

Busy BEE: Scaling Utility Customer Action in Decarbonization

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ABSTRACT

Utilities face unprecedented pressure to decarbonize, and many are responding, with 78% of US consumers served by utilities with greenhouse gas (GHG) emissions reduction goals. While we work to decarbonize our power supply, there are faster, more affordable pathways we must deploy today. Three of the biggest opportunities are found in energy efficiency, demand flexibility, and beneficial electrification, which rely on customer action. While there is potential in influencing customer behaviors to drive emissions reductions, do we know how much?

This paper builds off research completed to understand the climate benefits of behavioral energy efficiency (BEE) and structural energy efficiency (SEE), and an effort to quantify the impacts of customer action in achieving utility decarbonization goals. We have learned that BEE programs are delivering climate outcomes at ~1/4 the cost of SEE programs and scale ~5x faster. For maximum impact, utility energy efficiency (EE) portfolios should include both BEE programs that deliver savings, avoided emissions, and avoided climate damages on an accelerated time frame alongside SEE programs that take a longer time to ramp but continue to provide lasting benefits. We also know by 2040, customer action can reduce nearly 2x more GHG emissions than clean supply alone. Harnessing the collective action of the hive, BEE can achieve decarbonization goals while reaching the most customers at scale, including hard-to-reach customers.

This paper details the findings uncovered in these studies, as well as real-world examples of how utilities are influencing complex customer actions today. Also included are recommendations on how utilities can act on these insights.

Introduction

Our fight to mitigate the effects of climate change requires the involvement of utilities, regulators, advocacy groups, and energy customers. While there is no silver bullet to tackling this generational challenge, energy efficiency is widely accepted as one of the most cost-effective tools. Energy efficiency, beneficial electrification, demand flexibility, and clean energy are all widely recognized strategies to decarbonize our economy. Technologies and programs vary by region, but research shows some are more effective than others.

The Intergovernmental Panel on Climate Change (IPCC), the international body for assessing the science related to climate change, released its most recent report, the Sixth Assessment Report, and the warnings in these reports are getting increasingly dire. Even their Special Report: Global Warming of 1.5°C from 2018 stated, “avoiding overshoot and reliance on future large-scale deployment of carbon dioxide (CO₂) removal . . . can only be achieved if global CO₂ emissions start to decline well before 2030” (IPCC 2018). The IPCC reports assesses a variety of emissions scenarios, and the very low and low scenarios require meaningful GHG emissions reductions to begin immediately. The Summary for Policymakers for this latest report includes the important finding that “scenarios with very low or low GHG emissions . . . would

have rapid and sustained effects to limit human-caused climate change, compared with scenarios with high or very high GHG emissions” (IPCC 2021). The takeaway is clear: We must act quickly.

Behavioral Energy Efficiency

Energy efficiency is a least-cost carbon reduction strategy that reduces demand for energy supply through various programs and strategies. Energy efficiency measures include structural measures like HVAC replacements, appliance rebates, and weatherization, as well as behavioral energy efficiency that aims to change customer behavior by providing personalized, actionable insights on energy use through outbound communications like Home Energy Reports (HERs) and high bill alerts.

Residential BEE programs aim to directly change how and when people use energy as well as most other energy actions – from electrifying, weatherizing an existing home, or installing energy efficient devices within a home. This includes influencing one-time behaviors, habitual behaviors, and purchasing behaviors, such as the selection of energy efficient appliances or choosing to purchase an air source heat pump. BEE uses time-tested behavioral science principles such as social norming to encourage customers to reduce and control their electric and gas usage.

Behavior programs generate savings over a single year measure life and can achieve significant annual energy savings and avoided climate damages due to the large-scale, opt-out nature of the programs. Energy efficiency has historically been the focus of behavior programs, but behavior-based programs have evolved to incorporate strategies for all aspects of the decarbonization framework. Behavior-based strategies include energy efficiency and demand flexibility, with a foundation of equity and affordability, and can support beneficial electrification. Table 1 highlights various types of behavior-based strategies available.

Table 1. Behavior-Based Strategies

Energy Efficiency	Beneficial Electrification	Demand Flexibility
• Home energy reports • High bill alerts • Home energy assessments • Weekly usage updates • Experience automation with AI that predicts and fulfills customer needs	• EV adoption • EV owner engagement (e.g., pricing and automation adoption) • Heat pump education and adoption (space conditioning and water heating)	• Rate education for year-round peak shifting • Behavioral demand response (BDR) • TOU rate coaching • Device automation • Network automation for real time awareness
Equity and Affordability		
Deliver more energy and bill savings for low- and moderate-income (LMI) customers by finding, enrolling, and engaging LMI customers in financial and energy efficiency programs to make energy more affordable.		

BEE programs are particularly effective with respect to:

- The scale and speed at which the programs may be rolled out and begin to reduce energy consumption and GHG emissions, due to the opt-out program design and broad reach of utility customers;
- Supporting the equitable distribution of benefits from EE among low-income customers and other communities of focus by enabling large-scale participation, personalized messaging tailored to customer circumstances (e.g., no-cost/low-cost tips), and broad visibility and participation uplift for other relevant programs (e.g., low-income weatherization and bill assistance);
- Their ability to generate GHG emissions reductions immediately, and continue to do so if the programs continue to be implemented over the years; and
- Delivering avoided climate damages at a fraction of the cost of structural energy efficiency programs (Hibbard et al. 2020).

