CleanEnergy States Alliance

Tools to Tackle Affordability and Cost Allocation in Electricity Rate Design

November 6, 2025

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The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy.

CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

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Federal Initiatives

Provides opportunities for CESA-member organizations and all US states to:

- Learn about federal energy developments
- Exchange information to advance energy deployment in their state

www.cesa.org/projects/federal-initiatives

Webinar Speakers

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NREL
NATIONAL RENEWABLE ENERGY LABORATORY

CleanEnergy States Alliance

Thank You

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Tools to Tackle Affordability and Cost Allocation in Electricity Rate Design

Brittany Speetles and Joyce McLaren

November 6, 2025

Photo by Josh Bauer, NREL 61725

Agenda

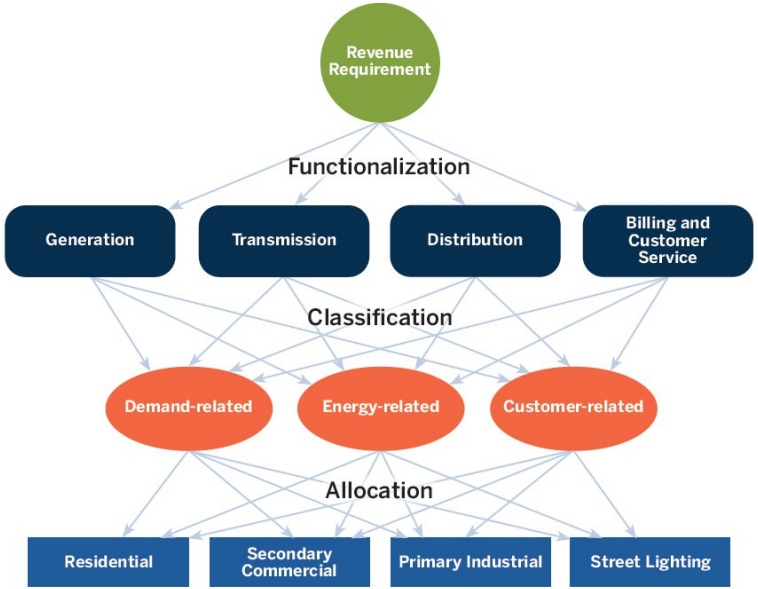
1. Rate Challenges of Today
2. Rate Analysis Capabilities at NREL
3. Example: Demand Charges in the Electricity Sector
4. Tapping into NREL Resources
5. Q&A

Rate Challenges of Today

Balancing competing and evolving criteria

Rates 101

- Rates determine how customers pay for electricity and fund investments to aid operation of the grid.
- Rates are developed by utilities and approved by regulators through rate cases.
- Regulators evaluate rates based on a variety of criteria including:
  - **Revenue sufficiency**, e.g., will utilities make enough money
  - **Customer understanding & acceptance** of rates as fair and reasonable
  - **Fair cost allocation** that apportions rates across customer classes
  - **Efficient customer behavior** that encourages customers' efficient energy use, management, and storage



How Utility Revenue Targets are Translated Into Rates

Image from Regulatory Assistance Project, Lazar, et al., (2020); Kavulla (2023). Original figure licensed under CC BY-NC 4.0

Rates Then and Now

- Historically, rate designs were simple
  - Limited ability to meter customer consumption in detail
  - Relatively stable utility cost drivers
  - Homogeneous customer base
- More complex rates are emerging with
  - More variable marginal costs and increasing fixed costs
  - New priorities, cost drivers, and technology (e.g., electrification, new technology, flexible loads, advanced metering)
- Relatively minor customer uptake of time-varying rates in the residential sector (~9% in 2023).[1]

1. 2023 EIA-861 (high variability across the country)

~90% of customers have advanced metering as of 2023[1]:

