Propelling Equitable Decarbonization through Utility Programs and Rate Design

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ABSTRACT

Several states and cities across the U.S. have set aggressive decarbonization goals to mitigate climate change. Utilities play a crucial role in achieving these targets by designing programs and rates to positively impact consumer energy use patterns and adoption of clean technologies. However, low-income, and disadvantaged utility customers have historically faced unequal access to the benefits of these types of utility offerings. As utilities strive to achieve regulatory mandates to decarbonize and support electrification in buildings and transportation, there is a significant opportunity for utilities to deliver more equitable programming that alleviates energy burden and also improves energy security. This paper highlights what is possible in today's landscape of utility programs and rate design. The authors combined literature review and 17 semi-structured interviews of utility stakeholders to identify successful program characteristics that can help drive the transition to equitable decarbonization. Recommendations are suggested to tackle key challenges in designing equitable and affordable programs. These recommendations address (1) customer needs identification, (2) bottom-up program design and evaluation, (3) program funding and outreach. In addition, the authors present leading-edge recommendations, such as the Modern Rate Architecture (M.R.A.) framework and higher resolution of customer class segmentation, that could further accelerate access to more equitable, affordable, and beneficial utility programs and rates for all.

Introduction

The international Paris Agreement limits global warming potential to 1.5 ℃ for all its member nations which includes the United States (UNFCC, n.d.). This would require a significant reduction in Greenhouse Gas (GHG) emissions through decarbonization efforts across all sectors. In light of this, the U.S. has set a goal to reduce GHG emissions by 50-52% below 2005 levels in 2030 (The White House, 2021, "President Biden's Actions on Climate"). This goal is being realized through policies, acts and laws set at the national, state, and local levels. An example of this at the federal level is the Inflation Reduction Act (The White House, 2022) which provides more than $300 billion in funding for clean energy and climate programs. Several states have enacted laws as well, such as New York's Climate Leadership and Community Protection Act (CLCPA) to reduce economy-wide greenhouse gas emissions to 40%

below 1990 levels by 2030 (New York State Senate, 2019). In California, Senate Bill 350 aims to increase the renewable portfolio standards (RPS) and energy efficiency in buildings by 50% in 2030 (California Energy Commission (n.d.)); in Michigan, Senate Bill 271 targets to achieve 100% clean energy standard by 2040 (Office of Governor Gretchen Whitmer, 2023), among several other states.

Decarbonization at this scale requires core transformation in deployed energy technologies and sources as well as planning, operation, and management of these since incremental changes to existing systems will not suffice. In the building sector it requires switching from fossil fuel powered appliances and equipment to more efficient electric powered technologies such as induction stoves and heat pumps for heating/cooling spaces and providing domestic hot water. In the transportation sector it means switching over to electric vehicles and the addition of charging infrastructure. The electricity consumed by these technologies can then be powered by cleaner renewable energy sources. To manage the additional electricity load, demand side management strategies such as building energy efficiency, peak shaving and load shifting, demand response may need to be deployed. Electric utility companies are critical in bringing this transformation about and fulfilling policy objectives by incentivizing customers to adopt new technologies and to modify behavior. They can help achieve increased building energy efficiency, electrification, demand flexibility and resilience. However, the traditional utility model has undergone little change over the last few decades and needs to adapt to these changes while continuing to provide reliable, affordable, and sustainable energy.

As we build towards this clean energy future, it is crucial we do so equitably, making equity and affordability central to our mission and not an afterthought. Members of disadvantaged communities have historically had less access to energy efficient technologies (ACEEE, 2021). The U.S. federal government describes disadvantaged communities as those that have been "historically marginalized and overburdened by pollution and disinvestment in housing, transportation, water and wastewater infrastructure, and healthcare" (Executive Office of the President, 2021). Members of these communities face energy burden, spending a large proportion of their income on energy bills (U.S. Department of Energy, n.d.). In a lot of cases, due to inefficient and ageing infrastructure and geographical factors such as urban heat island affect, they are disproportionately affected by adverse environmental impacts such as extreme weather events and pollution (U.S. Department of Energy, nd1). During outage events, they are also more vulnerable and at a higher health risk due to a lack of necessary resources (Dugan, J. et al., 2022). Access to clean energy technologies will provide safe, reliable and affordable power to these communities, reducing historical inequities. Disadvantaged communities represent a significant portion of the utility customer base; if not included in the modernization of demand-side energy technology, this will put limits on the utility's ability to maintain reliable and stable grid operations.