With an increased focus on decarbonization, we know it's becoming increasingly important to focus not just on total savings but drilling down deeper into when those savings occur. Savings are more valuable to the grid when they occur when demand, avoided emissions, and avoided costs are relatively high. Analysis of a large set of advanced metering infrastructure (AMI) data showed that savings from HER programs are proportionally higher during peak hours and peak days (Todd et al. 2014). While the detailed measure end use curves of BEE programs vary by utility territory, results across Opower implementations have revealed that generally, HER programs generate savings that are relatively well-aligned with the overall system load profile. Specifically, Oracle has found that savings are 1.5x higher than average during peak hours of peak seasons, as shown in Figure 1. So, if an HER program has overall savings of two percent, it would likely actually achieve three percent savings during peak hours. These results are based on HER EE programs specifically and don't even include solutions like Behavioral Demand Response or Behavioral Load Shifting that are specifically designed to address energy consumption during peak times.

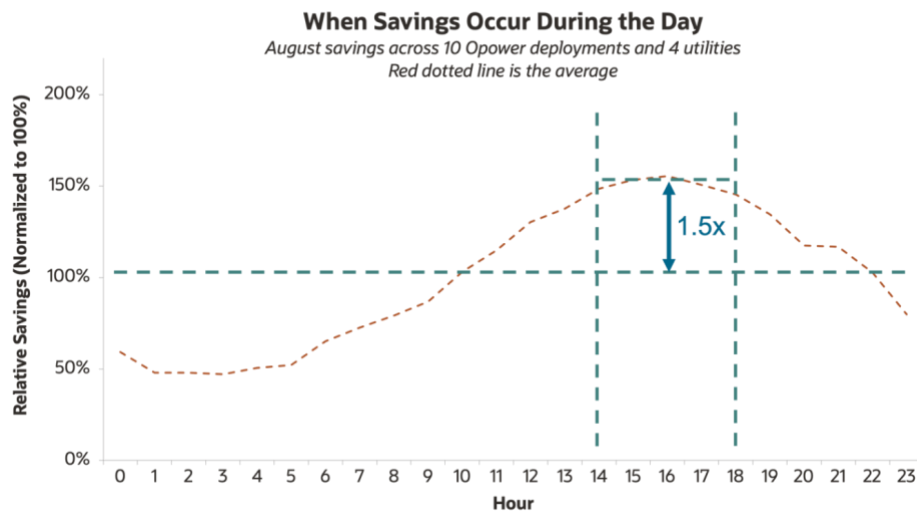


Figure 1. Average normalized daily savings by hour from HER programs during a summer month. *Source:* Oracle/Opower.

Energy Efficiency and Climate Change

Time is running out to respond to the climate crisis, and we know we need to deliver decarbonization outcomes equitably and affordably. And while a growing number of states and utilities are setting climate goals with a focus on equitable solutions, these goals aren't necessarily supported by energy efficiency regulations that will result in investments in solutions that will deliver GHG reductions when they're needed most to address the climate crisis most effectively. Specifically, in some places, such as Massachusetts and New York,¹ there has been a push to prioritize longer-lived measures or lifetime savings goals over shorter-lived measures or annual savings goals, based on an unfounded and incorrect assumption that this approach would yield better climate outcomes.

To better understand and articulate the performance of EE programs from a climate perspective, the Opower team at Oracle commissioned the research firm Analysis Group to conduct a first-of-its-kind study. Using public data from the most recent demand side management (DSM) filings for electric utilities in 4 states, the study compares behavioral EE programs to non-behavioral, or "structural", energy efficiency programs, in a variety of areas. To be clear: this report is not suggesting that behavioral EE is a *better* climate solution than deep energy retrofits. It should, however, be seen as a counterweight to the trend of focusing policy efforts on long-lived measures *at the expense of* simultaneously driving immediate reductions in GHG emissions through behavioral programs. An oft-forgotten fact of atmospheric science is that every ton of CO₂ emitted causes increased climate change impacts for *120 years* (Iowa State). In other words, while a measure with a one-year EUL may only reduce energy consumption for that one year, the lifetime *climate impacts* of those CO₂ reductions last for 120 years, and this must be factored into decisions about which types of programs to prioritize and deprioritize. Different types of EE programs have different value profiles, and energy efficiency categorically has a critical role to play in addressing the climate crisis. This research was a rigorous analysis to substantiate the real climate value of BEE. (Hibbard et al. 2020).