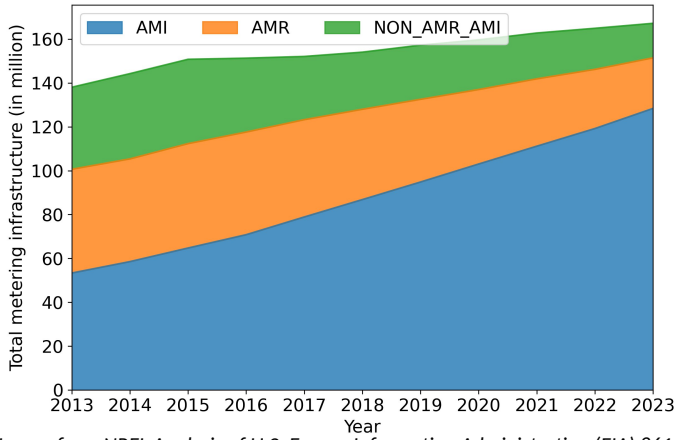


Image from NREL Analysis of U.S. Energy Information Administration (EIA) 861

Slide Credit: Bowen, Thomas and Christina Simeone, "Customer Rate and Tariff Design," Utility and Grid Operator Resources for Future Power Systems Webinar Series, DOE Office of Policy, July 17, 2025

Some Drivers to Cost Changes

Changing Loads and Energy Use Patterns

- New large loads (e.g., data centers, manufacturing)
- Growing electric vehicle (EV) adoption and unmanaged charging
- Building electrification shifts seasonal peaks
- More variable generation, self-generation, energy storage & smart assets

Macro-trends

- Rising cost of serving load (e.g., inflation)
- Major weather events
- Aging infrastructure
- Grid hardening

Will these trends increase utilization of existing assets?

Will they require significant new, but infrequently used assets?

Slide Credit: Bowen, Thomas and Christina Simeone, "Customer Rate and Tariff Design," Utility and Grid Operator Resources for Future Power Systems Webinar Series, DOE Office of Policy, July 17, 2025

Poll: What are your biggest concerns related to rate design?

- ❑ customer ability to understand and respond to increasingly complex rates
- ❑ ability to accurately recover costs
- ❑ maintaining affordability for customers
- ❑ increasing transparency of rate design
- ❑ decreasing time needed to update rates or respond to changing conditions
- ❑ other (please specify)

Poll: What tools do you use to conduct rate analysis?

- ❑ We use internally developed tools
- ❑ We use third-party tools (please specify)
- ❑ We hire a consultant to conduct analyses on our behalf
- ❑ We read analyses of others
- ❑ We do not engage in rate analysis activities

Motivation for Advance Rate Design Collaboration

- Well-designed rates are critical elements of a reliable and affordable electricity system.
- Rates are the primary means by which people interact with the electricity system.
  - For **commercial and industrial customers**, rates impact economics and drive business decisions.
  - For **residential customers and consumer advocates**, rates impact energy affordability and household energy burden.
  - For **regulators & utilities**, well-designed rates enable accurate cost recovery and efficient customer response.
- Decision makers need tools to evaluate and design rates that accurately respond to the quickly changing conditions of the electricity system, including the impacts of load growth and advanced energy technologies.
- Traditional rate design methodology has been slow to respond to changing conditions

Rate Analysis Capabilities at NREL

NREL's Rate Analysis Capabilities

NREL provides datasets and tools to help you:

- Track current and new rates
- Understand historical or regional trends
- Model the impact of proposed and existing rates on customers
- Understand interplay of rate design with technology adoption, electrification & new loads
- Design modern rates to meet changing grid conditions

Rate Analysis Tools at NREL

ResStock ComStock

URBAN OPT

Analyze building and district loads

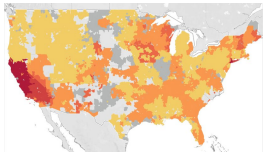
Utility Rate DATABASE

Understand current rates

Customer Affordability, Incentives and Rate Optimization (CAIRO)

Design and evaluate new rates

Geospatial Analysis Capabilities



Visualize data
Understand geographic rate variation

Utility Rate DATABASE

What is it?

- Database of electricity rates for U.S. utilities
- Detailed breakdown of each tariff
- Hosted and maintained by NREL
- Freely accessible online
- Users can lookup rates by utility, zip code, county
- Integrated with NREL modeling tools

  (e.g. System Advisor Model, REopt)
- Historical rate data is retained

URDB User Metrics (2025)

- 165,000 views from 19,000 distinct users on web app
- 13.8M hits and >620 users on URDB API

Last 30 days:
21,223 views from 4,476 distinct users on webapp

https://openei.org/wiki/Utility_Rate_Database

Customer Affordability, Incentives, and Rates Optimization Model

CAIRO estimates the impact of utility rate and program design decisions using future power system scenarios to identify tradeoffs aligned with traditional regulatory principles such as **affordability**, **economic efficiency**, **revenue adequacy**, and **consumer cross-subsidization**.