Overcoming these challenges and achieving these objectives requires us to draw out current successes, but also to innovate to be prepared for challenges that are yet to come. This paper synthesizes program characteristics and best practices based on 17 utility stakeholder interviews as they relate to the design and implementation of utility programs to achieve ambitious and equitable decarbonization goals. The study focuses on utility programs that are

already tailored to disadvantaged communities. The next section of the paper describes the methodology adopted for the study.

Methodology

This study focused on gathering data and glean insights into the current state of utilities and their best practices with regards to program design and implementation to support equitable decarbonization, and drawing out future innovations that can propel utilities to overcome future challenges. This was done by studying existing programs focused on equitable decarbonization, selecting a sample of programs and utilities to interview, performing semi-structured interviews with the utility stakeholders, uncovering existing best practices and finally identifying future innovation opportunities. More details of the study are provided in (NREL, 2024 a; NREL 2024 b).

First, a review of current policies, targets and laws set around decarbonization, particularly with an emphasis on equity at the national and state level in the U.S. was done. National policies and laws were identified and reviewed for relevant content, such as the Justice40 initiative that ensures that 40% of the overall benefits of federal investments in climate and clean energy projects, including building decarbonization, flow to disadvantaged communities (The White House, 2021, Justice40 Initiative). States with their own policies and targets were identified and documented. (RMI, 2022) lays out decarbonization goals, level of activity and anticipated impact as well as equity goals, level of activity and anticipated impact across the U.S. States. In some instances, national level objectives are further reinforced by state governments through their own targets. This nested policy structure is significant in that policy driven goals are often a key motivator in the design of utility programs. (ACEEE, 20222) provides a breakdown of building electrification programs across U.S. states. Most programs are found in states with ambitious climate targets, such as California and New York. States with decarbonization goals that include equity content were shortlisted and used as the starting point to identify utilities and programs that focus either entire programs or part of a program for underserved communities. Publicly available information on the program websites was studied, such as the program eligibility criteria, disadvantaged communities definitions, details of services or technology offered by the program etc.. 40+ utility programs were identified and classified based on program type, utility type and U.S. state. Out of these, 17 utility programs selected were based on having diversity in the ownership and business models (Investor-Owned-Utilities (IOUs), municipalities, cooperatives, and Community Choice Aggregators (CCAs)), variation in program offered such as services, rebates, incentives and whether these applied to technologies or behavior modification. They were also selected to have diversity in geographic regions and legislative landscapes. Lastly, they were also shortlisted based on having our team having a prior point of contact or active engagement on reaching out to the listed point of contact on their website. The distribution of utility stakeholders interviewed is shown in Figure 1. Other utility organizations such as customer advocacy groups and non-profits were also interviewed to get varied perspectives and insights. A summary of the programs selected is shown in figure 2.