The Hypothesis

The research is predicated on the idea that a ton of carbon avoided today is worth more than a ton avoided in the future and set out to test the hypothesis that behavioral EE has a significant impact on achieving climate goals, despite having a short measure life. Structural EE programs lead to the installation of EE measures with a longer effective useful life (EUL) that achieve significant energy savings and GHG emissions reductions on a lifetime basis. However, logistically, and administratively it can be difficult to ramp up structural retrofit programs to reach high participation levels, and the savings and emissions reductions get stretched out over a longer period. So, a program that saves 100 megawatt hours (MWh) in 2021 will have greater value in avoided damages than a program that saves 100 MWh over ten years from 2021-2030 at

¹ Massachusetts: An Act Creating a Next-Generation Roadmap for Climate Policy requires a GHG reduction goal for the 2022-2024 Energy Efficiency Plans. The goal requires the Electric and Gas Plans to collectively save at least 845,000 metric tons of CO₂e in 2030 with a focus on long-term measures with measure lives of at least 8 years to qualify as a resource for GHG reduction in 2030. In New York, utilities are incentivized to focus on specific outcomes (i.e., arbitrary effective useful life metrics) rather than achieving all cost-effective energy efficiency or a focus on emissions.

a rate of 10 MWh per year. This stems from the many reasons that achieving GHG emissions reductions sooner rather than later is higher in value, for example:

- The sooner emissions reductions are achieved, the sooner we begin to avoid the financial and societal risks and damages associated with those emissions.
- Early reductions push out the year when concentrations in the atmosphere may cross dangerous thresholds, or “tipping points.”
- Achieving reductions now reduces the burden - and likely the cost - of accomplishing the needed level of reductions later in time. Failing to make reasonable progress toward the emissions reduction goals places too great a burden on future economies to make up the difference.
- More aggressive action to reduce emissions now increases the flexibility governments will have to achieve deeper and more difficult reductions later; early reductions extend the time to develop processes and technologies that will be needed to get to deeper cuts.

Analyzing recent BEE and SEE program results published in publicly filed EE annual reports for a sampling of utilities in the US, the study compares behavioral and structural energy efficiency programs in terms of the following metrics:

- Cumulative lifetime electric savings
 - Sum of the annual energy savings across the EUL
- Cumulative avoided CO₂ emissions
 - Sum of annual reduction in CO₂ emissions across all years from implementation of the program in one year, considering the EUL of the measures and GHG intensity of electricity production
- Cost per ton of avoided CO₂ emissions
- Cumulative avoided climate damages²
 - Monetized damages associated with an incremental increase in GHG emissions each year. It includes (but isn’t limited to) climate change-caused changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services.
- Cost per dollar of avoided climate damages
- Number of participants

The Results

According to Analysis Group, structural programs generate cost-effective energy savings across the EUL of measures included in their programs, while behavioral programs are extremely cost-effective in reducing CO₂ emissions and increasing avoided climate damages by achieving fast reductions now (Hibbard et al. 2020). BEE programs can reach more customers due to their

² This is calculated as the present value of damages avoided due to reduction in CO₂, considering (a) annual reduction in emissions of CO₂ in each year, (b) the social cost of carbon which estimates total expected damages associated with emissions of GHGs in a given year, and which varies with the year in which the emissions occur, and (c) a discount rate to put future avoided damages into present-year terms. This does not include avoided energy and capacity costs.

opt-out nature, regardless of housing type, income, or location. BEE programs maximize the time value of achieving GHG emissions reductions sooner rather than later. This translates into a higher level of avoided damages from climate change per dollar spent (Hibbard et al. 2020). The research demonstrates that from a climate perspective, all types of energy efficiency programs are exceptional and necessary.

Table 2 provides a summary of metrics for National Grid, Massachusetts. This table highlights that the BEE program delivers climate benefits at a fraction of the cost of structural programs³; for Massachusetts this is about one quarter of the cost of structural programs.⁴

Table 2. Summary Comparison of Structural and Behavioral Energy Efficiency Programs Through 2030

Parameter	Structural Program (with lighting)	Structural Program (w/out lighting)	Behavioral Program
Cumulative Lifetime Electricity Savings (MWh)	410,010	211,357	227,246
Cumulative avoided CO ₂ emissions (tons)	110,679	54,949	65,411
Cumulative avoided climate damages	\$5,728,492	\$2,803,445	\$3,464,562
Number of participants from 2019-2021	76,957	76,957	705,000
Cost per ton CO ₂ avoided	\$1,367.05	\$2,104.30	\$287.17
Cost per dollar of avoided climate damage	\$26.41	\$41.25	\$5.42

Source: Hibbard et al. 2020.

A key takeaway from this example in terms of climate impacts is that scale has its advantages. The Massachusetts BEE program reaches nearly ten times the number of customers in the SEE program over the three-year program period and, even with its short EUL, delivers more lifetime energy savings and avoided emissions than the SEE program without lighting. The structural program is presented with and without lighting because lighting continues to be phased out from utility DSM portfolios, and utilities are considering more complex energy efficiency measures (e.g., heat pumps) to help achieve their savings goals. Even with a 1-year measure life, BEE programs deliver avoided CO₂ emissions and avoided climate damages at a significantly lower cost than SEE programs. BEE programs are also relatively equitable by enabling a significantly larger and more diverse range of customers to benefit directly from the program during the cycle in which they are paying into the energy efficiency fund. BEE programs deliver scaled energy savings and GHG emissions reductions on a short time scale. SEE programs lead to installation of energy efficiency measures with long EULs that achieve significant energy and

³ The National Grid structural program represented is Residential Coordinated Delivery from 2019-2021

⁴ This table tracks the program costs per ton of avoided CO₂. It does not include utility and customer savings that flow from investment in EE. When ratepayer benefits are considered, the Analysis Group found that the EE programs included in the study achieve CO₂ emissions reductions at negative costs.

