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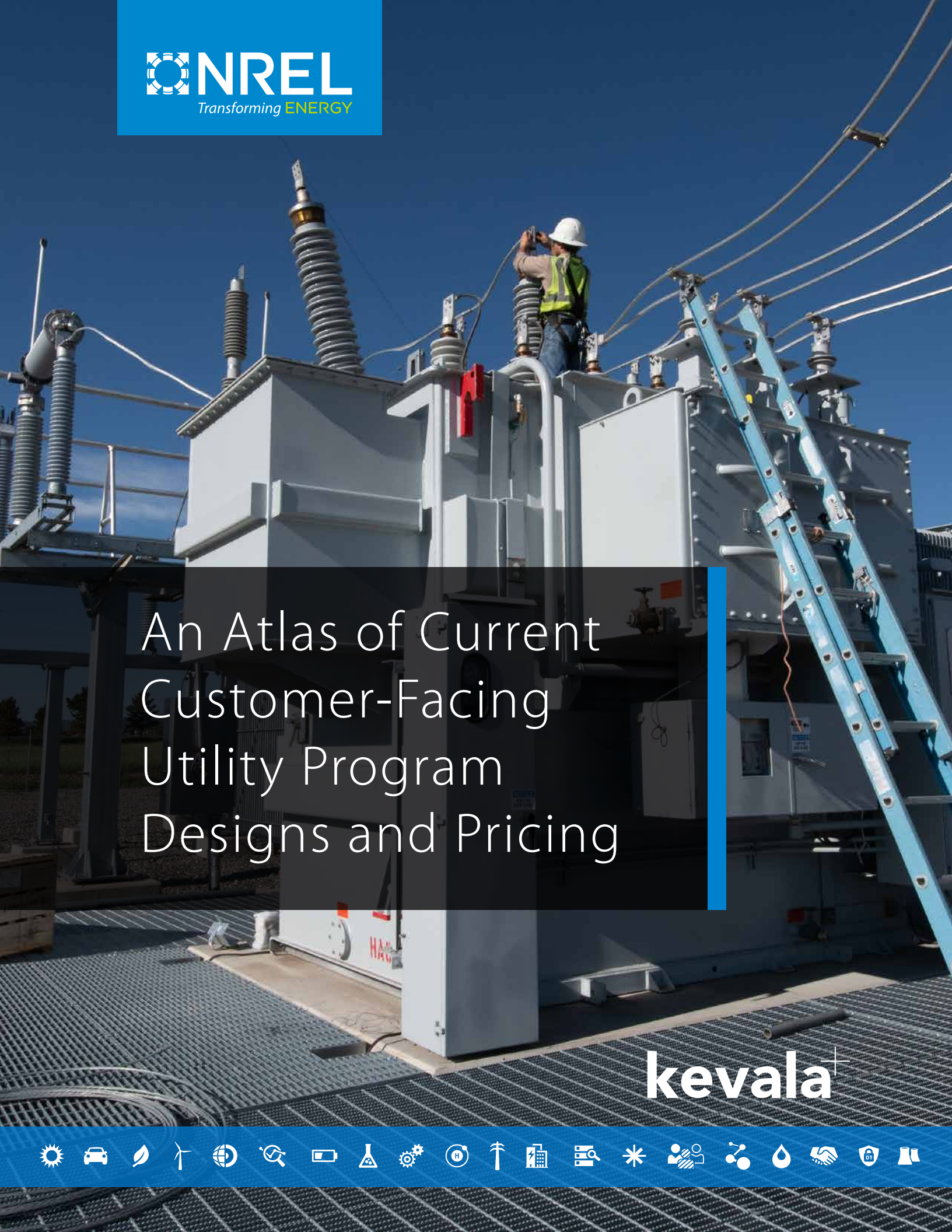

An Atlas of Current Customer-Facing Utility Program Designs and Pricing

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An Atlas of Current Customer-Facing Utility Program Designs and Pricing

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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

Contract No. DE-AC36-08GO28308

Technical Report
NREL/TP-5500-90456

August 2024

National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401
303-275-3000 • www.nrel.gov

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EXECUTIVE SUMMARY

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To achieve holistic decarbonization, customer accessibility to utility programs and incentives will be crucial. However, utilities face challenges to ensure accessibility for all utility customers. We explore utilities' current program and rate design practices, motivations behind these practices, and limitations to these existing practices.

The National Renewable Energy Laboratory (NREL) and Kevala, Inc. (Kevala) conducted a targeted literature review and leveraged extensive expertise, including that of team members with four decades of experience in the utility sector, to characterize utility programs and rate designs. This analysis delves into the motivations behind these programs and the various hurdles they face. Through this in-depth study, the team provides critical insights into the operational dynamics of utility programs, identifying key drivers and barriers that influence their effectiveness and implementation.

Motivations for utilities to host utility programs include increasing capacity, advancing technology, shaping public opinion, and complying with regulations.

Disadvantaged communities are disproportionately affected by pollution related to electricity generation and have historically been marginalized in utility program design. Utilities factor goals, context, eligibility, marketing and outreach, implementation, evaluation, and iteration—all underpinned by evidence and metrics—into program designs, which vary according to utility structure.

Motivations for utilities to host utility programs include increasing capacity, advancing technology, shaping public opinion, and complying with regulations. However, current practices face several limitations. These include:

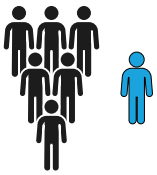
- Reliance on top-down regulation and guidance that neglect to consider customers of diverse demographics
- Limited pricing options for different customer classes
- A bias toward "typical" customers that excludes people of many demographics
- Ineffective program marketing
- Insufficient evidence and metrics to support program effectiveness.

This atlas is intended for individuals and organizations interested in understanding utility program design and rate structures. It serves as a resource for those new to the field of utility structures and programs in the US as well as stakeholders looking to deepen their knowledge of how utility programs are conceived, implemented, and evaluated. Our analysis presents complex information in an accessible manner, aiming to bridge the gap between expert knowledge and practical applications. To learn even more about key considerations of utility program design, we recommend reading Driving Affordable Decarbonization (Charan et al. 2024).

