Out of the Frying Pan and Onto the Wire

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ABSTRACT

Electrification in the residential sector is a fast-growing movement within the energy efficiency industry, driven by new legislation and policy directives in jurisdictions across the country. In this context, electrification intends to achieve a number of objectives, including energy savings and environmental goals (such as decarbonization), all while balancing equity issues and serving low- and moderate-income customers. These objectives are in agreement in certain scenarios; for example, the objective to achieve energy savings supports the objective to achieve emissions reductions. However, our research suggests that electrification does not always serve these objectives in all cases. For example, fuel switching projects may not always result in positive customer bill savings due to factors such as equipment and fuel costs.

Our collaboration with a number of utility clients highlights the importance of closely analyzing the impact of electrification on customer bills, especially with respect to low-income customers. Program administrators must consider key customer characteristics when engaging with prospective participants. These may include existing HVAC equipment and fuel types (natural gas, propane, fuel oil, etc.) and their associated costs, replacement technologies, heating and cooling load requirements, climate zone, and system sizing requirements. Program administrators must be fully transparent about lifetime project costs and seasonal bill impacts, such that their customers are educated on how their bills will change by eliminating fuel consumption and serving their space heating, water heating, and other needs with electric-equivalent technologies.

Introduction

This paper explores the challenges of achieving the many objectives of residential fuel switching to electricity (i.e., electrification), a fast-developing and salient feature of the energy efficiency industry and a core sustainability effort in the broader energy sector. The economic benefits of residential electrification, particularly utility bill savings, are a highly sensitive consideration, especially for low-income households. We investigate the stated objectives of legislation, policy, and utility programs and assess the potential financial impacts on consumers by comparing the costs of electrification projects with equivalent energy efficiency projects that address the incumbent fuel.

Our research, conducted across various jurisdictions and utility service areas, reveals that electrification projects do not always cost-effectively reduce energy consumption or carbon emissions, nor do they consistently ensure customer bill savings. This reality disproportionately affects low- and moderate-income households, who allocate a larger portion of their incomes to energy costs and are thus more vulnerable to fluctuations in their energy bills on a seasonal, annual, and long-term basis.

We argue that policymakers, utilities, and program administrators must rigorously assess and transparently convey the impacts of electrification. We advocate for policies that support

informed decision-making and propose a framework for evaluating the viability of electrification.

Electrification Expectations versus Reality

Electrification in the residential sector is a fast-growing movement within the energy efficiency industry, driven by new legislation and policy directives in jurisdictions across the country. Electrification intends to achieve several objectives, including energy savings and environmental goals (such as decarbonization), all while balancing equity issues and serving low- and moderate-income customers.

- *Save Energy:* Electric technologies are often more energy efficient than fossil fuels.
- *Reduce Greenhouse Gas (GHG) Emissions:* Electrification technologies can lower overall emissions if electricity can be generated using clean, renewable energy sources such as wind and solar - even with fossil fuels in the generation mix.
- *Reduce Customer Bills:* Overall energy costs should decrease as fossil-fueled technologies are replaced with electric technologies, particularly given that natural gas prices are historically more volatile than electricity prices.[1] In states analyzed by Rocky Mountain Institute (RMI), these households, which can least afford increased bills, will see their energy costs rise significantly. Energy expenditures for the lowest-income households are expected to increase by an average of 3 percentage points, compared to just 0.3 percentage points for the highest-income households. This volatility exacerbates energy poverty and underscores the need for targeted electrification efforts to provide more stable and affordable energy solutions for vulnerable populations (Rocky Mountain Institute, 2022).

However, AEG's collaboration with several utility clients highlights the importance of closely analyzing the impact of electrification, particularly the impact on low- and moderate-income customer bills. While some utilities and their customers benefit from electrification, not all utilities and/or customer types benefit from each objective.

For example, Washington Gas Light Company (WGL) analyzed the impact of switching from natural gas water and space heating to electric heating systems. The analysis was designed to inform WGL's incentives for high-efficiency natural gas appliances in future energy efficiency programs in Washington, DC, while also addressing the effects of these programs on low-income communities. As such, WGL performed a comprehensive comparison of the costs and emissions associated with upgrading to efficient natural gas versus electric equipment as current gas-fired units reach the end of their lifespan and assessed lifetime costs—covering equipment, labor, operations, maintenance, and energy bills—along with energy consumption and CO2 emissions for both heating solutions.