Translates:
Customer loads, regulatory guidance on rates, utility revenue assumptions…

Into:
Utility revenue requirements, multiple rates designs, customer demand response, customer bills, cost-shifting between customers.

For more information: *https://www.nrel.gov/grid/cairo*
Contact: Thomas Bowen, Thomas.Bowen@nrel.gov

Example Results:
Los Angeles Department of Water and Power

Rate Equity Metric	2019 LADWP Baseline w. EZ-SAVE	2035 LADWP BAU w. EZ-SAVE	LADWP BAU w. CARE & FERA	Simplified Tiers w. CARE & FERA	Simplified Tiers w. IBFC
Avg. Monthly Bill (All Households)	$105	$188	$188	$188	$188
Avg. Monthly Bill (Low-Income, 0-50% AMI)	$83	$193	$151	$138	$81
Average Annual Electricity Burden for:					
All Households	3.7%	7.3%	6.4%	6.0%	3.8%
Low-Income, 0-50% AMI	7.8%	16%	13%	12%	5.9%
Moderate-Income, 50-80% AMI	2.1%	4.0%	4.3%	4.1%	3.4%

Baseline | More Affordable ⟷ Less Affordable | No Change

Example: Demand Charges in the Electricity Sector

Demand Charge Project Overview

- Analyzed demand charge variation throughout the U.S. using the URDB and Tableau
- Synthesized historical context and implementation of demand charges in retail rates
- Conducted interviews with rate design experts
- Explored how demand charges relate to widely-accepted rate making principles and current and future electricity system topics

The results of this project are pending release and not for distribution.

Speetles, Brittany, Mark LeBel, Ron Nelson, Joyce McLaren, Daniel Zimny-Schmitt, and Dana Stright. 2025. *Demand Charges in the Electricity Sector*. Golden, CO: National Renewable Energy Laboratory. [Pending release].

Demand charges may be calculated in a variety of ways

What category of costs are recovered?

- Transmission
- Generation
- Distribution

How is the demand charge measured?

- Seasonal
- Monthly/Billing period
- Peak window demand charge
- Ratcheted: highest demand over 11-month period
- Contractual: demand billed for is predefined by agreement vs. measured at the meter

What time duration is observed to define highest demand?

- Highest average over 15 minutes
- Highest average over 30 minutes
- Highest average over 60 minutes
- Different options available with advanced metering

Demand Charge Insights

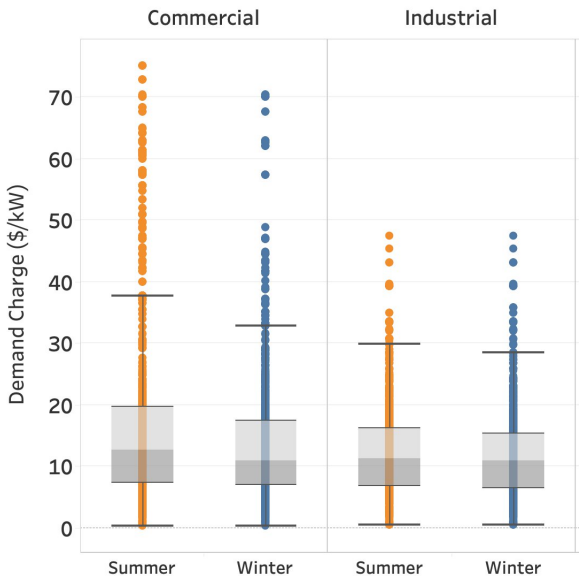
NREL summarized the results of expert interviews in terms of four widely accepted rate principles.

Effective Cost Recovery	Customer Understanding & Acceptance	Fair Cost Allocation	Efficient Customer Behavior
• Demand charges support cost recovery but may give less incentive for customer load shifting than other time varying rates. • Increased adoption of technologies that help customers reduce or avoid demand charges (e.g., BESS) may lower utility cost recovery from demand charges.	• Large C&I customers may use energy management systems to respond to price signals. Less common in residential sector. • Experts and studies have cited limited understanding of demand charges among residential and small commercial customers.	• Fair cost allocation may depend on the number of customers on each transformer and coincidence of customer load patterns with the demand charge.	• Customer response depends on the magnitude of demand charge and ability to shift load. • Non-coincident peak demand charges may not incentivize customers to reduce loads at system peak. • Load-controlling devices have not yet been widely adopted by residential customers.