Current Practice Limitations

Top-down regulation and guidance that neglect to factor in the full range of customer demographics

Limited pricing options for customer classes



Program bias toward "typical" customers can exclude many customer demographics

Ineffective program marketing

Limited evidence and metrics

CURRENT PROGRAM DESIGN AND PRICING PRACTICES

Photo by Dennis Schroeder, NREL 48962

Access to affordable electricity remains a critical national energy objective. Utility rate design and pricing provide mechanisms to ensure affordability. Yet, current program design and pricing practices have limitations and may not equitably benefit disparate populations. Therefore, there is a need to understand how current practices can promote or hinder access to affordable electricity, especially as more commercial and residential customers move toward decarbonizing and electrified technologies. In this section, we explore the role of utility structures, program and rate design, and utility motivation in providing access to affordable electricity, particularly among disadvantaged and underserved communities.

Utility Structures

Energy providers frequently administer customer programs and formulate pricing structures for their energy services in the form of rates, which sometimes can be skewed by conflicting objectives. On one hand, energy providers are charged with delivering benefits to customers, often through incentive or energy reduction programs. On the other hand, utilities must ensure just and reasonable billing for energy consumption (ACEEE 2022; Davis 2009). We observed that these tensions have led to varying degrees of pricing and program offering scrutiny, contingent on the structure of each energy provider. Utilities, as a subset of regulated energy providers in the United States, exhibit a broad and diverse spectrum of structures, each with its own set of rate and program design advantages and disadvantages thereby influencing how effectively utilities can cater to their customers. These utility structures can be described as follows:

- **Investor-owned utilities (IOUs)** are for-profit utilities that can be held privately or publicly. More than 70% of U.S. customers are served by 168 IOUs, which are regulated by public utility commissions (PUCs) (EIA 2019).
- **Municipal utilities (munis)** are not-for-profit public utilities owned by local governments. Munis owned by state government often are called public utilities. Over 2,000 municipal and public utilities serve about 15% of U.S. customers. Munis can also be regulated by PUCs but are more often directly managed by local governments (Heinemann and Smith 2020; NCUC 2023).
- **Community choice aggregators (CCAs)** are not-for-profit public utilities that procure electricity for a specific community or group of communities. CCAs are regulated by local governments.
- **Cooperative utilities (co-ops)** are not-for-profit private utilities owned by the customers the utility serves. The U.S. has more than 800 co-ops that serve 13% of customers and are regulated by boards of directors.
- **Retail supply programs** allow customers to purchase electricity from electric service providers that are not the distributing utility. Retail supply programs are regulated by local governments.

Traditionally, electric utilities in the United States have been classified as "natural monopolies,"[1] meaning their average cost falls as the firm increases in size (Sharkey 1983). While access to electricity is necessary for the safety and livelihood of a community, utility markets have not been considered competitive and are usually subject to extensive government oversight (Posner 1969). **Figure 1** shows the processes of different utility processes.