GHG emissions reductions on a lifetime basis. Many stakeholders incorrectly assume that "longer is better" when it comes to EUL and undervalue shorter-lived measures, when truly both are indispensable tools in the fight against climate change.

Utilities should administer BEE programs alongside SEE programs and increase investment in both. There is evidence that BEE programs increase participation in SEE programs, further increasing savings and avoided GHG emissions. A conservative estimate from past program assessments has found that coordinated administration of BEE with other EE programs can increase participation rate by nine percent (Allcott and Rogers 2014). Since BEE programs are flexible, data driven, and backed with behavioral science and artificial intelligence, they can be tailored with messages and energy savings options that are specific to customers' personal circumstances and help utilities achieve specific goals. Following the National Grid example above, Figure 2 below shows how BEE programs can create more participation in SEE programs, which increases energy efficiency savings and GHG emissions reductions. In addition, Figure 3 shows the relative speed at which BEE programs deliver avoided CO2 emissions.

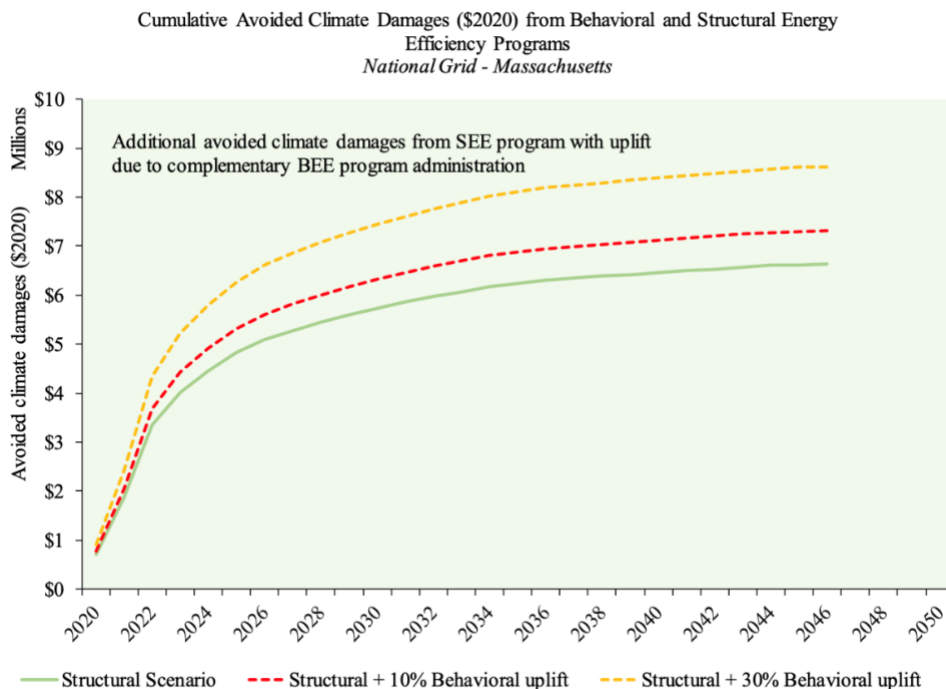


Figure 2. Coordinated Delivery of BEE and SEE programs. *Source:* Hibbard et al. 2020.

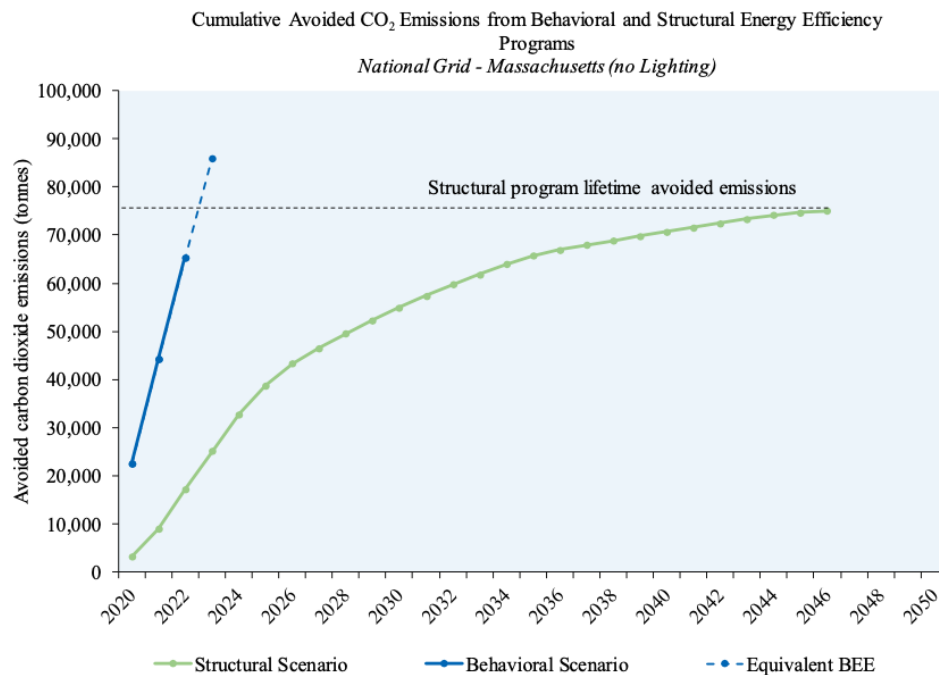


Figure 3. Timing of Cumulative Avoided CO₂ Emissions: BEE and SEE programs. *Source:* Hibbard et al. 2020.