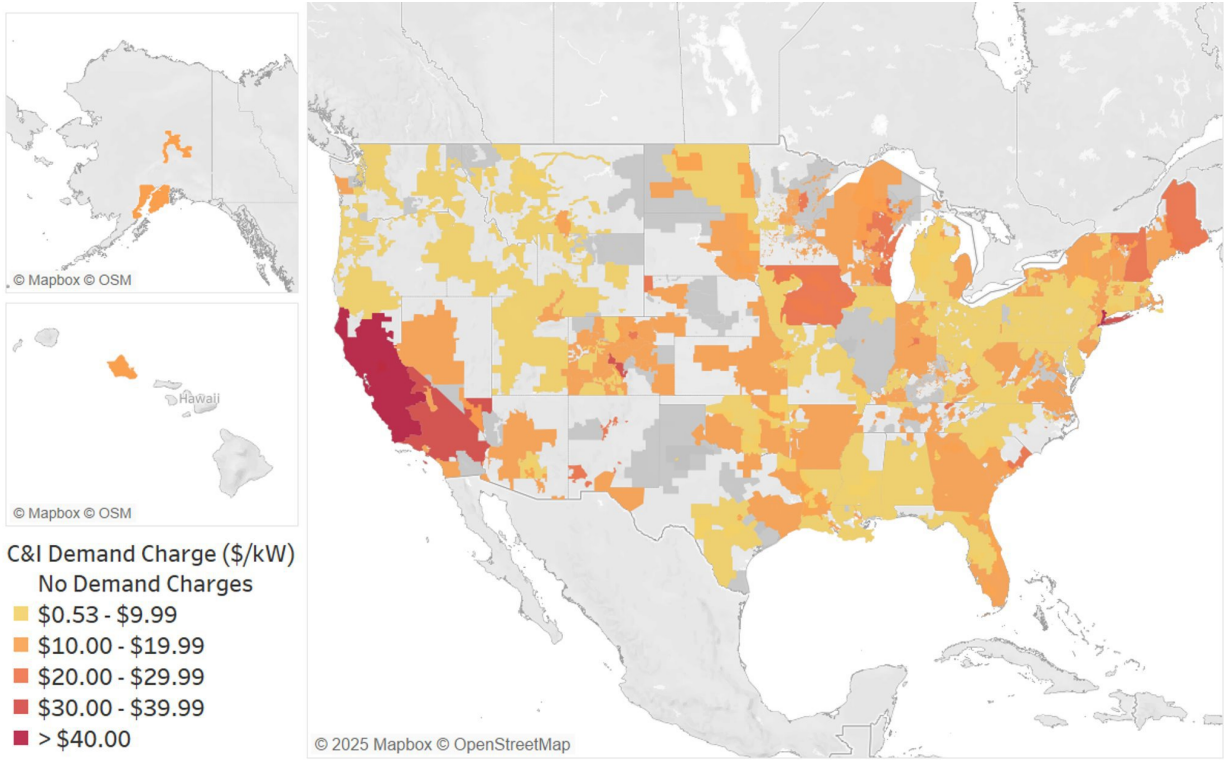
Pending publication. Do not cite.
Speetles, Brittany, Mark LeBel, Ron Nelson, Joyce McLaren, Daniel Zimny-Schmitt, and Dana Stright. 2025. *Demand Charges in the Electricity Sector*. Golden, CO: National Renewable Energy Laboratory. [Pending release].