Figure 1. Utility Stakeholders Interviewed

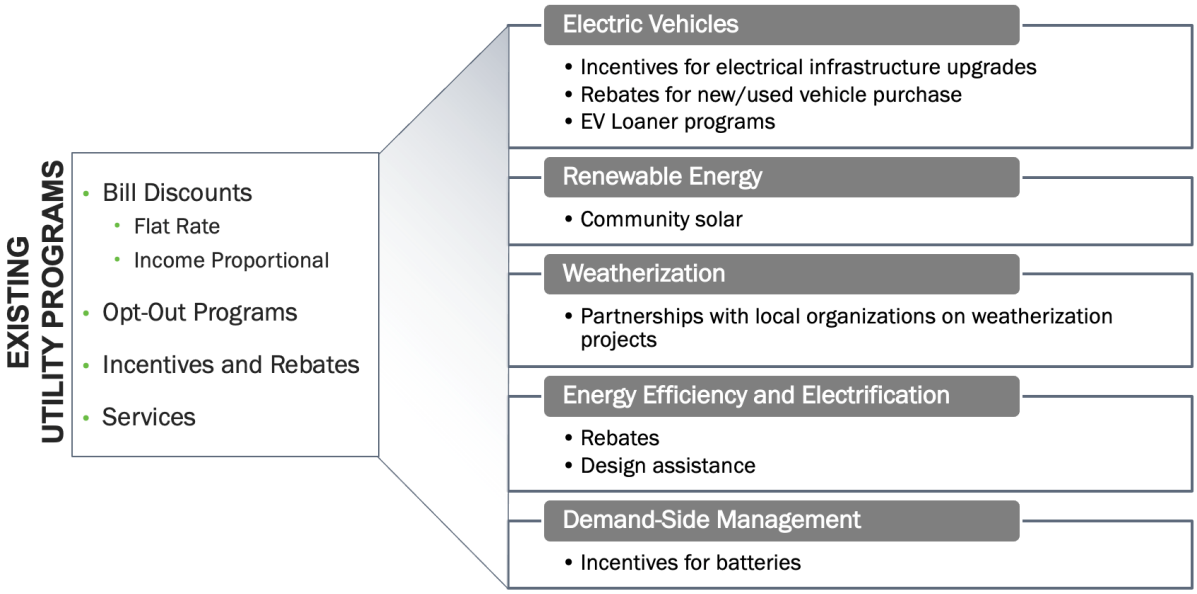

Figure 2. Existing utility program types tailored to energy efficiency, renewable energy, electrification, decarbonization, and for underserved communities.

For the shortlisted utility programs, we identified points of contact to reach out and set up hour-long virtual interviews. The objective of the interviews was to explore the utility's experience and identify common themes and best practices as they relate with utility program design and implementation for equitable decarbonization. These interviews with the selected utility stakeholders are not aimed to present an exhaustive analysis for all best practices of current utilities in the United States but rather a sample that presents sufficient diversity while also allowing us to do a deep dive through 1-hour long interviews. These best practices also do not represent a prescriptive path but provide a knowledge bank that could further equity across customers compared to conventional approaches. We adopted a semi-structured interview approach and prepared a list of broad questions that would best aid our research. We

purposefully created broad questions that were open ended and meant to guide the discussion, and adopted a listening approach to let the utility stakeholders share as much relevant information as they could, and to also allow room for topics we did not anticipate.

The questions were prepared collaboratively between the NREL, Kevala and CU Boulder team and were based on understanding several aspects of utility activities such program design and motivation, implementation and outreach activities, stakeholders, and performance metrics. We modified these questions for the Customer Advocacy group and non-profit organization. The list of questions for utility interviews is provided in the Appendix. Kevala is a leading data and analytics consultant, and the Kevala team has deep knowledge and expertise in working with utilities, regulators and developers towards grid decarbonization and electrification. Through this experience in working with utilities and their extensive knowledge of the current challenges in the industry, they are in a unique position to provide valuable insights to work towards equitable program design. This collaboration between the teams was instrumental in developing holistic solutions, balancing research and innovation, and industry experience and knowledge of current challenges.

During the interview extensive notes were taken which were then organized and mapped across each interview category mentioned above i.e. program motivation, program design, program outreach and enrolment etc.. Each category was further broken down into current practices, success, barriers, and metrics if any. Having this breakdown of information across the classification for all utility interviews enabled us to draw out larger themes and key takeaways. It highlighted current successes and barriers but also laid the foundation for identifying future innovations given the current challenges. These current best practices and future innovations are further described in the next section.