The findings, summarized in Table 1, indicate that significant residential bill savings are not achievable, highlighting the complex challenges of making electrification beneficial for all customers (AEG, 2022).

[1] According to the Energy Information Administration (EIA).

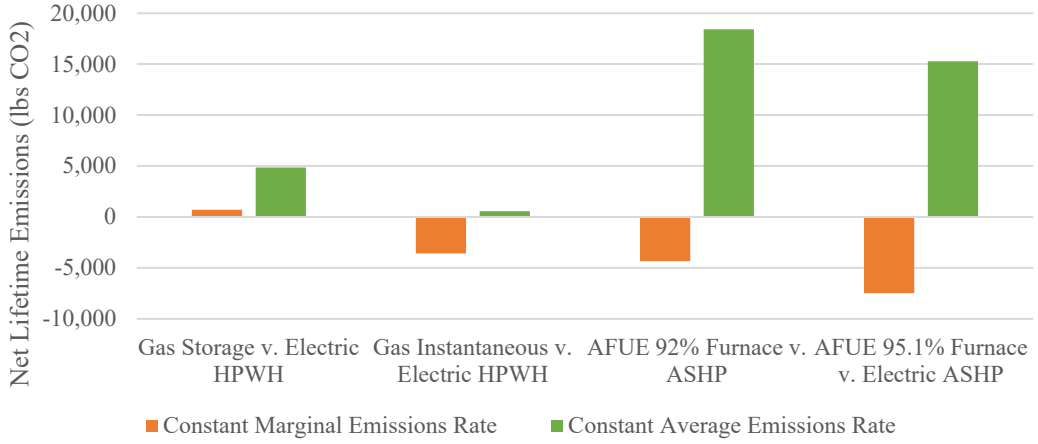
Table 1. Lifetime Equipment Electrification Cost Analysis Results

Lifetime Cost Impacts	Water Heating Scenarios		Space Heating Scenarios	
($NPV)	Gas Storage v. Electric HPWH	Gas Instantaneous v. Electric HPWH	AFUE 92% Furnace v. ASHP	AFUE 95.1% Furnace v. ASHP
Electric Equip & Labor Costs	$7,449	$7,449	$14,974	$14,974
Gas Equip & Labor Costs	$1,134	$1,773	$3,739	$3,847
Difference	**-$6,315**	**-$5,676**	**-$11,235**	**-$11,127**
Electric O&M Costs	$261	$261	$1,191	$1,191
Gas O&M Costs	$0	$1,353	$1,316	$1,316
Difference	**-$261**	**$1,092**	**$125**	**$125**
Electric Bill Impacts	$1,129	$1,129	$5,469	$5,469
Gas Bill Impacts	$1,263	$980	$5,614	$5,431
Difference	**$135**	**-$149**	**$146**	**-$38**
Total Electric Costs	$8,839	$8,839	$21,634	$21,634
Total Gas Costs	$2,398	$4,105	$10,669	$10,594
Difference	**-$6,441**	**-$4,734**	**-$10,965**	**-$11,040**

Source: AEG, 2022

As seen in Figure 1, WGL compared the lifetime carbon emissions of efficient natural gas and electric options across two scenarios. Under constant marginal emission rates, natural gas generally produced fewer emissions in most configurations. Conversely, with constant average emission rates, electric equipment was shown to emit less carbon than natural gas. These outcomes may vary with future changes in emission rates for both energy sources, highlighting the importance of keeping customers informed about the evolving benefits of different technologies and helping them navigate the complexities of transitioning to cleaner energy solutions.

Figure 1. Net Lifetime Reduction of CO2 Emissions for Gas and Electric Equipment Scenarios



Source: AEG, 2022

Proposed Framework

The proposed framework for evaluating the viability of electrification considers statutory, policy, and program objectives, the composition of the utility's customer base, and key variables impacting project outcomes, including end uses, technologies, fuel types, climate characteristics, and costs. The proposed framework and key questions for consideration are summarized in the table below and detailed in the following sections of this report.