Demand Charges are Widely Used in C&I Sectors

On-peak demand charges per tariff by sector and season



Commercial and Industrial Demand Charges, Summer Months



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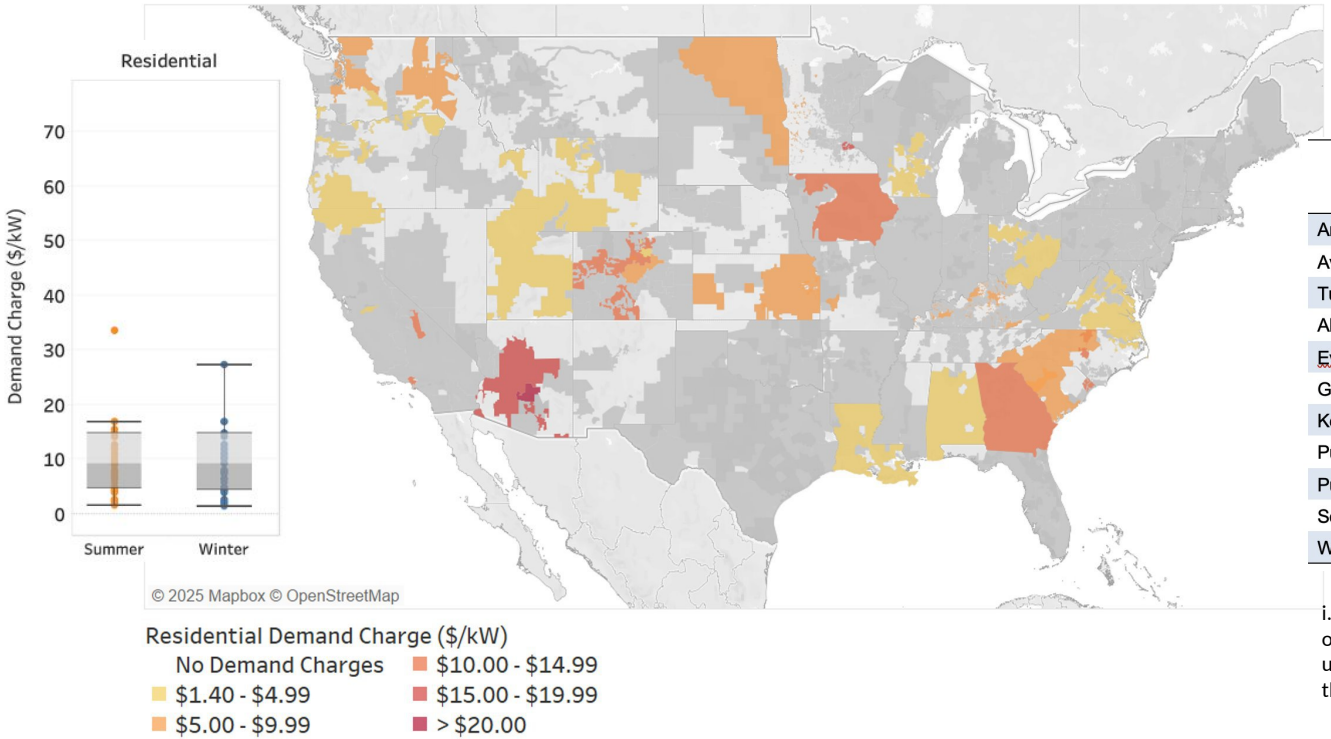
Residential Demand Charges

Residential Demand Charges, Summer Months



Name of Utility	Percent of Residential Customers With Demand Charges
Arizona Public Service Co	17.6%
Avista Corp[i]	4.5%[i]
Tucson Electric Power Co	1.6%
Alabama Power Co	<1%
Evergy	<1%
Georgia Power Co	<1%
Kentucky Utilities Co	<1%
Public Service Co of Colorado	<1%
Puget Sound Energy Inc	<1%
South Carolina Electric & Gas Co	<1%
Wisconsin Power & Light Co	<1%

i. Data for Avista includes approximately 16,000 customers on a "Residential and Farm General Service" rate, and it is unclear whether these customers would be categorized in the residential service class in other jurisdictions.

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Tapping Into NREL Resources

How NREL can help solve your rate analysis challenges

Need for Advanced Rate Analyses

Load growth, new industries, and advanced energy technologies are challenging traditional approaches to rate design.

Stakeholders need transparent, easy to use tools to inform decisions and enable an increasingly efficient power system.

NREL can help regulators, utilities and consumer advocates with methods to understand rate effectiveness and evaluate innovative rate design proposals.

Work with NREL to:

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- ✓ Track current and new rates
- ✓ Understand historical or regional rate trends
- ✓ Model the impact of proposed and existing rates on customers or utility revenues
- ✓ Understand interplay of rate design with technology adoption, electrification, new loads
- ✓ Design modern rates to meet changing grid conditions

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Poll: What are the most relevant issues for you to analyze with respect to rates?