Overall, the Analysis Group study found that BEE delivers climate benefits significantly faster and cheaper than SEE. While individual customer savings may be small for BEE programs, they deliver significant climate benefits at scale, and coordinated administration of BEE and SEE programs can drive greater benefits and help utilities achieve their goals faster. Timing matters: just as energy savings are more valuable when generation is dirtiest and most expensive, GHG emissions reductions are more valuable the sooner they are achieved. Achieving GHG emissions reductions sooner and faster has incredibly important implications for the degree of damage climate change will cause. Understanding these results, let's examine the role utility customers play in achieving decarbonization goals.

Utility Customer Pathway in Decarbonization

Utility customers play a key role in achieving decarbonization goals. As we've seen, through energy efficiency alone, utilities can achieve significant avoided climate damages. With decarbonization goals that go beyond energy efficiency, there are additional tools that can be leveraged in the residential sector to achieve GHG emissions reduction targets. Oracle engaged The Brattle Group to quantify this potential. The report focuses on two key sectors, residential homes and light-duty vehicles, "in which customer actions have a direct impact on GHG emissions" (Sergici et al. 2021, 2). This is considered the customer action pathway to decarbonization. By focusing on homes and light-duty vehicles, the research is pointing to energy efficiency, rooftop solar, growing adoption of EVs, and home electrification as the fastest and most efficient ways that customers can make a difference in climate change.

The Brattle Group found that by 2040, utility customer action can reduce nearly two times more emissions than clean energy supply alone. They modeled 284 million metric tons of avoided CO₂ available by “greening the grid” with non-emitting energy supply sources. On the customer side, when Brattle added together gas and electric energy efficiency⁵, beneficial electrification, and behind-the-meter solar, they found 534 million metric tons of avoided CO₂. Table 3 below details the potential for demand side resources.

Table 3. Utility Customer Potential for Decarbonization

Energy Efficiency	Beneficial Electrification	Demand Flexibility
Reduce emissions with efficient building upgrades and behaviors. 180 MMT of emissions reduction by 2040	As supply becomes cleaner, convert transportation and heating to electricity. 287 MMT of emissions reduction by 2040	Enable renewables & resiliency. Optimize beneficial electrification with smart price signals and DER automation.
Equity and Affordability		
Provide equitable access to clean energy solutions and ensure limited-income customers do not get stuck with the cost of a more expensive energy system.		

The report found that near-term GHG emissions reduction potential at the household level is driven by energy efficiency and behind-the-meter solar through 2030 because of higher near-term power generation emission rates (Sergici et al. 2021). Energy efficiency savings today have a greater climate impact than the same energy efficiency savings in the future because the electricity fuel mix is becoming more climate-friendly over time as we continue to invest in clean energy generation resources and decommission higher-emission resources. Customer adoption of electric vehicles (EVs) may provide the greatest emissions reductions by 2040. Notably, EV adoption emissions impact increases significantly between 2030 and 2040 because of the potential 4x increase of EVs on the road combined with lower power generation emission rates (Sergici et al. 2021). Figure 4 below shows how each factor in the customer pathway will impact GHG emissions. In addition, demand flexibility (e.g., smart thermostats and time-varying rates) will be an essential component of customer action in decarbonization.

⁵ Energy efficiency in the Brattle report is inclusive of behavioral and structural energy efficiency. They are not separated out from each other as they were in the discussion of the Analysis Group paper.

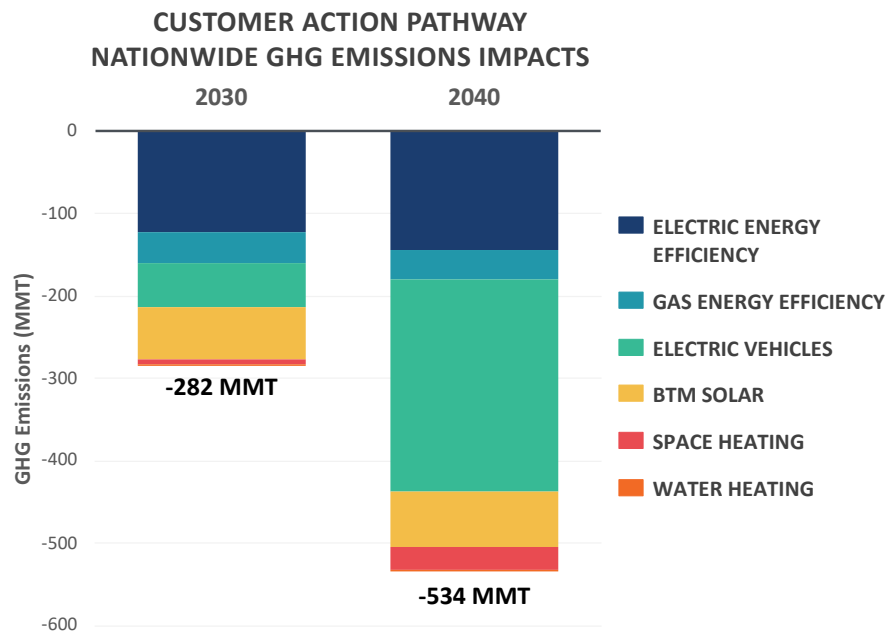


Figure 4. Customer Action Driving GHG Emissions Reduction *Source:* Sergici et al. 2021.