1 A natural monopoly is a monopoly within an industry with high infrastructure costs and other barriers to entry.

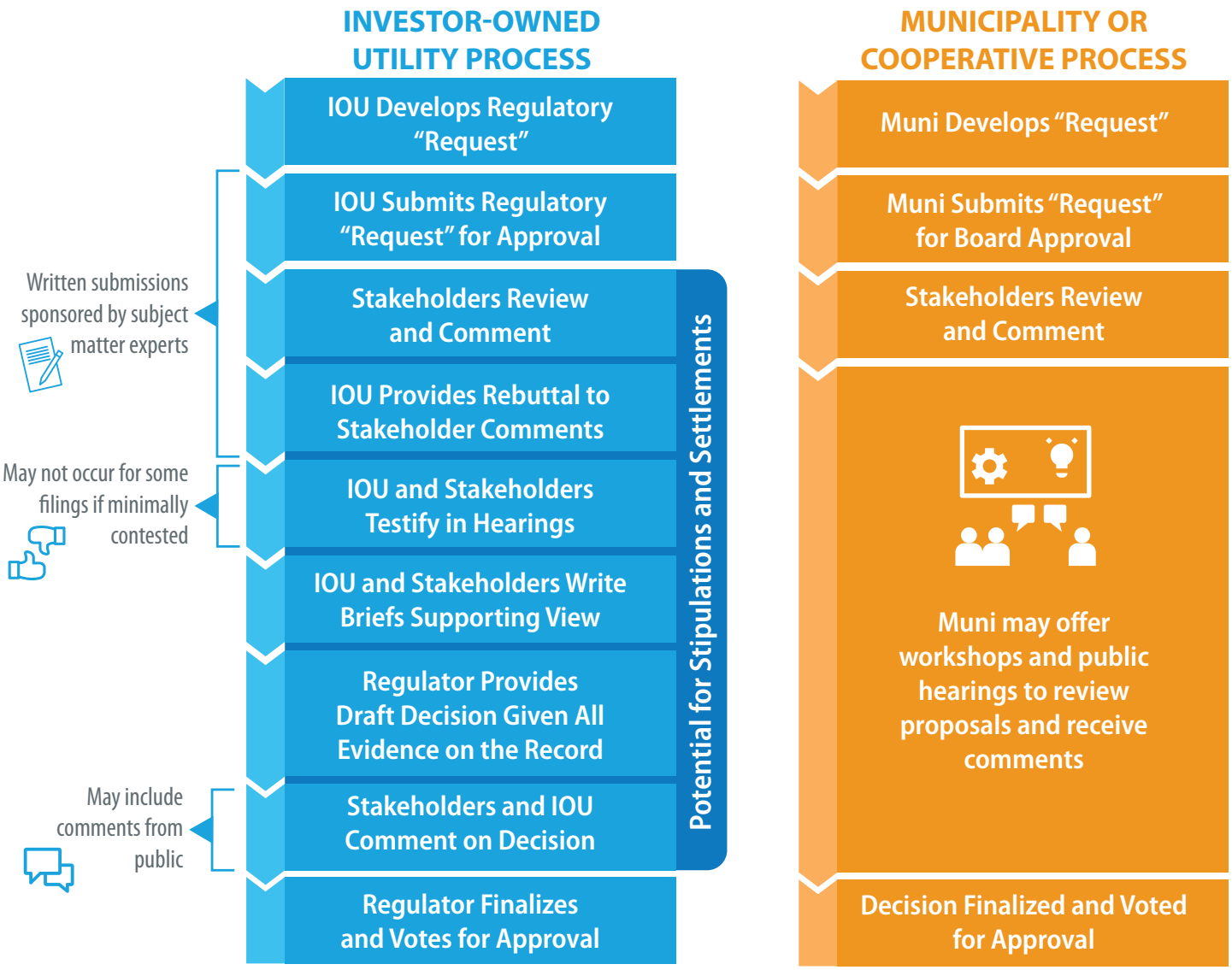


Figure 1. Structure and processes of utilities

The PUC establishes a set percentage by which the IOU annual revenues can exceed costs (i.e., a rate of return). The PUC process is often similar to judicial proceedings: written materials are formally submitted, after which interested parties can intervene based on fairness, equity, costs, competitiveness,[2] or other concerns. Interested parties, often referred to as "intervenors", range from industry trade groups such as solar panel installers to large customers and private or public customer advocacy organizations.[3] Some states financially support intervenors, which fosters diversity of opinions and perspectives. When financial support is not available, there is a higher barrier to intervention, making it more likely that only privileged entities with an abundance of resources, time, and money will participate. Also similar to court proceedings, much of what is determined in PUC proceedings establishes precedent and is replicated across the jurisdiction, regardless of whether that territory contains one IOU or five.

In the past 30 years, the electric power industry has evolved to become more competitive, particularly with respect to electricity generation (FERC 2023; Murphy et al. 2021). For instance, CCAs and retail supply programs have played a significant role in increasing competition by providing electric supply alternatives (sometimes at a lower price point), or generating electricity using by renewable resources. CCAs and other less-regulated entities can play an important role in program design and the services offered

2 As the industry has become more deregulated, PUC use market rules to prevent utilies from exercising monopolistic powers with measures that may even include prohibiting the utility from offering some services provided by competitive entities.

3 Public advocacy agencies are funded by state or local agencies.

to disadvantaged communities. CCAs have a significant advantage in developing innovative program designs for their customers because their service areas cover smaller, more localized portions of the population when compared to IOUs. This allows CCAs to interact more closely with their customers and design programs that better able to meet customers' needs and advance local government commitments to renewable energy procurement, decarbonization, energy equity, and utility affordability (Trumbull, Gattaiecca, and DeShazo 2020). State policy regulating CCAs, contributes to differences between states with regulated utility markets and those with deregulated markets, where one entity does not control all aspects of electricity generation, transmission, and distribution (Gultom 2019). The status of CCA programs across the United States can be viewed in **Figure 2**.

Over time, more states in the US have legalized broader participation in electricity generation and distribution, increasing customer choice.

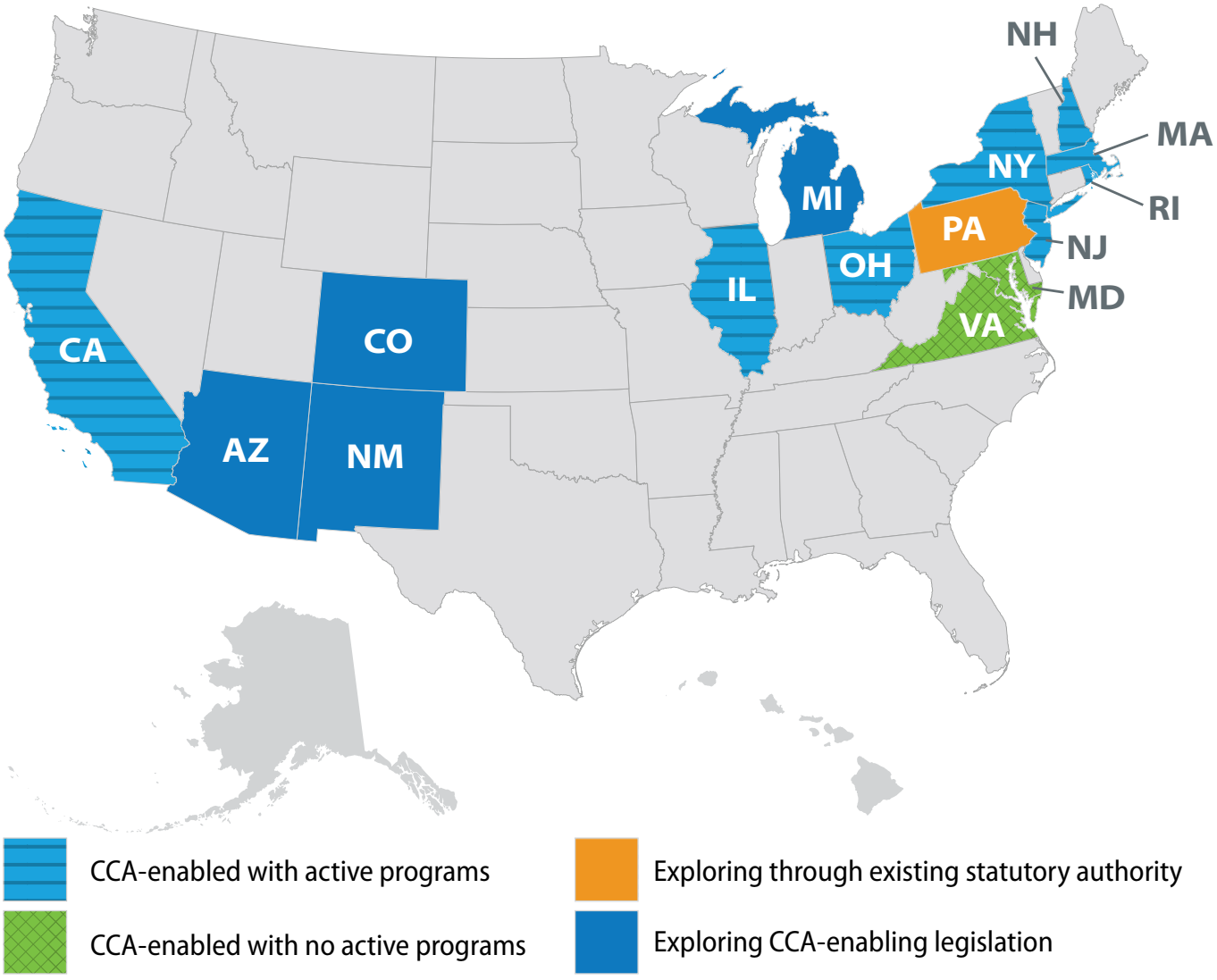


Figure 2. Status of CCA programs in United States as of June 2023
Source: Depit 2023

Cost Recovery and Cost-of-Service Studies

Cost recovery is central to utility rate and program design, because utilities must recover investments in improvments to energy services and customer service. Utilities primarily leverage revenue from customers at different rates to recover operations, maintenance, and capital investment cost. Utilities design and implement rates depending on the cost of generation, distribution, and service.