Current Successes and Future Innovations

Current Successes

This section elaborates on current best practices and future innovations that can drive utilities to face the upcoming challenges equitably. These practices are culminated based on the insights garnered from examining various aspects of utility programs through utility stakeholder interviews. The utility program aspects discussed include program design, identifying needs of customers, financing mechanisms, outreach enrollment as well metrics and evaluation of programs. These practices are thematically organized across program elements that are currently being implemented by one or more utilities interviewed as part of the programs they offer for disadvantaged communities. These are identified as practices outside of conventional approaches that could lead to a more equitable outcome for customers. These key takeaways and best practices are summarized and highlighted in Table 1. These can act as a knowledge bank to be shared across programs and utility stakeholders to integrate into their practices and enhanced further. These can be applied holistically to improve the overall program design process or viewed as best practices to improve specific elements of the program.

Table 1 Program Element and Best Practices

Program Element	Best Practices
Identifying Customer Needs	Partner with local community-based organization to identify community needs
Bottom-up Program Design and Evaluation	Timely, focused, and strategic communication channels for the public, and relevant stakeholders.
Funding	Accessible and inclusive financing mechanisms to reduce upfront cost of technology
Outreach	Provide accessible information in multiple languages and partner with local organizations to enroll customers
Program Evaluation	Standardized and diverse metrics for evaluating and comparing programs

Identifying Customer Needs

This relates to the initial stages of program design when utility stakeholders are designing and deliberating the program objectives. It is essential that these objectives capture the needs of the customer base, especially the diverse needs of their customer classes, when the program is meant for the entire customer base at large, or the specific needs of a particular customer class when the program is targeted towards those. This also requires having realistic and accurate customer class segmentation. Furthermore, when designing programs for disadvantaged communities it is essential to identify their unique needs, that may not necessarily correspond to the perceived needs of other customers. For example, these customers may prioritize health, safety and comfort in their buildings that may be best served by weatherization programs and building retrofits (ACEEE, n.d.). Through our interviews, we found that 2 utilities successfully worked with trusted boots-on-the grounds local organizations to identify underserved customer needs and garner feedback on whether a program was actually beneficial to these communities. This proved to be pathway for success as these organizations are very attuned to community challenges and needs through regular engagement and outreach. Having this as a feedback mechanism for utilities can ensure they capture these unique needs. Moreover, utilities can co-design programs with local organizations, ensuring these organizations have an active voice in incorporating needs of underserved communities (E-source, 2022). Other successful cases found in literature are when utility programs are designed by or gather feedback from a working group consisting of individuals from diverse groups, representing different utility stakeholders, or different customer classes with varied interests (ACEEE, 2021). This process makes sure these individual interests are captured and represented in the program design.

Bottom-Up Program Design, and Evaluation

This refers to constant engagement post the program design phase, as the program is getting implemented and evaluated. This can be done through timely, focused, and strategic communication channels for the public, and relevant stakeholders. These could be in the form of town halls, focus groups etc. and making sure these are accessible and inclusive. This can be instrumental in making sure individual voices are being captured, making the process more democratic. An evaluation framework that includes these methods of gathering feedback and is incorporated in improving the program is essential. Through the utility interviews it is found that 10 utilities out of our interviews, that is more than 50% utility stakeholders participated in some form of customer engagement to get feedback in program design and implementation. This was done by working closely with local organizations and getting ground up stakeholder feedback through different stages of the program from implementation to evaluation using active channels such as surveys, phone calls and texts, townhall meetings as well as participation of customer advocacy groups in PUC meetings and hearings. It was also a good practice to compensate individuals and provide childcare to make these more accessible and reduce the barrier to participation (Rocky Mountain Institute, 2022).

Funding

The cost of a program is established and approved during the program design phase through utility filings for review by the regulator, rate-payer advocate, and other stakeholders. Through our utility interviews, we found some programs to be funded through bill riders which are flat bill increases often across the customer base, regardless of participation in program. This could result in further inequity for non-participants and exacerbate any energy burden faced by underserved community members. This was found to be the case in as many as 5 utility stakeholders out of the total utility stakeholders interviewed. To resolve this, innovative rate structures can be designed following the principles of Modern Rate Architecture, that emphasizes transparency to account for what customers are paying for as well as equity to better align customer rates with cost of services for different customer groups.