Demand Flexibility

Demand flexibility is necessary to support and enable the customer pathways for decarbonization. Demand flexibility facilitates the integration of renewable energy resources, reduces renewable energy curtailment, and mitigates the need for system upgrades to serve rising peak demand. The benefits of demand flexibility include:

- Reduce renewable curtailment by shifting energy usage to hours of low net load;
- Reduce or shift energy usage away from hours with high marginal emissions rates;
- Facilitate cost-effective adoption of electrification by mitigating load impacts of new electricity-intensive end-uses; and
- Provide real-time grid balancing services increasingly needed with increasing intermittent generation resources (Sergici et al. 2021).

There is a significant amount of untapped demand flexibility potential in the residential sector that will continue to grow as more customers adopt technologies such as EVs, battery storage, and smart thermostats. A 2019 Brattle study estimated that there is nearly 200 GW of cost-effective demand flexibility potential in the US by 2030, roughly 20 percent of 2030 US peak demand (Hledik et al. 2019). Behavior can play a role in demand flexibility with strategies such as behavioral demand response, behavioral load shifting, rates engagement, and device automation.

Beneficial Electrification

Beneficial electrification (also commonly referred to as strategic electrification) is powering end uses (e.g., space and water heating or vehicles) with electricity instead of fossil fuels in a way that increases efficiency and reduces GHG emissions. This often includes fuel-switching from gas or oil powered end uses to highly efficient electric end uses. A surprising finding from the Brattle report is that home electrification is a much smaller contributor to GHG reductions, even as the grid greens (Sergici et al. 2021). This is largely due to low customer adoption rates of efficient heat pumps resulting from the large upfront capital investments associated with these technologies. In short, throughout much of the country, electrification of household end uses is simply not cost-effective for most residential customers, absent significant subsidies that tend not to be cost-effective from a ratepayer standpoint. While market transformation efforts are ramping up to address this issue, Brattle's findings point to the importance of continuing to fund more traditional energy efficiency and demand response programs and diverting funding from such programs to electrification is likely to result in a slower path to our GHG reduction goals.

The Brattle report identified that emissions reductions from home electrification vary across regions and are highly concentrated in the Northeast, where oil and propane heating are still prevalent. Space heating electrification may result in a net reduction of five million metric tons (MMT) of GHG emissions in 2030 and 28 MMT in 2040; of that, the Northeast accounts for 12 MMT. (Sergici et al. 2021). Behavior-based strategies can help accelerate electrification, including EV adoption, EV owner engagement, and simplifying complex purchases for home electrification (e.g., heat pumps).

Case Studies

To contextualize the findings of these reports, the following section includes two case studies, one of National Grid in Massachusetts and the other of Pacific Gas and Electric Company (PG&E) in California. These case studies demonstrate instances of behavior-based strategies being leveraged to drive decarbonization outcomes. The National Grid case study examines how behavioral outreach can generate more weatherization results. The PG&E case study provides an example of how behavior has evolved beyond HERs to better influence the timing of savings to target more avoided GHG emissions.

Massachusetts

National Grid is pursuing some of the most ambitious decarbonization goals in the industry. In the winter of 2021, National Grid used its behavioral energy efficiency program to change the status quo of their weatherization program (officially called Residential Coordinated Delivery). Even though weatherization makes homes cozier and healthier, influencing people to take that action is notoriously difficult. Driving participation in the weatherization program was a priority for National Grid because it reduces carbon emissions and helps their customers save on winter heating bills. National Grid leveraged the behavioral program to accelerate their weatherization program to demonstrate to their stakeholders that these two energy efficiency

programs are better together. The goal was straightforward: weatherize more homes, which served three strategic purposes:

- Reduce emissions quickly and affordably by reducing customer heating energy use;
- Satisfy customers by helping them lower their winter heating bills; and
- Demonstrate the power of behavioral programs in supporting weatherization to energy efficiency stakeholders.

Between December 2020 and April 2021, National Grid delivered hundreds of thousands of Opower’s disaggregation-powered HERs with heating insights and weatherization program promotions to their Massachusetts customers. Half of those promotions were static content (messaging control), and half were personalized with disaggregation insights that showed each customer how much they spend on heating (messaging treatment). Customers clicked those personalized promotions at a 75 percent higher rate than the static ones. A randomized controlled trial (RCT) was used to measure statistically significant differences in how customers digitally engage with disaggregation modules.