No.	Framework Subject	Questions for Consideration
1.	Identify Primary Objectives	1) What are the main goals of the utility/program administrator's energy efficiency programs? 2) Which statutory and regulatory requirements are priorities according to state law for these programs?
2.	Identify Secondary Objectives	1) What supplementary goals does the program aim to accomplish, such as enhancing customer experience, reducing energy consumption and greenhouse gas (GHG) emissions, and improving comfort and safety? 2) Are there any agreements with stakeholders that influence program objectives?
3.	Understanding the Customer Base & Barriers to Adoption	1) Has the utility/program administrator demonstrated comprehensive knowledge of its customer base, including income levels, geographic distribution, housing stock, and equipment saturation? 2) Have potential barriers and opportunities for electrification been identified, such as system load constraints and projected costs for upgrades and maintenance?
4.	Identify Program Parameters	1) Are the program's parameters, including minimum savings and cost-effectiveness requirements, clearly defined and aligned with the stated objectives? 2) How do these parameters address specific energy efficiency and sustainability goals? 3) Is there a process in place to regularly review and adjust the program's parameters to maintain or enhance alignment with its stated objectives, especially as external conditions or technologies evolve?
5.	Identify Impacts to Customers	1) Has the program design thoroughly analyzed how various factors, such as end uses, technologies, fuel types, climate characteristics, and costs, might affect customers' experiences? 2) What strategies are in place to adjust project parameters when factors change, ensuring the program effectively meets customers' needs and goals under different conditions?

6.	Determine Program Qualification Criteria	1) What specific qualification criteria have been established for program or project planning and implementation? This includes detailed requirements for reducing energy consumption and GHG emissions. 2) Under what specific conditions are projects permitted to proceed if they result in an increase in customer bills, and how do these conditions align with the overall goals of energy efficiency and customer benefit? 3) How does the program evaluate and balance the potential increase in customer bills against the long-term benefits, such as lifetime savings and environmental impact? 4) What mechanisms are in place to ensure that any initial financial burden to the customer is justified by substantial, quantifiable benefits?
7.	Track & Evaluate Program Performance	1) After the program's implementation, what methods are employed to track and evaluate its performance relative to its initial objectives? This includes assessing the program's strengths, pinpointing areas for enhancement, and identifying barriers. 2) How does the program incorporate performance tracking and evaluation findings to facilitate continuous improvement? Are there specific processes for addressing identified barriers and enhancing program effectiveness over time?

(1) Identify Primary Objectives

The primary objective of a utility program is to meet statutory and regulatory requirements in accordance with state laws or rules specific to electric and gas utilities for a given jurisdiction. These requirements establish legal directives for energy efficiency improvements, decarbonization efforts, and the integration of renewable energy sources, guiding utilities in their pursuit of sustainable energy goals. These mandates ultimately define the highest priorities of a utility's energy efficiency or electrification program, which may include first-year or lifetime energy savings goals as a percentage of energy sales or greenhouse gas emissions reductions, cost-effectiveness requirements, budget caps, and designated spending for low-income designated customers. Within the last several years, electrification has become a more integrated component of traditional energy efficiency programs, requiring program administrators to balance electrification goals amongst existing statutory requirements.

For example, Vermont's state energy policy was designed to ensure that the state's energy needs were met in a way that prioritized adequacy, reliability, security, and sustainability. It emphasizes the importance of affordability and supports the state's economic vitality through the efficient use of energy resources and cost-effective demand-side management, all while being environmentally sound. The policy mandates ongoing identification and evaluation of energy resources that align with the principles of least-cost integrated planning. This approach encompasses efficiency, conservation, load management, the wise use of renewable resources, and environmentally sound energy supply strategies. Furthermore, Vermont is committed to meeting its energy service needs in a way that adheres to greenhouse gas emissions reduction requirements as outlined in the Vermont Climate Action Plan (Vermont Department of Public Service, 2022).

In addition, California Senate Bill 1477 (SB 1477) aims to reduce GHG emissions by encouraging the transition from natural gas to electric heating and water heating systems in

residential buildings, and the California Public Utilities Commission (CPUC) implemented Rulemaking R.19-01-011 to focus on decarbonization strategies centered on replacing natural gas appliances with electric alternatives. These initiatives support California's goal to reduce greenhouse gas emissions to 80% of 1990 levels by 2050 (California State Legislature, 2018; CPUC, 2019).

Questions for Consideration

1. What are the main goals of the utility/program administrator's energy efficiency programs?
2. Which statutory and regulatory requirements are priorities according to state law for these programs?