Energy modifier programs offer incentives for clean technologies such as building energy efficiency, distributed energy resources, and electric vehicle charging, promoting the use of these technologies. However, the up-front capital cost of purchasing and installing these technologies may still be significant and pose a barrier for participation by disadvantaged community members. It is found that flexible financing mechanisms that enable financing clean energy technology over time may reduce this barrier. It is also found programs for low to moderate income customers, removing income verification and credit checks to determine eligibility and relying on other methods such as geo-location to determine eligibility largely increased enrolment in the program. Lastly, it’s found that partnering with third-party providers and non-profits can help finance programs for underserved communities since some of these organizations work on applying and securing government grants, and city, state or federal funds (such as the weatherization funds) to ensure benefits from these programs flow to disadvantage community members.

Equitable Service Offerings, and Outreach

A large part of utility operations involves outreach and implementation activities such as enrolling customers, advertising the program and providing the program services. Making these operations equitable can require additional administrative efforts. Successful examples from our interviews have been when utilities share program and enrollment details in multiple languages and consider factors such as internet accessibility and computer proficiency. Another successful characteristic for programs targeted for disadvantaged communities is automatically qualifying customers that are enrolled in other programs for disadvantaged community members offered by the utility. This minimized duplicative efforts across programs to determine eligibility. From our interviews 2 utilities make use of federal databases such as Low-Income Home Energy Assistance Program (LIHEAP) (Office of Community Services, 2023) to determine eligibility since these databases consider several factors for qualifying individuals and leveraging them provides a standardized way to determine program eligibility. In certain cases, working with local organizations or developers can help determine eligible customers and get them enrolled since they interact with community members on a regular basis and are trusted entities.

Utilities often also partner with third parties or non-profit organizations to administer programs. This can greatly help share responsibilities and allow utilities to focus on other aspects of program and rate design.

Metrics and Program Evaluation

Metrics and Program Evaluation provide a way to establish credibility for utility offerings. They help justify the cost of the program in the eyes of the regulator and establish trust in the program for its customers. Common metrics found in utility programs include number of applicants enrolled, cost of program or cost spent on program. While these metrics may provide certain insights on the program, there may be a need for more detailed analytics especially as they relate to the objectives of the program and how effective the program was in achieving those and benefiting customers (e.g., impact evaluation).

Defining these metrics and a program evaluation methodology should be an active element of utility program design with concerted efforts by the utility, in collaboration with different stakeholders such as regulators and customer advocacy groups towards defining metrics that reflect the success and outcomes of the program. For programs designed for underserved communities, it is found that certain utilities use metrics that reflect the positive impacts of the program on these communities such as reduction in energy bills and lesser cases of services getting discontinued due to unpaid bills.

Efforts should be made to translate benefits from a program into measurable outcomes, these could be environmental impacts such as carbon and energy reduction or impacts on energy affordability as mentioned above. In a lot of cases measuring these quantities may come with extra cost and effort. Metrics around data already collected (such as number of enrollments) or public records may be an easier lift. However, doing more detailed analytics on the results of a program even though at an additional cost, may pay for itself as the program is deemed successful and gets continued funding. More details on how detailed metrics can be defined are provided in the section below.

Future Innovation

So far, we have covered current best practices in equitable utility programs and rate design for disadvantaged community members to ensure programs capture needs, equitable access, take in customer feedback and have equitable funding opportunities for these. However, to truly achieve equitable decarbonization goals, we need to extend our efforts with future forward thinking that would better tackle not just the limitations of equitable program and rate design today but would better prepare us for the challenges that are upcoming. A few innovations and opportunities that can aid us in doing so are listed below.