- Messaging treatment: received winter eHER with heating comparison & personalized weatherization promo with disaggregation pie chart
- Messaging control: received winter eHER with heating comparison & static weatherization promo

This randomization process ensures both groups are statistically equivalent and allows us to understand the impact on key outcomes such as energy usage, digital engagement, and participation in the weatherization program. Figure 5 below shows the results of the experiment.

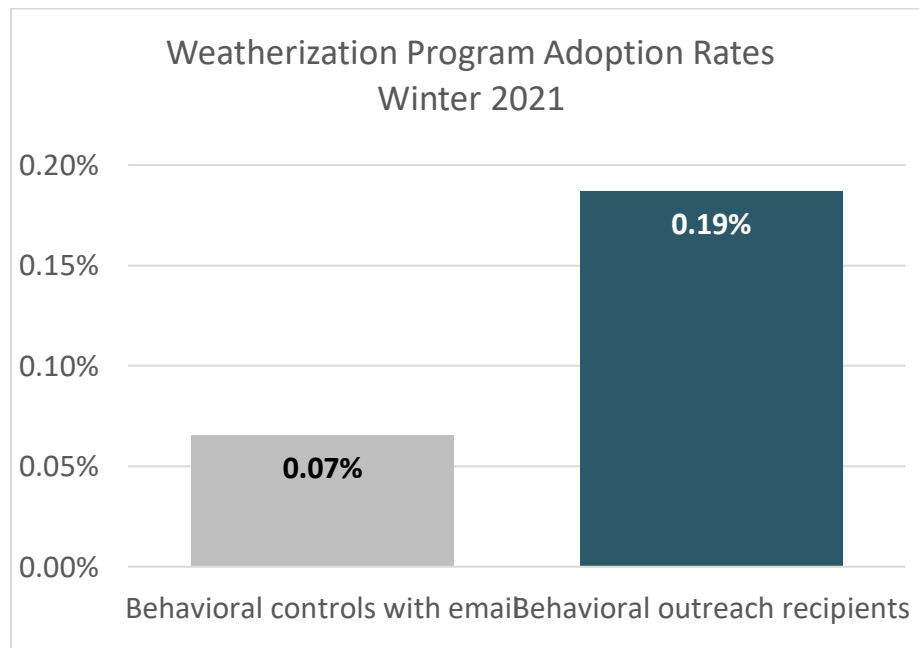


Figure 5. National Grid Weatherization Test Results. *Source:* Oracle/Opower 2022.

Figure 5 shows National Grid nearly tripled their weatherization program adoption rate by delivering digital HERs with heating comparisons and personalized weatherization promotions. The BEE program helped National Grid get more than 300 additional homes weatherized between December 2020 and April 2021 (Oracle 2022). These results provide a clear example of how BEE and SEE programs can be administered in a coordinated manner.

California

The Golden State has a long and storied history of leadership on both climate change and energy efficiency efforts that date back to the 1970s. As a result, California leads the nation in solar energy and has set aggressive targets for its renewable portfolio standard (RPS) such that the state plans to source 100 percent of its electricity from zero-carbon generation by 2045. While this is incredibly exciting from a GHG mitigation standpoint, such a strategy is not without its challenges. The intermittency of renewables creates quite the headache for the state's grid operator, CAISO, which must balance customer demand with the tectonic shifts in the generation output of these resources each day. This in turn means that DSM programs must help fill the gaps by driving energy use reductions during specific hours of the day and year.

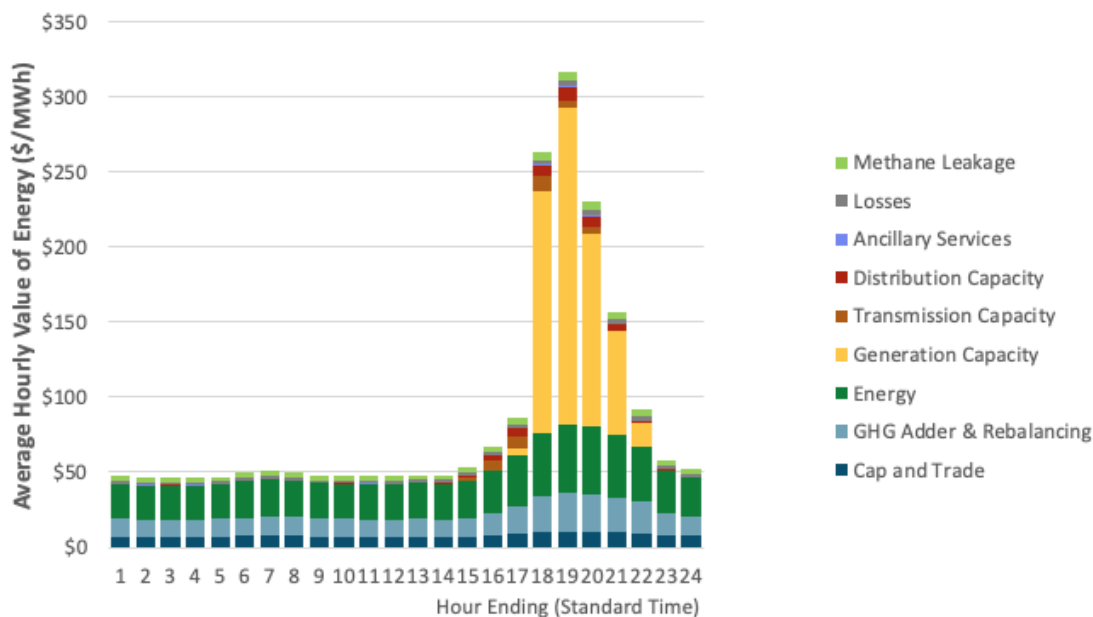


Figure 6. CA hourly average avoided costs. *Source:* CAISO.