(2) Identify Secondary Objectives

Overall, statutory and regulatory guidelines provide a critical foundation for utilities to achieve their primary goals of reducing load, decreasing greenhouse gas emissions, and promoting electrification. These mandates ensure that utility programs align with statewide energy policies and environmental targets, setting a clear pathway toward sustainability. It is equally important to consider secondary goals that support broader community and utility initiatives. This includes developing community action plans, enhancing utility-specific programs, fostering partnerships that drive innovation, engaging in customer education and outreach, and promoting equity within communities.

Secondary objectives often address the broader impacts of electrification, such as economic development, job creation, and ensuring that all customer segments benefit from these initiatives, particularly low-income and disadvantaged communities. Stipulated settlements between utilities and stakeholders may set specific electrification targets, timelines, compliance mechanisms, or other commitments beyond the legislative requirements for a given jurisdiction. These agreements allow utilities to avoid litigation through the energy efficiency plan filing process, with stipulating parties committing to, for example, low-income spending beyond statutory minimum requirements, diverse contractor targets, and efforts to promote equity within communities or other social goals. These agreements are key influencing factors in program planning, guiding the direction and implementation of initiatives, including those aimed at advancing electrification. As program administrators navigate these complex interests and directives, the influence of such agreements becomes evident in how utilities prioritize their objectives and design and implement energy efficiency programs, all while committing to achieve their statutory goals (ACEEE, 2021).

Questions for Consideration

1. What supplementary goals does the stipulation aim to accomplish, such as enhancing customer experience, reducing energy consumption and GHG emissions, and improving comfort and safety?
2. Are there any agreements (i.e., stipulations) with stakeholders that influence program objectives?

(3) Understand the Customer Base and Barriers to Adoption

To effectively implement electrification programs, utilities and program administrators need a deep understanding of their customer base, with a special focus on the challenges and needs of low- and moderate-income households. This understanding goes beyond cost and emissions considerations and includes insights into customer behaviors, preferences, and barriers they face when adopting new technologies. For instance, many customers may lack awareness or knowledge about the benefits of electrification, such as potential energy savings and environmental impacts. Additionally, there might be a cultural or habitual preference for traditional energy sources, which can inhibit the adoption of electric alternatives. Addressing these knowledge gaps and behavioral barriers through targeted education and outreach is crucial for overcoming resistance and fostering acceptance.

The shift towards electrifying key end uses, such as space and water heating, faces significant obstacles, primarily due to the steep initial costs of electric equipment and the lack of infrastructure to support widespread adoption. The cost obstacle places low- and moderate-income customers at a particular disadvantage, as they frequently struggle to afford the upfront investment in newer, more efficient technology. Furthermore, these households may face barriers such as inadequate access to information about available incentives, rebates, and financing options. The absence of easily accessible financing options and incentives thus limits the opportunities for these households to realize the long-term financial and environmental benefits of electrification compared to higher-income customers. Additionally, there may be technical limitations, such as the need for home upgrades to accommodate new electric systems, which can be particularly burdensome for older homes often inhabited by low- and moderate-income families.

Therefore, understanding the customer base and the barriers to electrification is crucial for designing effective programs. With this foundational knowledge, the next step involves identifying specific program parameters that can drive successful implementation and adoption of electrification initiatives.

Questions for Consideration

1. Has the utility/program administrator demonstrated comprehensive knowledge of its customer base, including income levels, geographic distribution, housing stock, and equipment saturation?
2. Have potential barriers and opportunities for electrification been identified, such as system load constraints and projected costs for upgrades and maintenance?

(4) Identify Program Parameters

The effectiveness of electrification programs is significantly enhanced when their design and implementation align closely with overarching goals, such as reducing energy consumption, lowering emissions, and ensuring cost-effectiveness and equity. This strategic alignment ensures that the benefits of electrification extend across all customer segments, addressing environmental, economic, and social objectives. Utilities may define specific, measurable criteria for projects, including savings and weighted average measure life targets, cost-effectiveness metrics (for example, cost per unit of energy saved or a minimum benefit-cost ratio), emissions reductions, and lifetime customer bill savings. Special attention is given to making electrification

technologies affordable and accessible, particularly for low-income households, fostering an inclusive energy transition (ACEEE, 2021). The methodology behind setting program parameters is critical to success. Utilities use various economic models to predict project outcomes, considering market trends, technology costs, fuel costs, and potential future developments in energy production. Pilot projects serve as a litmus test for these models and larger-scale implementation, offering real-world insights into program effectiveness and areas for improvement. This approach, underpinned by a commitment to aligning program parameters with stated objectives, enables utilities to navigate the design and implementation of electrification programs effectively.