A utility often develops a detailed understanding of its expense through a cost-of-service (COS) study that informs rate and program design. COS studies help ensure that customer rates reflect the amount of money spent by the utility to deliver the energy in addition to a rate of return if the utility is an IOU. COS studies also assess cost shifts needed to make rate structures equitable. Rates may be based on the total or average of a customer class (e.g., residential) but fail to account for the heterogeneity of customers within a specific class. Sometimes, this rate disparity can be due to participation in specific utility programs (such as net metering) or diverse energy usages within a specific class.

COS studies which are regularly conducted to course-correct for unintended consequences of rate designs and help ensure regulatory compliance, vary depending on the size of the utility, changes in demand, and other factors. COS studies are typically conducted every 3–4 years as part of regulatory proceedings and often result in a major rate change (Costello 2014; RedClay 2018).

COS studies are central to a utility's operations and serve many functions. They aid in unbundling costs so that utilities can charge separately for specific services. From our interviews, we found that utilities develop a means for allocating costs among customer classes in accordance with each class's contribution to the cost of service. Understanding avoided costs is critical to the evaluation of program and pricing options for cost-effectiveness. Conducting COS studies provides direction for a utility for investments, rates, and programs.

COS studies can be approached by considering embedded costs of service or marginal costs of service, which are shown in **Figure 3**.

Oregon Cost-of-Service Study

Oregon - Electric utilities can file general rate cases[4] at any time and must perform annual power cost adjustments to reflect changes in wholesale energy costs (Public Utility Commission 2023b)

4 A general rate case is a regulatory proceeding that establishes utility rates and revenue requirements.

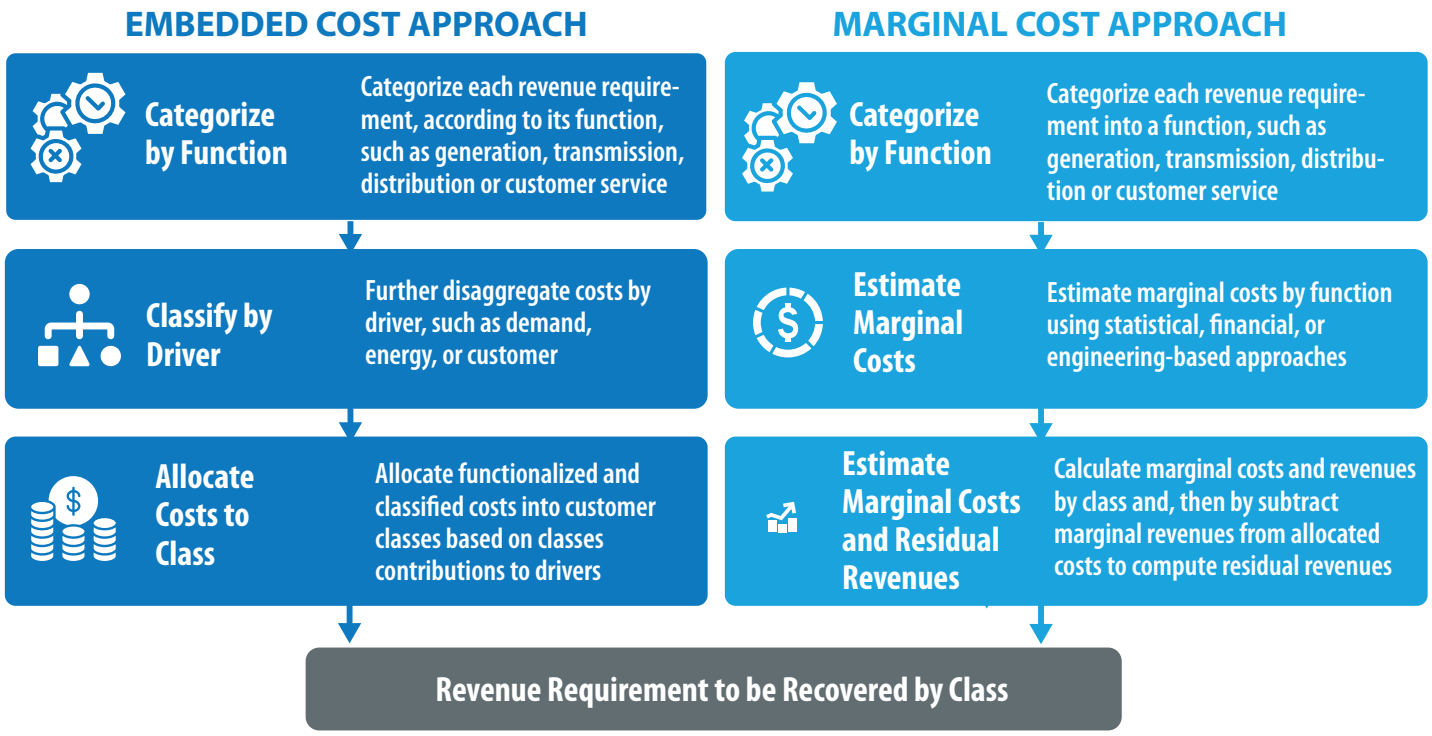


Figure 3. Steps to embedded and marginal cost of service approaches
Source: Kevala, Inc.

Embedded COS studies consider the actual costs for a determined period, such as:

- a test year or previous year, and include the investment costs for a utility asset, minus the accumulated depreciation already claimed;
- a reasonable return on that investment;
- and operations, maintenance, and administration expenses.

Marginal COS focuses on incremental costs from serving additional customers or loads and is based on the investment expected for a utility asset to make in order to meet the incremental load. Marginal COS factors in a reasonable return on investment in addition to operations, maintenance, and administrative expenses.

Program Design

Programs for customers that reduce load through energy efficiency or demand response are critical in the transition to a clean energy future and are capable of (O'Shaughnessy et al. 2022). In Figure 4, we show common stages of utility program design (Energy Star 2023; Energy Efficiency and Renewable Energy 2016). Our research was supplemented by interviews with utility stakeholders as part of the Driving Affordable Decarbonization (Charan et al. 2024).