Fortunately, the California Public Utilities Commission (CPUC) and other state agencies have invested heavily in analyzing these price swings and incorporating them into the most granular avoided cost framework of any state in the country. This creates a challenge and opportunity for DSM program providers. On the one hand, average avoided costs are quickly

falling year after year; on the other hand, avoided costs in specific hours are incredibly high, creating an opportunity for programs that can capture savings during those times. While most efficiency measures have fairly static load shapes, the advantage of behavioral EE programs is that they can adapt their tactics to focus savings on those hours that matter most. In 2018-19, PG&E released a solicitation for innovative residential EE programs, and in response, the Opower team at Oracle created the Continuous Energy Feedback Program.

Building on the existing HER program, which comprised upwards of 50 percent of total savings in PG&E's portfolio,⁶ this new program design adds new elements that both boost overall savings and focus them during the most valuable hours of the day. This is achieved through the following innovations:

- Focusing HER messaging on peak periods of the day;
- Leveraging CA's nation-leading TOU rate rollout and incorporating all-new TOU Coaching e-mail communications that provide a weekly look-back at the specific ways each customer used energy, followed by load-shifting tips personalized to each household's usage patterns and appliances; and
- Layered Bill Forecast Alerts to let customers know when they're on track for a particularly high bill with plenty of time remaining in their billing cycle to lower their usage.

The entire program utilizes multiple RCTs to continuously measure not only the quantity of energy saved, but also the 8,760 (hours per year) shape of the savings. This enables Opower to monitor and adjust the load shape assumptions as needed throughout the program's lifecycle. The various program elements are currently being phased in, and the combined innovations are set to achieve a 55 percent boost to cost-effectiveness relative to prior iterations of stand-alone HER programs, while driving over 185 GWh, 6.2 million therms, and 42 MW of energy and demand reductions annually (CEDARS 2022).

Recommendations

Based on the findings from the Analysis Group and Brattle reports, as well as the case studies, the following are regulatory recommendations to consider in setting up states and utilities for success in achieving decarbonization goals.

- Consider GHG metrics and the timing of GHG reductions in the planning, budgeting, and evaluation of EE programs, such as cumulative GHG reduction targets for energy efficiency program cycles (e.g., three-year plans) that prioritize avoided GHG emissions throughout that cycle.
- Maintain annual energy savings goals to capture the time component of avoided GHG emissions.

⁶ CPUC's California Energy Data and Reporting System (CEDARS): PG&E total claimed net savings- 318.6 GWh (<https://cedars.sound-data.com/upload/confirmed-dashboard/PGE/2020/>); PG&E claimed net savings from Residential Energy Advisor- 161.4 GWh (<https://cedars.sound-data.com/programs/PGE21001/details/2020>)

- Pursue all cost-effective energy efficiency. This is critical as beneficial electrification measures begin to integrate in energy efficiency portfolios to ensure all measures that are cost-effective are considered without favoring short- or long-term measures.
- Adopt performance incentives or performance-based regulation frameworks that reward utilities for cost-effective energy savings and rapid GHG emissions reductions. Utilities can set GHG-related performance incentives that reward utilities based on achieving a certain level of avoided climate damages through energy efficiency and electrification.
- Promote joint design and administration of BEE and SEE programs for cross-pollination in the portfolio. Program managers for BEE programs should coordinate with EE, marketing, electrification, and low-income program teams to identify opportunities to leverage behavior-based strategies for their programs.
- Implement and maintain revenue decoupling to promote energy efficiency and beneficial electrification. Decoupling ensures utilities are not disincentivized to pursue energy efficiency while promoting electrification. This regulatory mechanism provides stable revenue for utilities regardless of sales volume.

Conclusion

As utilities work to decarbonize in support of climate goals, it is important to think beyond clean energy supply, as by 2040, utility customer action in the areas of energy efficiency, beneficial electrification, and demand flexibility can reduce nearly two times more GHG emissions than clean energy supply alone. Programs using behavioral science principles and techniques can accelerate and maximize the potential from customer action, while delivering other outcomes like supporting equitable distribution of benefits. BEE programs deliver climate outcomes at ~1/4 the cost of SEE programs and scale ~5x faster, and utilities should administer both BEE and SEE in a coordinated manner for maximum impact. As stakeholders consider the role of EE in decarbonization, timing is crucial. Energy savings are more valuable when generation is dirtiest and most expensive, GHG emissions reductions are more valuable the sooner they are achieved, and regulatory frameworks should be thoughtfully structured to incentivize both outcomes. National Grid in Massachusetts and PG&E in California provide real-world examples of how utilities are putting these principles into practice.

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