Questions for Consideration

1. Are the program's parameters, including minimum savings and cost-effectiveness requirements, clearly defined and aligned with the stated objectives?
2. How do these parameters address specific energy efficiency and sustainability goals?
3. Is there a process in place to regularly review and adjust the program's parameters to maintain or enhance alignment with its stated objectives, especially as external conditions or technologies evolve?

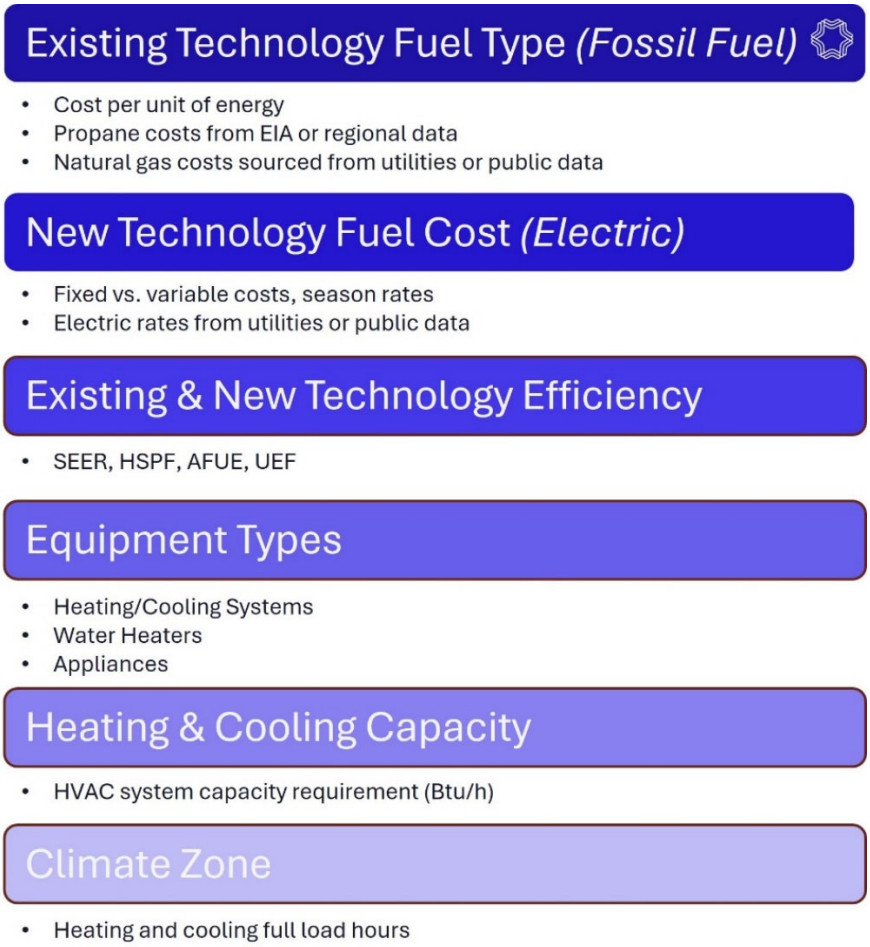
(5) Identify Impacts to Customers

The effectiveness and outcomes of electrification programs are significantly influenced by various factors, including the specific end uses targeted for fuel switching, the types of fuels currently in use, the introduction of new and existing technologies, efficiency levels, climate characteristics, and the costs of fuel, equipment, and labor. Identifying these variables is essential to understanding how different aspects of an electrification project can impact its ability to meet the program parameters defined in the proposed framework.

AEG conducted a detailed analysis on a large Midwestern dual-fuel utility in which various fuel-switching scenarios were examined to determine their lifetime bill impacts (i.e., fuel costs) on residential customers. Figure 2 indicates the variables modeled with the aim of calculating the total net bill savings resulting from technological upgrades.[2]

[2] Note that equipment costs were not a variable included in the analysis.