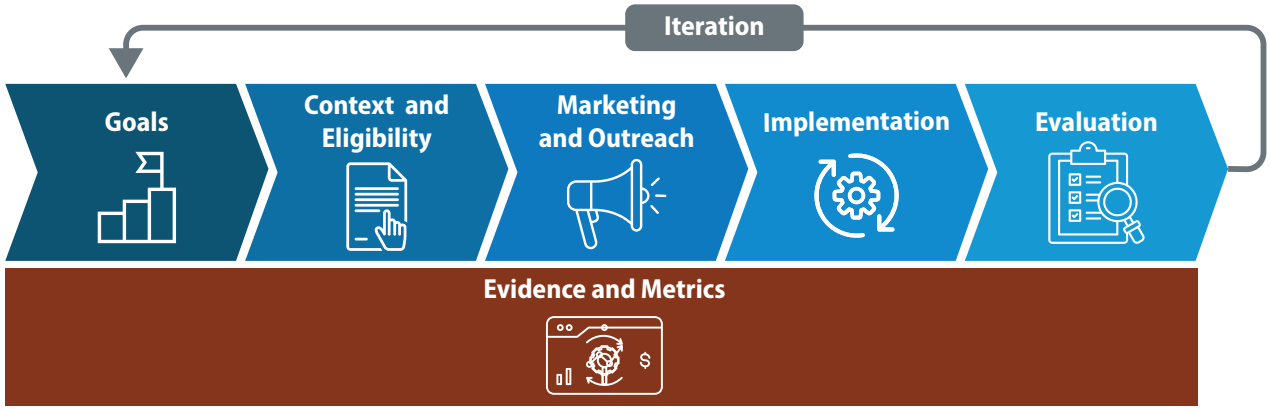


Figure 4. Common phases of utility program design

Critical steps in utility program design include:

- Goals,
- context and eligibility;
- marketing and outreach;
- implementation,
- evaluation,
- and iteration

While Figure 4 presents these as sequential steps, our interviews with utilities indicate that these stages can happen simultaneously across a utility's program portfolio and may even occur in a different order. For instance, pilot programs may be used to test implementation strategies before eligibility and marketing strategies are finalized. Evidence and metrics underlie these processes to ensure feasibility and accountability throughout the process (Molina 2014).

Our research with utility experts found that being clear and explicit with goals can help to create clarity in direction and program implementation decision-making.

Goals

Utilities develop program goals in partnership with stakeholders. Increasingly, program goals include decarbonization objectives to ensure a transition to clean energy and to meet stakeholder needs (Banks 2022). From our interviews, we found that utility program managers often gather information about customer needs and determine eligibility to ensure that the benefits are directed and in line with program goals. This process determines social, financial, and material incentives. There are many motivations for setting these goals, such as public opinion, regulatory requirements, legislative interests, technology requirements, or increased electricity demand (More detail on motivations behind goals can be found in the **Motivation for Utility Programs** section).

Goals can determine utilities' rebate and incentive designs. On one hand, utilities may seek to maximize impact by deeply decarbonizing a few customers' energy use. On the other hand, utilities may seek to maximize the number of customers positively impacted through easy-to-implement programs, such as incentivizing use of LED lighting in commercial buildings. Our research with utility experts found that clear and explicit with goals can improve understanding of direction and program implementation decision-making. For a utility program administrator at an IOU, goals are often established by regulators.

Context and Eligibility

Utility programs incentivize customers to invest in energy conservation and management solutions. Utilities often design these programs with assumptions about what a "typical" customer[5] might need or want, overlooking the needs of other customers. From our interviews, we found that customers usually self-elect to participate or enroll, and the utility provides financial assistance—through rebates or financing options—in lowering the cost of new, more energy-efficient and/or decarbonizing technologies. Focusing on a specific customer class provides more opportunities for targeted incentives, marketing, and implementation strategies to ensure effective programs (Energy Efficiency and Renewable Energy 2016).

In our interviews, utility program stakeholders shared that eligibility was often determined by what quantifiable criteria. Income, location, fuel type, energy use, and physical space for equipment installation are all characteristics commonly used to target specific customer segments. For customers, this can result in high administrative burdens due to long, specialized processes for verifying income, delaying program enrollment and accrual of benefits (Herd and Moynihan 2019). As such, some utility program stakeholders noted that they use multiple methods to verify eligibility rather than one method to reduce burdens. Other utility program stakeholders shared that they guide customers through the verification process to streamline application completion and delivery of benefits. Utility program stakeholders also shared that they used benefit cost analysis to determine financial incentives.

Utilities operate within diverse community needs and priorities that can promote or hinder their ability to design and implement certain programs. From our interviews, we found that utilities and their partners shared a need to understand their customers to ensure programs are appropriate for the communities. As contexts have shifted in the last decade, most notably in the area of renewable energy generation economic viability, utilities have adapted their programs to provide more comprehensive and diverse offerings. Utilities typically design programs as one-time incentives that reduce customers' barriers in transitioning to decarbonizing technologies that improve buildings or

5 "Typical" customer is defined as a hypothetical customer with patterns that mirror the average load behavior of the customer class and who access information via billing inserts and the internet.

services. These incentives can draw participant interest in new or existing programs that align with the utilities' goals. For example, energy efficiency programs may help utilities reduce capacity demands through weatherization and efficient technologies such as advanced heating and cooling technologies (Molina 2014).

Marketing and Outreach

Marketing provides a critical step to share information about eligibility and encourage enrollment. Utilities market their programs through various formats, such as utility websites, bill inserts, direct mailings, and customer service representatives interactions. We found that these marketing approaches are typically determined during regulatory proceedings to approve the program, but often come with major limitations in how they reach disadvantaged community customers. Programs biased toward the "typical" customer can embed assumptions about access to information and resources (i.e., access to a computer to complete enrollment and availability of financing).

When disadvantaged communities are not prioritized in utility program outreach, disadvantaged customers may remain unaware of beneficial programs or lack the time or resources to enroll. To systematize inclusion, a few utility stakeholders collaborate with trusted local organizations connected to the community, such as local housing authorities or other non-profits. Some utilities hire representatives from different customer demographic groups to help design programs and provide ongoing feedback on the programs' success and impact, enabling utilities to increase utilities' focus on these diverse customer needs to these different demographics and adjust the program as needed on an ongoing basis to meet customer needs.

To systematize inclusion, a few utility stakeholders collaborate with trusted local organizations that are connected to the community, such as local housing authorities or other non-profits.