People Centered Approach

Figure 2. Human Centered Utility Design Process. *Source: Marjorie Schott, NREL*

It is found that utility program design goals and motivations are often top-down, policy-led and regulator-enforced efforts. However, in doing so, a lot of times certain customer classes such as underserved communities may be left behind. This is seen in case of certain energy-modified programs that only more affluent customer classes end up making use of because of some of the challenges mentioned earlier such as higher upfront costs, barriers to enrollment and better applicability and accessibility to technology (for e.g. Electric Vehicle Charging Programs). It is also possible that these programs are funded through bill riders across the customer base, so underserved communities end up paying for them, even though they aren't benefiting from the program. This top-down approach can be expanded to a more people centered approach that takes in more input and feedback from different customer classes, especially underserved communities that may have been underrepresented from utility program engagement. Human centered design refers to a problem-solving approach that focuses on the needs and wants of the end user, putting people in the center of the development process (Harvard Business School, 2020). It aims to develop solutions tailored to the end-user's needs by placing their preferences at the forefront of each design phase. it In case of utility program design, human centered design

principles can be implemented through close collaborations in the form of co-designing program, getting feedback from, and administering programs with local boots on the ground organizations that are well versed with underserved community needs. This is shown in Figure 2.

Modern Rate Architecture (MRA)

Modern Rate Architecture is a framework that highlights principles of transparency, equity, sustainability that should form the bedrock of new rate or programs designed by the utility. These principles are further elaborated below.

Transparency: Delineate what customers are paying for with a precise breakdown of services and costs attached.

Equity: Ensure prices are fair to all customers and investments in technologies are available to all customers (through subsidies where possible).

Sustainability: Forward facing programs that can be adapted for market changes in the coming years.

Access: Equal access to service options across all customers

These principles can be implemented through the following framework as illustrated in Figure 3.

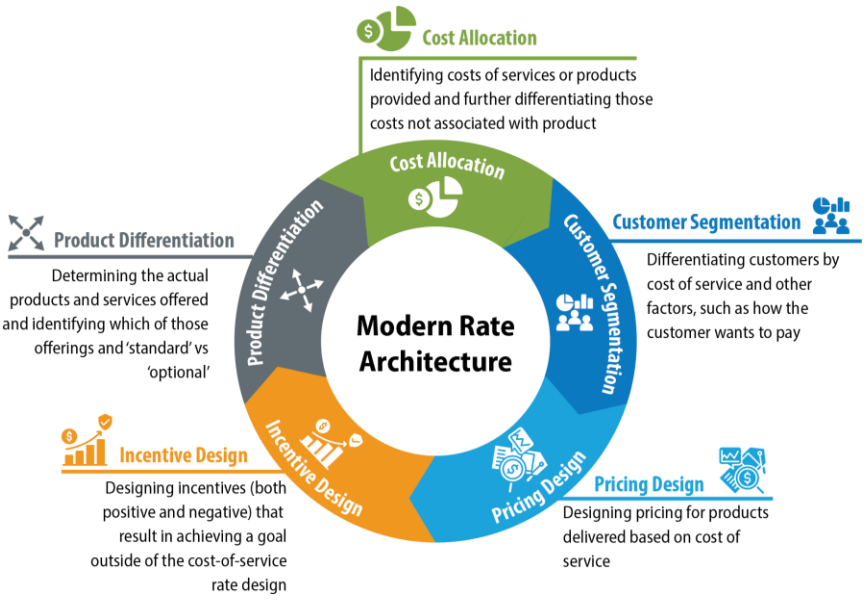

Figure 3. Modern Rate Architecture *Source*: *Adapted from "A Modern Rate Architecture for California's Future".*

The MRA framework begins with product differentiation, i.e. identifying services offered by the utility and classifying them as standard versus optional and cost allocation i.e. costs for the services identified and differentiating them from costs not associated with services. This is a step forward from bundling of costs (wrapping up all costs for utility services into one) and encourages transparency in utility operations.