Figure 2. Key Bill Impact Modeling Variables



Source: AEG, 2022

Tables 2 and 3 reveal a stark outcome: transitioning from propane and natural gas to electric technologies generally results in negative net bill savings in specific scenarios. Table 2 focuses on the bill impacts for a household switching from an 80% AFUE propane furnace to a SEER 16 air-source heat pump (ASHP), with the water heater being replaced by a heat pump water heater. Table 3 highlights the bill impacts for a natural gas household switching from an 80% AFUE furnace to a SEER 16 ASHP, with the water heater being replaced by a heat pump water heater. This finding underscores a critical barrier to electrification, highlighting that upgrading to electric equipment and adding central air conditioning could financially burden customers without utility incentives, particularly those in low-income brackets.

Table 2. Propane to Electric Fuel-Switching Annual Bill Impacts

Propane to Electric		Bill Impact by Fuel Type			
Existing Technology	New Technology	Propane	Winter kWh	Summer kWh	Total Savings
Propane Furnace/No CAC	Air-Source Heat Pump	$1,967.81	-$1,133.52	-$287.57	$546.99
Propane Water Heater	Heat Pump Water Heater	$451.03	-$93.49	-$30.64	$326.90
			Total Net Bill Savings		$837.89

Table 3. Natural Gas to Electric Fuel-Switching Annual Bill Impacts

Propane to Electric		Bill Impact by Fuel Type			
Existing Technology	New Technology	Natural Gas	Winter kWh	Summer kWh	Total Savings
Gas Furnace/No CAC	Air-Source Heat Pump	$959.68	-$1,133.25	-$287.57	-$461.44
Gas Water Heater	Heat Pump Water Heater	$219.96	-$93.49	-$30.64	$95.83
				Total Net Bill Increase	-$365.31

However, other scenarios with varying technology, fuel type, and climate characteristics may benefit customers positively. Tables 3 and 4 illustrate an alternate scenario where switching from propane/natural gas 80% AFUE furnace with a central air conditioner to a SEER 16 ASHP, with the water heater being replaced by a heat pump water heater. These projects include the electrification of space and water heating and appliance end uses, as well as upgrading an existing central air conditioning unit to an efficient heat pump for cooling.

Table 4. Propane to Electric Fuel-Switching Annual Bill Impacts

Propane to Electric		Bill Impact by Fuel Type			
Existing Technology	New Technology	Propane	Winter kWh	Summer kWh	Total Savings
Propane Furnace/CAC	Air-Source Heat Pump	$1,967.81	-$1,133.52	$104.08	$928.64
Propane Water Heater	Heat Pump Water Heater	$451.03	-$93.49	-$30.64	$326.90
Propane Clothes Dryer	Heat Pump Clothes Dryer	$71.63	-$68.20	-$35.37	-$31.94
Propane Range	Electric Range	$62.35	-$22.87	-$11.86	$27.62
				Total Net Bill Savings	$1,261.22

Table 5. Natural Gas to Electric Fuel-Switching Annual Bill Impacts

Natural Gas to Electric		Bill Impacts by Fuel Type			
Existing Technology	New Technology	Natural Gas	Winter kWh	Summer kWh	Total Savings
Gas Furnace/CAC	Air-Source Heat Pump	$959.68	-$1,133.25	$104.08	-$69.49
Gas Water Heater	Heat Pump Water Heater	$219.96	-$93.49	-$30.64	$95.83
Gas Clothes Dryer	Heat Pump Clothes Dryer	$34.93	-$68.20	-$35.37	-$68.64
Gas Range	Electric Range	$30.41	-$22.87	-$11.86	-$4.33
				Total Net Bill Increase	-$46.62

Source: AEG, 2022

These findings suggest the financial implications for customers requiring more expensive energy-efficient electric options, especially those less economically advantaged, can be significant barriers. The negative bill savings associated with switching to electric equipment without incentives can dampen the enthusiasm for electrification among residential customers (AEG 2022). This poses a challenge for utilities and policymakers aiming to promote electrification as a pathway to a more sustainable energy future. It's imperative to develop and implement targeted incentives and support mechanisms to mitigate these impacts and foster broader adoption of electrification technologies. These should be designed to ensure that the transition to electric technologies economically beneficial for all customers, particularly those who are most vulnerable.

One of the emerging rate policy options aimed at supporting electrification is ensuring affordability and equity among low- and moderate-income households. Solutions such as

percentage-of-income payment programs (PIPPs), which cap monthly utility payments for income-eligible households, modifications to electric rates to incentivize fuel-switching, and income-based fixed charges are all possibilities to help mitigate the negative bill savings impacts when a top-tier efficiency option is unrealistic (ACEEE 2023). However, the viability and success of these options need to be weighed against the overall cost impacts on customers.