Implementation

Programs are often managed by a program implementer and a network of trained contractors. While a program might be well-defined from the outset, several decisions remain as customers enroll in programs. Key implementation considerations shared by utility program stakeholders include:

- ensuring fair contracting and bidding practices,
- engaging and developing the workforce,
- assessing the quality of contracted projects,
- providing financing options,
- and clauses for liability and technology quality.

From the interviews, we found that utilities may keep implementation within operations or decide to contract out entire programs, depending on each utility's experience with program implementation, regulatory requirements, and access to highly skilled implementation contractors.

Evaluation

After successful implementation of programs, the utility monitors and evaluates the success of the programs. The metrics and evidence (e.g., customer satisfaction) help to inform any need for course corrections to the program over time. Most PUCs have adopted standard approaches to analyzing customer programs. California was one of the first states to develop and require use of a standard evaluation process for customer program cost-effectiveness (outlined in the California Standard Practice Manual) that includes a series of defined tests for assessing the benefits and costs of a customer program from several perspectives (California Public Utilities Commission 2021). DOE's Better Buildings Energy Efficiency Cost Effectiveness Tool 2.0 uses the tests outlined in the California Standard Practice Manual (Energy and Environmental Economics and Lawrence Berkeley National Laboratory 2017). Many other states have either adopted California's Standard Practice Manual outright or similarly structured processes and tests such as Illinois' establishment of standards outlined in its Total Resource Cost Test (Illinois Energy Efficiency Stakeholder Advisory Group 2022). **Table 1** shows the four standard tests included in California's Standard Practice Manual.

Table 1. Benefit-cost tests as outlined in the California Standard Practice Manual

Sources: California Public Utilities Commission, Kevala, Inc.

PARTICIPANT COST TEST (PCT)	UTILITY COST TEST (UCT)	RATE IMPACT MEASURE (RIM)	TOTAL RESOURCE COST (TRC)
The PCT measures the quantifiable benefits and costs to the customer due to participation in a program. • **Benefits** include utility bill reductions, incentives, and any reduction in a customer's other costs. • **Costs** include all out-of-pocket expenses incurred plus utility bill increases, equipment or material costs, and ongoing operation and maintenance costs.	The UCT measures the net costs of a demand-side-management program as a resource option based on the costs incurred by the utility (factoring in incentive costs) and including any net costs incurred by the participant. • **Benefits** include the avoided supply costs. • **Costs** include expenses related to programs and incentives paid by the utility and the increased supply costs for periods in which load is increased. Revenue shifts, which are viewed as transfer payment are excluded from costs.	The RIM measures the impact on customer bills due to changes in utility revenues and program operating costs. • **Benefits** include savings from avoided supply costs and any increased revenue from participants. • **Costs** include program costs incurred by the utility, incentives paid by the utility, decreased revenues due to decrease in load, and increased supply costs due to increase in load.	The TRC measures the net costs of a program as a resource option based on the total costs of the program and represents the combined effects of a program on both the customers participating and those not participating in a program. • **Benefits** include avoided supply costs and reduction in other costs. • **Costs** include program costs such as equipment purchase, installation, operation, and maintenance; administrative costs; plus the increase in supply costs for the periods minus any tax credits—regardless of who pays.

Some utility stakeholders use third-party evaluators to conduct a review of utility programs to promote independence and transparency.

Iteration

Program design requires iteration, so that utility program implementers can identify and remove potential barriers to program participation (Energy Star 2023; Energy Efficiency and Renewable Energy 2016). One utility program administrator recalled how the utility conducted pilot programs and used data to iterate on outreach approaches and enrollment strategies.

Across all stakeholders, feedback was expressed as a keystone of successful and responsive utility program design. Interviewees emphasized the role of customers in driving iteration with utility programs by leveraging multiple sources of engagement including: a customer advisory council, biannual customer town halls, annual surveys, and customer complaints line. One utility program administrator communicated the need for more feedback mechanisms within their processes. Gathering feedback from both internal and external sources when developing programs shifted one organization's mindset when developing and iterating on programs. Another utility program stakeholder identified a need to balance between gathering feedback and promptly delivering program benefits to customers.

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Evidence and Metrics

Based on our thematic synthesis, the evidence metrics utilities use vary greatly, as detailed above in the **Evaluation** section. Utilities often gather program and administrative cost information for regulatory purposes. Enrollment and impacts to utility bills are popular metrics among stakeholders. Benchmarking program practices, such as tech-

nology costs and contractor installation time, is part of the best practices for energy-efficient utility programs (Energy Efficiency and Renewable Energy 2016).

Across our interviews, it was seen as easier to measure programs' impacts on individual customers than on communities. While some utilities are able to calculate energy savings as part of the utility program, others are unable to do so because of limited resources. Similarly, gathering data on demographics, such as disadvantaged community status, has not been uniformly adopted and varies widely among stakeholders. Some utility stakeholders use surveys to assess customers' satisfaction and their willingness to pay for decarbonization programs. These findings align with other reviews that find a lack of metrics across non-federally-funded policies and programs (Sandoval et al. 2023).

Program stakeholders also keep informal and formal records on the workforce quality and availability. One utility keeps track of the number of electricians who received training from a workforce development center. In contrast, another utility states that its workforce is nonexistent, an opinion based on experience in a previously administered utility program.

Rate Design

Customer rates are structured regulator-approved prices for utility services. Often, regulator-approved tariffs are strictly enforced by the utility. As with utility programs, prices outlined in tariffs are accompanied by detailed terms and conditions for payment and eligibility. Each customer class has a designated default pricing tariff, which means that when customers sign up for service and meet a certain income criteria, they are automatically put on that pricing tariff. A range of pricing options are offered to all customers in a customer class, although specialty rate eligibility is limited to certain types of customers (such as discounted rates for low-income customers) are limited. Specialty rates are even illegal in many states because of antiquated views of utility customer classes. Legacy policies created to prevent discrimination among customers do not always support customers of all demographics—particularly disadvantaged customers. From our interviews and review, we found that in many cases, these tariffs are imposed on the entire customer base, regardless of their participation in the utility program.

Multiple pricing options may be offered to specific customer classes, leaving other customers with only one choice. Customers may find various pricing options only apply to specific technology investments (such as electric vehicles), or that incentivizes for changes in energy use require taking advantage of rate structures such as time-of-use utility rates. These programs and pricing options are usually marketed through bill inserts or a utility's website, which could limit participation for customers without easy access to the internet or motivation to look at the inserts.

Utilities often offer assistance programs for customers who are struggling to pay their utility bills, or looking for more even and predictable utility bills. These programs, such as the Low-Income Home Energy Assistance Program (LIHEAP), help ensure that energy needs can be met for customers who face financial difficulties or have fallen behind on bill payments. It also appears that some utilities are able to provide greater benefits to the entire customer base, including disadvantaged communities, through better access to programs, differential customer rates, and removing barriers to enrollment.

Motivation for Utility Programs

Modifying and developing new program provide key mechanisms for utilities to deploy innovative strategies. Programs can incentivize technologies that reduce grid stress, extend transformer life, and increase reliability, such as photovoltaic systems (Kannan and Vakeesan 2016). These programs help to modulate the capacity changes driven by increasing electricity demands, whether from growth in the number of customers or increased electrification. Utilities are also motivated to deploy innovative programs to address the needs of ratepayers and be responsive to public opinions. In addition, regulation of utilities can often include requirements for specific program provisions.

Table 2. Examples of Motivation for Programs

Capacity	Technology	Public Opinion	Regulation
• Greater electric vehicle adoption increasing demand • Photovoltaics shifting demand	• Energy-efficienct technology decreasing demand • Batteries allowing demand flexibility	• Protests and media coverage from rate changes • Calls from ratepayers on programs	• Public utility commissions • Boards of directors • Local governments

Capacity

As electrification increases, utilities must determine how they will meet increasing demand. Energy-efficient and decarbonizing technologies have become widely available for customers. In the United States, electric car sales have broken records, with sales momentum expected to continue for the next five years (Statista 2023; IEA 2023). Photovoltaic technologies accounted for 54% of all new electricity-generating capacity installed in 2023 (SEIA 2023). In short, demand and generation of electricity is quickly changing. During interviews, one CCA utility stakeholder expressed that its organization faced barriers to delivering electricity on time because of increased electric vehicle charging demand.

As adoption of decarbonizing technologies increases, the demand on the electric grid has fundamentally shifted, requiring utilities to consider alternative strategies to deliver reliable and affordable electricity (Banks 2022). A few interviewees felt behind on investments in utility generation and distribution systems, describing themselves as trying to catch up with current demand and unable to prepare for future demand growth. Currently, there are too many fossil-fuel power plants to meet climate goals (Leahy 2019). Utilities that need to generate additional capacity, must consider how they will add renewable generation to their portfolios and pay for additional capacity.

Utilities that need to generate additional capacity, must consider how they will add renewable generation to their portfolios and pay for additional capacity.

Technology

Across all stakeholder interviews, electric vehicles and photovoltaics were commonly brought up as technologies that are changing energy demand and generation needs. Some stakeholders shared how these technologies provide motivation for new programs, such as incentivizing batteries to store surplus energy from photovoltaics or installing electric vehicle charging stations. In addition, energy efficiency programs can be designed to increase the resilience of customers' buildings. Utilities have recognized the shifting landscape of technology adoption and demand and have leveraged innovative programs to meet existing needs while delivering benefits.

Public Opinion

Requests from the public can be strong motivators for utilities to modify existing programs or develop new ones. As previously mentioned, a few interviewees shared that feedback from customers, through calls, member advisory committees, public comment, or other modes, can influence new or existing program designs. Public requests often come from customers who are knowledgeable about current or potential utility programs and who are willing and able to contact their utilities regarding these matters.

Public oversight, such as customer advisory boards, can also motivate utilities to decarbonize. City, state, and federal policies are both calling for and regulating to ensure that utilities address climate change, equity, and energy justice.

Regulation

Utilities are subject to different types of regulation (typically administered at the state level) depending on their structures, state level. IOUs and municipal utilities are often regulated with rules and legislation. In an interview with an IOU program designer, they shared how they receive their energy savings goals from the PUC. One program administrator shared how most of its IOU's programs were the result of regulation. This regulation includes a specified amount of revenue the utility can collect, which also limits how much profit the utility can generate if it is an IOU.

CCAs and the remaining utility types are subject to much more lenient regulation. Typically, the state's renewable portfolio standard and local administrative requirements must be met to establish and maintain a new CCA or other utility structure. CCAs and other non-IOU utility structures are not-for-profit entities, so the net revenue they collect can be reinvested back into the communities they serve (Trumbull, Gattaciecca, and DeShazo 2020). Furthermore, because CCAs and other utility structures have rate-setting abilities, they can raise or lower rates to increase or decrease their revenues (while keeping pricing competitiveness in mind).

Jordan Macknick, Energy and Environmental Analyst at NREL, takes a temperature reading and water samples from the Platte River, upstream of the Excel Zuni Power Plant in Denver, Colorado.
Photo by Dennis Schroeder, NREL 33324

FEDERAL AND LOCAL POLICY IMPACT ON UTILITIES

Photo by William Gillies, NREL 86104

The changing incentives and policy landscape at the federal and local levels can have an impact on customers and utilities, alike. It is also possible for a utility to be enlisted by law to aid in or fully carry out policy objectives. Utilities can be influenced by federal goals or initiatives, such as the Justice40 Initiative and the Inflation Reduction Act (IRA). Finally, the funding of various laws through the tax base (e.g., electric vehicle rebates) may motivate utilities to create programs that bolster existing incentives.

State and federal entities are motivating utilities to decarbonize. Numerous states have allocated funds for clean energy and climate programs. President Biden signed the Inflation Reduction Act of 2022 (IRA), which legislated $369 billion in funding for clean energy and climate programs.

State Clean Energy and Climate Program Examples

Illinois - Climate and Equitable Jobs Act: Sets hard deadlines for decarbonization and establishes utility accountability measures.

New York - Climate Leadership and Protection Act: Sets goal of 100% clean, carbon-free electricity by 2040.

California - Senate Bill 100: Requires that renewable energy and zero-carbon resources supply 100% of electricity retail sales to end-use customers by 2045.

Maine - Maine Won't Wait: Aims to reduce carbon emissions by switching from fossil fuels to electricity.

Michigan - Senate Bill 271: Specifies energy reforms designed to push utilities toward renewable energy.

The portion of the funds provided to utilities through the IRA is intended to help utilities meet or exceed their decarbonization goals. Some predictions estimate the IRA could lower U.S. net greenhouse gas emissions by 40%-42% below 2005 levels by 2030 (Mammadov and Lee 2022). This reduction is expected to be accomplished by accelerating energy transitions through incentives for renewable energy project development and decarbonization technologies.

Section 13701 of the IRA sets the Clean Electricity Production Tax Credit, which is available to corporate entities or energy companies, at 0.3 cents per kilowatt hour of electricity (The White House 2023a). Any entity building new electric generation with zero greenhouse gas emissions, such as renewable energy facilities, is eligible to receive this tax credit. IOUs, muni, CCAs, energy service providers, and all other electricity generators are expected to be eligible to use this tax credit to accelerate the development of new renewable energy facilities. This benefit may encourage utilities to meet or exceed their decarbonization goals. Entities that purchase electric generation from other suppliers, such as most co-ops, are not eligible for this tax credit.

The IRA also includes funding for transmission upgrades. Utilities that own and operate transmission lines may be eligible for direct loans or grants to modify or construct transmission facilities and to plan interstate, interregional, and offshore transmission lines.

Inflation Reduction Act of 2022

$369 billion in funding for clean energy and climate programs.

Predictions show IRA could **lower U.S. net greenhouse gas emissions 40%–42% below 2005 levels by 2030**.

Section 22004 of the IRA provides loans and grants to rural electric cooperatives (The White House 2023a). These funds are available to rural electric cooperatives that achieve greenhouse gas emissions reductions through energy efficiency improvements to electricity generation, transmission, and distribution. These funds are specifically aimed at helping rural co-ops meet decarbonization goals and better serve their communities.

While the IRA brings many benefits to utilities, it also imposes a minimum corporate tax of 15% on IOUs with profits greater than $1 billion in profits. While this minimum tax is a significant increase over the previous rate, benefits of renewable energy generation tax credits are expected to outweigh the negative effects of tax increases (Pomerantz 2022).

In addition, some cities set their own decarbonization goals. While IOUs may be less affected by cities' goals, municipal and co-op utilities may be responsible for helping meet those goals.

Another method of decarbonization targets the supply of electricity (Arent et al. 2022). However, as we move further toward competitive electric generation market served by multiple parties at various price points, it is becoming more difficult for IOUs, because they are not the entities generating electricity, to implement decarbonization policy as regulators expect. CCAs and other less-regulated utilities that generate supply have more control over how electricity is generated and can account for decarbonization incentives more directly. However, because CCAs and other providers are less regulated than IOUs, the impact of policy in driving decarbonization is less clear.

Utility-scale solar photovoltaic plant on capped landfill in Worcester, MA.
Photo by Teresa Wheeler, NREL 881278

HURDLES IN UTILITY PROGRAMS

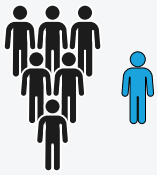
Photo by Dennis Schroeder, NREL 60439

From our research and synthesis, we identified limitations of the current processes for designing and implementing utility programs and rates.

Limitations of Status Quo

Top-down regulation and guidance that neglect to factor in the full range of customer demographics

Limited pricing options for customer classes



Program bias toward "typical" customers can exclude many customer demographics

Ineffective program marketing

Limited evidence and metrics

Top-Down Regulation

Utility rate and program design are currently driven by a top-down approach focused on broad program offerings with distorted long-term incentives for customers who self-select into programs based primarily on participants' financial benefits. The distortion is generally caused by incentives such as net metering that embedded in rates and tough for customers to recognize, or through incentives such as investment tax credits or rebates that reduce upfront costs sunset at specific dates, and create increase the cost of ownership.

Limited Pricing Options Within Customer Classes

Utilities generally offer a limited number of rates to a customer class based on the class's maximum or average consumption, demand, or use of a specific technology (photovoltaics, electric vehicles, etc.). These rates do not consider how or when a customer consumes energy apart from a time-of-use-based rate, or customer demographics beyond customer class (residential, commercial, industrial, etc.). This leaves a rate designed to meet the general needs of each customer class with limited exceptions and imprecisely targeted impacts.

Program Bias Toward "Typical" Customers

Traditional rate and program designs are based on an antiquated view of utility customers. Utilities and their regulators view customers the way they did more than 100 years ago, classifying customers by building type (e.g., residential or commercial and industrial) and size (e.g., small, medium, and large). Programs are inherently designed for "typical" customers in each class, which dismisses any outliers.

Right now, the average low-income household experiences an energy burden—the percent of household income spent on energy costs—as much as three times higher than households in higher income brackets. Because the amount of benefit increases according to the size of the customer's tax bill, this tax credit model also perpetuates inequitable access to incentives.

Further, many of the opportunities to decarbonize (such as purchasing electric vehicles, installing rooftop solar, or adopting more efficient heat pump systems) are limited to customers who have the capital and access needed to acquire these technologies. Lastly, many incentive mech-

anisms, such as investment tax credits, favor those with higher incomes (Slanger and Mendell 2021). President Biden has made bringing clean energy benefits to marginalized and low-income communities a priority. Right now, the average low-income household experiences an energy burden—the percent of household income spent on energy costs—as much as three times higher than households in higher income brackets. Because the amount of benefit increases according to the size of the customer's tax bill, this tax credit model also perpetuates inequitable access to incentives.

Program Marketing

Program marketing can increase enrollment in utility programs, but current approaches can be limited. These marketing strategies may be exclusive to certain customer groups and may not be fully engaging. Utilities often use existing communication channels, such as email notifications, web portals, or mailed utility bills, to inform customers of new programs. However, this marketing often assumes that customers have the time and knowledge to research a program and determine if it is right for them. This is not always the case, and improved marketing can enhance customer enrollment in these programs.

Limited Evidence and Metrics

There is no established standard for tracking the success of a program. Utilities track program metrics in a variety of ways, often even within a single utility, based on methods determined by the program designers. This variation makes it hard to compare one program's success to that of another program.

Specifically, a widening wealth gap between customers has meant that wealthier customers are able to reduce and even "zero out" their energy bills with investments in technologies and by taking advantage of targeted financial offerings.

We argue that these shortcomings result in strain on energy justice—equal access to affordable, clean, and reliable electricity—and hinder the ability of low-income customers to better manage energy bills. Specifically, a widening economic gap between customers has meant that wealthier customers are able to reduce and even "zero out" their energy bills with investments in technologies and by taking advantage of targeted financial offerings.

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NREL/TP-5500-90456 • August 2024

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