breakdown of customer-related costs for residential customers.

Figure 5.1 – Residential Customer-related Costs by Component (2024$)



Customer-related costs described in the following sections are found in Table 5.1.

Marginal Customer-related Distribution Facilities

Distribution facilities costs are largely driven by voltage levels and transformer sizing. For customers who are served at the secondary voltage level, marginal customer distribution facilities costs include the SMUD-owned final step-down transformer and the lines that connect the customer to the 12 kV or 21 kV primary feeder. For customers who take power at primary voltage,

i.e. 12 kV, 21 kV, 69 kV or 115 kV, the distribution facilities include the costs associated with connecting the customer's transformer to SMUD's existing distribution or subtransmission system. Marginal distribution facilities vary with the installed capacity of the customer. The marginal distribution facilities cost has been determined as a cost per customer-year, by customer type, and rate class, as shown in Table 5.1, column [c].

Metering

Meter costs include the capital, installation and O&M costs for servicing the meter. Meter costs vary by customer class and by the service voltage. Metering costs for customers served at higher voltages include voltage reduction equipment, wiring and the physical structures required for metering these customers.

Meter reading costs are calculated using historical and forecasted data (2020-2024). As the standard meter-read practice is for all meters to communicate usage data wirelessly to SMUD, the total cost is divided by total metered customers to generate a cost per metered customer value. See Table 5.1, column [d].

Billing

Customer account service costs include the costs of billing, and a variety of aspects of customer care. These services also include O&M expenses for the call center and information services, customer and Account Management services, collections, and billing system costs.

Public Goods expenses for energy efficiency, low-income and medical assistance, advanced and renewable technologies, and research and development expenses are excluded from Customer Account costs for marginal costing purposes.

The cost of uncollectable expenses is allocated to customer segments based on historical write-off data that is broken down into the broad customer categories. See Table 5.1, column [e].

Customer Information

Customer assistance and information awareness costs consist of historical costs for general communications and customer planning activities, customer assistance expenses, advertising, and commercial account management. See Table 5.1, column [f].

Table 5.1 – Customer-related Marginal Cost (2024$/customer-year)

[a]	[b]	[c]	[d]	[e]	[f]	[g]
Class	**Sub-Class**	**Customer-Related Distribution Facilities**	**Metering**	**Billing**	**Customer Information**	**Total**
Residential	Standard	$414	$45	$104	$32	$596
	Three Phase	$1,670	$45	$104	$32	$1,851
Small Commercial 0-299kW	<20kW	$1,670	$71	$55	$213	$2,009
	>20kW	$5,118	$242	$83	$213	$5,656
Agricultural	<30kW	$1,971	$71	$55	$135	$2,232
	>30kW	$4,215	$242	$55	$313	$4,825
Medium Commercial 300-499kW	Secondary	$27,786	$242	$83	$544	$28,655
	Primary	$1,597	$3,074	$83	$544	$5,298
Large Commercial 500-1,000kW	Secondary	$43,672	$242	$83	$577	$44,575
	Primary	$1,597	$3,074	$83	$577	$5,332
	Subtransmission	$7,707	$22,896	$83	$577	$31,264
Very Large Commercial 1,000kW +	Secondary	$86,595	$242	$83	$587	$87,508
	Primary	$1,597	$3,074	$83	$587	$5,342
	Subtransmission	$7,707	$22,896	$83	$587	$31,274
Lighting	Street Lighting	$0	$10	$60	$45	$114
	Traffic Lighting	$0	$71	$60	$45	$176

6 Other Cost Adders

Zero Carbon Plan (ZCP)

On April 28, 2021, the SMUD Board of Directors approved the 2030 Zero Carbon Plan to eliminate carbon emissions from our power supply by 2030. Absolute zero carbon is a bold and ambitious goal — one we believe we can and must achieve. We can't get there with today's technology and we can't get there alone. That's why innovation and partnerships are key pillars of the vision.

The bold vision gives SMUD an opportunity to be the convener to bring together a wide-range of stakeholders — businesses, elected officials, community leaders and organizations, think tanks, regulators, start-ups, academic institutions, venture capitalists and others to align resources for maximum impact. We'll be looking to partner with others to develop technology, find innovative sources of funding and develop new business models. We'll also need to work closely with regulators on climate-friendly policies and regulations that encourage electrification in the building and transportation sectors, which are currently the largest emitters of carbon/greenhouse gases in California. SMUD is committed to achieving our zero carbon goal in an inclusive way that leaves no communities behind.

SMUD will achieve its zero carbon goals by focusing on four areas:

- Natural gas generation – we'll reimagine our natural gas fleet to eliminate gas emissions through retirement, re-tooling and using renewable fuels.
- Proven clean technology – we'll expand the use of our existing carbon-free energy technologies like wind, solar, hydro, biomass, geothermal energy, battery storage and demand response. These technologies can get us about 90% of the way to our carbon free goal.
- New technology and business models – we'll explore new and emerging technologies – like power-to-gas technology, hydrogen and methane, long-duration batteries and carbon sequestration – that are either currently unknown or are not ready for large scale adoption due to price, reliability or other factors. This will help us identify potential partnerships and business models like virtual power plants and launch pilot projects and programs to test.
- Financial impacts and options – we're focused on making sure achieving our zero carbon goal is possible at a reasonable cost that minimizes rate increases for our customers, limiting rate impacts to the annual rate of inflation.

The costs necessary to achieve our ZCP includes the cost to reduce gas emissions, added reliability costs, energy losses from battery storage efficiency losses, and commodity cost differences associated with our plan for thermals such as reduced need for gas, differences in O&M budgets for gas plants, and reduced overall efficiency for our gas fleet.

The 20-year levelized cost of the ZCP is projected to be $0.0139/kWh.

Public Good Costs

The public good budget line item was added in 1998 based on policy changes approved by the Board and implemented May 1, 1998. Public Good programs include programs such as low income and medical rate discounts and administration, emerging technologies, research and development, energy efficiency, and building electrification.

The 20-year levelized public good cost is projected to be $0.0137/kWh.

7 Future Direction and Uses

Marginal costs are important decision-making tools for:

- Designing wholesale and retail rates; and
- Estimating costs to serve customers; and
- Estimating the benefits of proposed generation, transmission, distribution, energy efficiency, and load management investments; and
- Evaluating a customer's competing service options.

This Rate Costing Study is the latest study SMUD has undertaken. Changes in industry conditions and SMUD's own practices and costs demand that SMUD periodically update marginal costs to ensure that they remain an effective analysis tool. SMUD is therefore presenting this information in the areas identified above and others as conditions arise.

8 | Glossary

A&G Administrative and General – expenditures related to the day-to-day operations of a business.

Commercial Time Periods

Season	Time Period	Time	Days
Summer	Peak	4 pm to 9 pm	Monday through Friday, excluding holidays
	Off-Peak	All other hours	Every day, including holidays
Non-Summer	Peak	4 pm to 9 pm	Monday through Friday, excluding holidays
	Off-Peak	All other hours	Every day, including holidays
	Off-Peak Saver	9 am to 4 pm	Every day, including holidays

GHG Greenhouse Gas – Gases that trap heat in the atmosphere are called greenhouse gases.

O&M Operations and Maintenance – services required to assure the built environment will perform the functions for which a facility was designed and constructed.

RPS Renewable Portfolio Standard – A regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal.

T&D Transmission and Distribution:

Electric power **transmission** is the bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation.

Electric power **distribution** is the local wiring between high-voltage substations and customers.

ZCP 2030 Zero Carbon Plan – plan adopted by the Board to eliminate carbon emissions from our power supply by 2030.