Questions for Consideration

1. Has the program design thoroughly analyzed how various factors, such as end uses, technologies, climate characteristics, and costs, might affect customers' experiences?
2. What strategies are in place to adjust project parameters when factors change, ensuring the program effectively meets customers' needs and goals under different conditions?

(6) Determine Program Qualification Criteria

Establishing qualification criteria for electrification projects is essential to ensure the program aligns with energy efficiency and decarbonization goals and addresses equity and affordability. The qualification criteria should evaluate the feasibility and impact of electrification measures, considering energy savings, GHG emission reductions, and economic effects on customers. Program administrators should ensure the electrification program qualification criteria align with the primary objectives (e.g., achieving specific energy savings targets) and secondary objectives (e.g., addressing social goals, such as equitable service to low-income households). To achieve these objectives, the criteria must encompass several key components.

- *Meet or exceed predefined efficiency standards to ensure they contribute to overall energy savings.* For example, replacing traditional heating systems with high-efficiency heat pumps should result in measurable reductions in energy consumption. This metric assesses the longevity and sustained impact of electrification measures. Projects should be evaluated based on their expected lifespan and maintenance needs to ensure long-term benefits and cost-effectiveness. For instance, investments in durable, high-efficiency appliances that provide sustained savings over 10-15 years are preferable.
- *Favorable return on investment for both the utility and the customers, as demonstrated by cost-benefit analysis.* The analysis should consider the initial installation costs as well as ongoing operational savings.
- *Assess the impact on customer bills, particularly for low- and moderate-income households.* Programs should aim to implement measures that either reduce bills or mitigate bill increases and enhance affordability when paired with rebates, subsidies, or other financial assistance programs. For example, offering subsidies for the upfront costs of efficient electric appliances can make electrification more accessible and affordable for low-income households.
- *Potential to reduce greenhouse gas emissions.* Programs should prioritize measures that reduce GHG emissions, including not only direct emissions reductions but also the broader impact on the grid, such as reducing peak demand and enhancing the integration of renewable energy sources.

By incorporating these criteria, program administrators can ensure that electrification initiatives are not only technically and economically viable but also socially equitable. An example of a successful program is California's Low-Income Weatherization Program (LIWP),

which offers comprehensive home upgrades to improve energy efficiency and reduce energy costs for low-income residents. Program qualifications revolve around income eligibility, property type, location, and eligible energy efficiency upgrades within the property. The program demonstrates the importance of targeted support and comprehensive planning in achieving energy and equity goals (CHP 2023).

However, we recommend that program administrators adopt a more granular understanding of the impact of electrification and these programs on participants and non-participants alike. This includes analyzing how the qualifications and measures influence customer adoption rates and addressing potential barriers that might prevent certain households from participating. A thorough analysis should consider the immediate benefits and long-term impacts on energy savings, emission reductions, and overall impacts on customers. This approach will help ensure that electrification programs are inclusive and beneficial to all segments of the population, especially those in underserved communities.

Questions for Consideration

1. What specific qualification criteria should be established for program or project planning and implementation? This includes detailed requirements for reducing energy consumption and GHG emissions.
2. Under what specific conditions are projects permitted to proceed if they result in an increase in customer bills, and how do these conditions align with the overall goals of energy efficiency and customer benefit?
3. How does the program evaluate and balance the potential increase in customer bills against the long-term benefits, such as lifetime savings and environmental impact?
4. What mechanisms are in place to ensure that any initial financial burden to the customer is justified by other substantial, quantifiable benefits?

(7) Track and Evaluate Program Performance

To evaluate and track the performance of electrification programs after implementation, program administrators can employ several preferred methods and various tools and techniques. First, it is crucial to establish clear performance metrics that align with the program's objectives. Key Performance Indicators (KPIs) should be used to measure progress, including the number of households served, energy savings, GHG emission reductions, reductions in energy bills, cost-effectiveness, customer satisfaction, and other non-energy benefits received.

Data collection and analysis form the backbone of performance tracking. Continuous data should be gathered from various sources, including smart meters, utility bills, and customer feedback surveys. Advanced data analytics tools can process and analyze this data, helping identify trends and areas for improvement. For example, California's LIWP uses detailed performance metrics to track energy savings and GHG reductions while incorporating customer satisfaction surveys and assessments of health and safety improvements (CHP 2023).