The next step is customer segmentation. How customer classes are defined is noteworthy because utilities design programs and rates keeping these customer classes in mind. Traditional customer segmentation is based on broad classifications into residential, commercial, industrial categories. While such a classification may be useful in certain cases, it does not capture nuances associated with the changing utility landscape. For example, the proliferation of distributed energy resources is happening unevenly across customer groups due to unequal access to these technologies across customers. This further leads to irregular changes in load profiles across these groups. The cost for utilities to serve these customer groups varies, however currently these differences aren't reflected in rates charged to these customers. The energy transition is an opportunity for utilities to rethink traditional customer segmentation such that it improves equity and affordability across customer classes. Pricing Design emphasizes charging customer groups in proportion to their cost of services. Incentive Design refers to subsidies, discounts or services offered by utilities through a program. These should be demarcated from the cost of services to ensure transparency to customers and incentivize the intended customer behavior.

Advanced Program Metrics

There is a need for advanced metrics that holistically and iteratively measure the performance of a program throughout its life cycle. There is a need for a framework of evaluation, and multiple metrics that measure different aspects of the program for it to be successful. Metrics may also need to evolve as the program matures through its different stages. These metrics may also be updated with changes in the goals of the program or as feedback on the program is gathered and it is offered again. It is also essential to study how the impacts and benefits of a program can be translated through measurable metrics. There may be secondary, indirect benefits derived from the program. For example, it is possible that as a result of weatherization programs there is a decrease in hospital visits in underserved communities due to better thermal comfort, reduced mold growth and healthier indoor living conditions. Measuring these indirect impacts can be indicative of the success of a program. Advanced data analytics can also be key in capturing nuances that may not be apparent and gain insights on what can be improved in the program.

Multi Stakeholder Marketplace

This approach proposes to create a marketplace of successes, ideas, business models and program administration infrastructure across utilities to avoid duplicated efforts, foster collaboration and encourage learning from the others' successes and failures. Since current utilities operate in silos independent from each other, there is limited exchange of information that could benefit them. In certain cases, it is seen within the same larger service territory IOUs and municipalities share ideas and pair resources. The multi stakeholder marketplace proposes to expand this to a larger scale for neighboring utilities.

Conclusion

This paper highlights the need for equitable decarbonization and the role of utilities in achieving it. The approach adopted includes literature review, interviews with utility stakeholders and input from industry and research professionals. It highlights the current best

practices of utility programs as they relate to identifying customers, outreach, metrics and funding. It also draws out future innovations that can aid in facing the upcoming challenges, such as adopting a people centered approach, the modern rate architecture framework, advanced metrics and a multi stakeholder marketplace.

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Appendix

Interview Guide

Objective

The primary objectives of the interviews were to gain insights into the utility stakeholders' experience in designing and implementing programs for disadvantage community members including: factors that drive program design, barriers if any, metrics used to evaluate program and the main stakeholders in the process.

Structure

The interview began with a round of introductions and an overview of the goals of the project. The following is a brief list of topics covered for the utility interviews:

- **Program Design**
  - What are the motivations and drivers for program design?
  - Where can we find any public records on utility filings?
  - How do you approach customer segmentation and design programs keeping these customer classes in mind?
  - What needs of the disadvantaged community is the program trying to meet?
  - Do you consider how program benefits stay within a disadvantaged community?
  - What are the primary barriers in developing programs for disadvantaged communities?

- **Stakeholders**

        - Who are the primary stakeholders in the design and implementation of utility programs?
        - Do you receive feedback or public input in the design of programs?
        - Are there any working groups for the design of programs
        - What was the most successful narrative in securing support and customer participation?
- **Metrics**
    - What are some of the metrics that you use?
        - How do you come up with metrics to measure success of a program, especially with regard to inclusion of disadvantaged communities?
- **Implementation**
    - What are barriers to implementation of programs?
    - Have you discovered any unique operational barriers that you haven't normally seen in other typical programs?
    - What are the strategies adopted in spreading awareness about utility programs amongst customers?
- **Other/going forward**
    - Are there other people or successful programs (at your utility or others) that we should connect with?
    - Do you mind if we follow up with additional questions?
    - Do you have any plans for new programs that you are implementing?

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