Customer feedback is another critical component. Regular customer satisfaction surveys should be conducted to gather feedback on program effectiveness, ease of participation, and areas needing improvement. Qualitative feedback from customers can provide insights that quantitative data might miss, offering a fuller picture of the program's impact.

Engaging third-party evaluators can provide an unbiased assessment of the program's performance. This can include process evaluations, impact evaluations, and cost-benefit analyses. Third-party evaluations often bring credibility and transparency, essential for securing ongoing funding and support. For instance, the New York State Energy Research and Development Authority (NYSERDA) uses third-party evaluations to monitor its Clean Heat Program, employing rigorous performance tracking through data analytics to monitor energy savings and emission reductions while gathering customer feedback to enhance program effectiveness (Clean Heat NY 2023).

Benchmarking and comparisons against similar programs in other regions or states can help identify best practices and areas for improvement. Benchmarking also helps set realistic targets and goals, ensuring the program remains competitive and effective. Regularly engaging with stakeholders, including trade allies, community organizations, and policymakers, helps gather feedback and ensure the program meets community needs. Stakeholder workshops and focus groups can provide valuable insights into program strengths and weaknesses.

Questions for Consideration

1. After the program's implementation, what methods are employed to track and evaluate its performance relative to its initial objectives? This includes assessing the program's strengths, pinpointing areas for enhancement, and identifying barriers.
2. How would the program incorporate performance tracking and evaluation findings to facilitate continuous improvement? Are there specific processes for addressing identified barriers and enhancing program effectiveness over time?

Conclusion

In conclusion, it is imperative for program administrators to undertake a comprehensive and nuanced evaluation of the adoption and benefits of new electrification programs. While the drive to electrify is strong and can bring significant benefits in terms of energy efficiency and reduced greenhouse gas emissions, it is also crucial to consider the potential negative impacts on specific households or communities. These impacts can include increased utility bills, the cost-effectiveness of eligible upgrades, and the financial burden on moderate- and low-income families.

A thorough evaluation should provide a complete view of these impacts, ensuring that participants and non-participants are considered. This includes assessing the long-term cost implications, understanding the barriers to participation, and identifying ways to mitigate any adverse effects. By adopting a holistic approach to evaluation, program administrators can ensure that electrification initiatives are not only successful but also equitable and inclusive. Utilizing the proposed framework, this deeper dive will help create programs that truly benefit all members of the community, avoiding unintended detriments and fostering widespread adoption and satisfaction.

References

American Council for an Energy-Efficient Economy (ACEEE). 2023. Equity and Electrification-Driven Rate Policy Options. https://www.aceee.org/white-paper/2023/09/equity-and-electrification-driven-rate-policy-options.

———. 2023. Impact of Electrification and Decarbonization on Gas Distribution Costs. https://www.aceee.org/research-report/u2302.

———. 2021. The 2021 City Clean Energy Scorecard. https://www.aceee.org/research-report/u2107.

Applied Energy Group (AEG). 2022a. 2022 Washington Gas Light Company EEDR Potential Study – Final Report. www.edocket.dcpsc.org/apis/api/filing/download?attachId=182873&guidFileName=3cebcc07-f6b4-4cf2-8134-b6287ab926ff.pdf.

——— . 2022b. Confidential AEG Analysis of Large Midwest Dual-Fuel Utility Bill Savings Impacts.

California Housing Partnership (CHP). 2023. Low-Income Weatherization Program Multifamily: Impact Report. https://chpc.net/wp-content/uploads/2023/12/LIWP_PolicyBrief_2023Feb-121323.pdf.

California Public Utilities Commission. 2019. Order Instituting Rulemaking Regarding Building Decarbonization. Rulemaking 19-01-011. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M273/K834/273834923.PDF.

California State Legislature. 2018. Senate Bill No. 1477. Low-emissions buildings and sources of heat energy. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB1477.

Rocky Mountain Institute. 2022. The Myth of Stable and Affordable Natural Gas Prices. https://rmi.org/the-myth-of-stable-and-affordable-natural-gas-prices/.

Vermont Department of Public Service. 2022. 2022 Vermont Comprehensive Energy Plan. www.publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf.