

Evaluation of Programs for “Hard to Reach” Customers and Leveraging Non-Energy Impacts (NEIs)

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ABSTRACT

As a reflection of the dynamic nature of the present energy system and its associated challenges, non-energy impacts (NEI) have become increasingly important to program administrators seeking to meet evolving program goals. As Consortium for Energy Efficiency (CEE) member organizations increasingly work to serve Hard-to-Reach (HtR) customer groups, evaluating, prioritizing among, and achieving cost-effectiveness with these programs remains an ongoing challenge. Simultaneously, some policy objectives drive programs to reach diverse customer groups equitably; demonstrating that programs comply with equity-related policies and capturing the true value of programs is an added complexity. The CEE membership recognizes the potential benefit of taking a deeper dive into NEIs and recently fielded a survey of administrators’ energy efficiency program in the US and Canada to understand needs and priorities in the industry. The survey has informed CEE’s ongoing work on NEIs, and establishing common language and definitions around NEIs, coming up with criteria to prioritize which NEIs to study in more detail to benefit the industry broadly, and then investing in that research, is a valuable course of action. Program administrators will benefit from an energy efficiency industry characterization of NEIs and the methodologies that are in current use, an understanding of the most critical challenge(s) program administrators face when considering NEIs, and a national scale study of a subset of NEIs valid across jurisdictions. This information will facilitate exchange among program administrators and enable more comprehensive consideration of the true value of efficiency programs for future program impacts and support resource prioritization.

Introduction

Some member utilities of the Consortium for Energy Efficiency (CEE), a consortium of ratepayer-funded efficiency program administrators from the US and Canada, are increasingly prioritizing more equitably serving their customers with energy efficiency programs. These efforts include a renewed focus on historically underserved audiences such as income eligible, low-English proficient, and indigenous energy users. Because these customer groups are often low energy users, and it can be expensive to reach these energy users, the implementation of efficiency programs targeting these audiences may not meet program cost-effectiveness thresholds, where those thresholds are applicable for these customer groups. A subset of members within CEE have joined forces to collectively analyze how non-energy impacts (NEIs) can be quantified and monetized for programs geared to underserved audiences. This paper describes the early stages of this collaborative work efforts to ensure that NEIs are more fully accounted for in valuing energy efficiency programs.

The study and consideration of the NEIs arising from energy efficiency programs has long been a practice among program administrators, and significant research has already been done to quantify the impact of programs on numerous NEIs of interest. Studies of the non-energy benefits (NEBs) arising from energy efficiency programs have been published as early as 1990

(e.g., Vine and Harris 1990), and hundreds of studies and reports have followed. A report from the Lawrence Berkeley National Lab recently reviewed NEI studies from 30 states to assess the transferability of findings from one jurisdiction to another (Sutter et al. 2020), which is an area of continued relevance and investigation at CEE. In addition, other efforts have been made to establish a framework for the categorization of NEIs (see Rasmussen 2017 for an example of this for the industrial sector). The impact of programs on low-income and other underserved audiences has also been a subject of previous investigation (e.g., Heffner and Campbell 2011; Schweitzer and Tonn 2003; Skumatz, Kawaja, and Krop 2010; Raissi and Reames 2020), as well as the effectiveness of NEIs as motivators for customers to make energy-efficiency improvements (Mills and Rosenfeld 1996). While the research area is mature, changing industry conditions has renewed program administrator interest and raised the profile in this work. Program administrators are increasingly engaging in new research to fill in the gaps in both NEI coverage and jurisdictional relevance to meet present circumstances and challenges.

This paper describes recent approaches that have been considered amongst some program administrators as they have worked to quantify and monetize some NEIs, and it does not draw conclusions about best practices, nor is that the goal of this effort. Rather, the authors seek to categorize the contextual setting, characterize the specific NEIs, and describe the methods associated with program administrator experiences with the eventual outcome of the work as transferable learnings for better attribution of NEIs.

Purpose, Scope and Methods

Objective

Program administrators recognize the importance from an equality standpoint of ensuring that all customers have easy access to the value of their energy efficiency programs. Additionally, many members have mandates specific to serve income eligible and underserved customers within their service territories, and the purpose of this work effort is to enable Program Administrators to more effectively value non-energy impacts of their programs focused on underserved audiences.

Some underserved customer groups may use little energy, making it difficult for program administrators to achieve significant energy savings or cost effectiveness from these programs relative to typical efficiency programs.¹ Research efforts quantifying NEIs are often difficult and expensive, and therefore sometimes difficult to undertake. In addition, underserved customers may be more motivated to participate in utility programs if they perceive benefits beyond energy savings, in areas that may be of higher priority to them. As such, there is interest among program administrators in working together as a community to study and characterize some NEIs and develop better understanding of methodologies used by some to quantify NEIs, aiding in the improvement of the cost effectiveness of these programs.

This effort offers an opportunity for program administrators to exchange and learn from their respective experiences on NEIs to more equitably engage energy users and promptly apply the latest “state of the art knowledge” to their programs and efficiently satisfy both internal and external mandates on equity. The focus of this research effort incorporates the following objectives:

¹ In other instances, the opposite may hold true, and underserved customers lacking adequate insulation may have quite high energy usage and associated costs.

- Identify and define the NEIs resulting from programs to realize true participant and societal values most likely to compel greater program participation.
- Characterize and describe methods that quantify NEIs relevant to underserved audiences such as improved health and safety in order to more accurately represent the true costs and benefits of programs.
- Provides the chance to collectively classify and quantify additional benefits beyond legacy NEIs of reduced water and fuel consumption.

Scope

Over the past year, the topic of NEIs has risen in importance among members of CEE's Evaluation Committee, as revealed in Committee meeting discussions and in a survey of Committee members. The Evaluation Committee at CEE brings together program administrator evaluators to identify and seek solutions to common challenges as part of CEE's mission to progress the demand side management industry. Concurrently, CEE has launched a Center for Equity and Energy Behavior, reflecting the persistent and growing interest among program administrators to more equitably serve all customers in their jurisdictions. While the work of the Center will have several facets, NEIs have been identified as a means for program administrators to understand the impact of their programs on equity-related goals and will be one of the focus areas of the Center. The characterization of NEIs introduced in this paper will be within the scope of the Center, and the Evaluation Committee will continue to take complementary steps to progress program administrators' ability to effectively utilize NEIs. In this vein, the Evaluation Committee is currently hosting a series of lunch-and-learn calls highlighting recent member research. One outcome of this call series is an opportunity to capture the key elements required for a meaningful characterization of NEIs serving the needs of members and the goals of CEE's Center for Equity and Energy Behavior. This effort will provide a framework for establishing common language and definitions around NEIs, with an eye towards those most meaningful for programs geared to underserved audiences.

The scope of the Center's characterization effort begins with an investigation of the landscape of all NEIs relevant to energy efficiency programs, narrowing down which may be most beneficial and prove particularly relevant to equity objectives and garnering greater program participation, and defining and characterizing those NEIs. The next step is to consider how NEIs can be more completely accounted for when understanding all the benefits associated with programs to support program investment and accurately characterize program impacts. These activities will take place during the first of the three years of Phase 1 of the Center for Equity and Energy Behavior. Through this work efforts, CEE members will share learnings on how different jurisdictions have addressed the practical constraints around incorporating NEIs when considering the cost-effectiveness of their programs and portfolios in concert with the tension to more equitably serve all energy users, many of whom are not cost-effective to engage.

Methods

Energy efficiency program administrators have begun collaborating to better understand approaches to quantifying and valuing NEIs in the U.S. and Canada. This collaboration will include an assessment of which NEIs may most benefit program equity. CEE is pursuing several efforts to help program administrators address pressing needs related to NEIs, including the following:

- An already-completed member survey to establish program administrator priorities.

- A characterization of NEIs, especially as it concerns impacts to HtR customer groups, under the umbrella of CEE's new Center for Equity and Energy Behavior.
- An on-going call series highlighting recent NEI research with a focus on identifying components of recent work that are potentially transferrable across jurisdictions.

CEE Member Survey

To better understand energy efficiency program administrator priorities and approaches to quantifying NEIs as related to equity in the U.S. and Canada, CEE's Evaluation Committee conducted a survey among these program administrators and also held a series of discussions to seek input from North American utility staff on these topics. Overall, CEE led 6 roundtables between June 2021 and April 2022, which included participation from 37 utilities in the U.S. and 5 utilities in Canada.

CEE Center for Equity and Energy Behavior

Using preliminary survey results as a starting point, the overarching approach of the upcoming work effort of the Center is as follows, with each of these three steps corresponding to one of each of the three years of Phase 1 of the Center:

1. *Characterize NEIs*: consider and develop comprehensive inventory of possible NEIs, i.e., those with societal, utility and/or participant benefits associated with program delivery; define and characterize these NEIs giving context to jurisdictional traits, audience served, governing policy and regulation, common definition of the benefit as well as cost-effectiveness perspective in order to more accurately represent the true value associated with programs.
2. *Prioritize NEIs*: determine what criteria should be used to gauge the relative priority of the NEIs identified for further study, assess each NEI relative to these criteria with an eye towards transferability across jurisdictional boundaries, and consider which equity-relevant NEIs will be priorities for Center focus.
3. *Synthesize and Analyze*: Based on project participants discretion, engage in deeper-divide research exercise on priority NEIs based on the first two years learnings. This could include developing recommendations for methods for the inclusion of NEIs in program valuation if circumstances or mandates provide for opportunity to capture NEIs, or may alternatively include conducting a national-scale study of prioritized NEIs leveraging methods that enable transferrable learning. This work would consider approaches for better quantifying priority NEIs and identify or apply transferable quantification approaches that have yielded successful outcomes.

Evaluation Committee: NEI Lunch-and-Learn Series

To better understand energy efficiency program administrator priorities and approaches to quantifying NEIs as related to equity in the U.S. and Canada, program administrators within the CEE Evaluation Committee have been sharing their research efforts through a series of calls highlighting recent program administrator NEI research. Leveraging non-energy program benefits can be challenging, and by understanding the experiences of their more experienced peers, members have an opportunity to develop a collective understanding of approaches that are gaining traction in some service territories. The lunch-and-learn series is an opportunity to identify what elements will be critical for the characterization efforts of the Center for Equity. The following elements have been shared during the first three sessions:

- Definition of impact, including accounting frame (i.e., is the benefit estimated based on impact to participants, to society, or to the utility)
- Intended audience and audience definition (e.g., income eligible could be defined as income below 80 percent of the area median income or by customer's energy burden)
- Governing policy or regulation
- Other external drivers motivating the study
- Application of study to energy efficiency programs (e.g., are the NEIs to be included in cost-effectiveness testing, and what is the relevant methodology; are the NEIs intended to be used in marketing programs based on benefits other than energy savings; NEIs estimated for a different reason)
- Method of quantification (e.g., primary or secondary research, input data, assumptions, methodology)
- Assessment of the transferability of the findings to other jurisdictions

Results

CEE Member Survey

In total, 19 program administrators responded to a cursory member survey. Questions focused on which NEIs were of highest priority to better understand and quantify, and also sought input on how these topics could most effectively be addressed collaboratively which has lead to the upcoming characterization of NEIs through the efforts of the Center. Though these are overview level data, three NEIs rose to the top. The first NEI of high interest was economic benefits to underserved groups, such as low-income energy users, with 16 of 19 respondents asserting this was a priority or high priority. Environmental impact related NEIs (such as outdoor air quality or conservation improvements) were also highly valued, with 15 out of 19 respondents identifying this as either a priority or high priority. Finally, health and safety related outcomes (such as improved indoor air quality and improved living conditions) were mentioned by 14 of the 19 respondents as priority or high priority. Despite the small sample size, this initial data provides an early glimpse into U.S. and Canadian priorities for how better accounting for NEIs to fully value programs may go hand-in-hand with equity objectives.

Program Administrator Experiences in the U.S. and Canada

To date the Evaluation Committee has hosted three NEI lunch-and-learn calls featuring research from ComEd, Puget Sound Energy (PSE), and the Independent Electricity System Operator (IESO). In this section, the coauthors of this paper from IESO and PSE capture the recent research presented to CEE members, and illustrate the types of information shared during this call series.

This nascent effort will form the initial inputs to a larger dataset that will allow for comparisons and shared learnings across programs. For the purpose of this paper, these examples represent snap shots of programmatic experience and evaluation. We conclude with an explanation of how these case studies will inform the larger work and a brief discussion of the next phase of the effort.

IESO Case Study

Background

Through a directive from the Ontario's Ministry of Energy, the IESO was directed to design, coordinate, deliver and/or fund the delivery of electricity energy efficiency programs including programs for low-income and income eligible consumers for the 2021-2024 Conservation and Demand Management (CDM) Framework. The new framework aims to provide continued opportunities for electricity consumers to manage their electricity costs, provide stability for the network of companies involved in the delivery of CDM programs and help to cost-effectively meet electricity system needs. The programs under the new framework are targeted to those who need them most, including commercial, industrial, institutional and on-reserve First Nations consumers, as well as low-income and income-eligible consumers.

Under the new CDM framework, the Energy Affordability Program (EAP) provides support to income-eligible electricity consumers by helping them to lower their monthly electricity costs and to increase their home comfort. The program offers free upgrades on lighting, showerheads and aerators, drying line for clothes, energy efficient refrigerator, window air-conditioner, attic or basement insulation, smart thermostats and weatherstripping.

People who live in Ontario (including those living in grid-connected First Nation communities) and are responsible for paying their monthly electricity bill as a homeowner or as a renter qualifies for this program. The type of support provided depends on the household income level from the previous year and the number of people in the household or on the receipt of a qualifying government or energy-support benefit. Residents of social housing are also eligible. The following table shows the household income level limits depending on the number of people residing in the home:

Table 1. Household Income Level Limits Based on Number of People Residing in the Home

Number of people in the Home	Before-tax household income (CDN\$)	Number of people in the Home	Before-tax household income (CDN\$)
1	36,578	5	81,791
2	51,729	6	89,598
3	63,354	7+	96,775
4	73,157		

The EAP evolved from the Home Assistance Program (HAP) which began in 2013 and had similar program offerings to low-income Ontarians. Similarly, the Ontario Government, through HAP, provided opportunities to low-income households to improve electric energy efficiency in their homes and to enable them to effectively manage their electricity use.

Although the Energy Affordability Program is not required to meet cost effectiveness benchmarks, the IESO has to ensure that the program is designed and delivered in a cost-effective manner as is reasonably practicable and in a manner that results in impactful electricity bill savings for low-income households. HAP has delivered significant energy savings from 7 to 21 GWh from 2013 to 2020 as shown below. Despite the savings, the program exhibited benefits-costs ratio for the Total Resource Cost (TRC) test below the cost effectiveness benchmark of 1.0 for majority of the program years. This TRC test already considered a 15 percent adder topping up the benefits from energy and demand savings for the program. This 15 percent adder represented the NEBs that can be derived from the energy efficiency program.

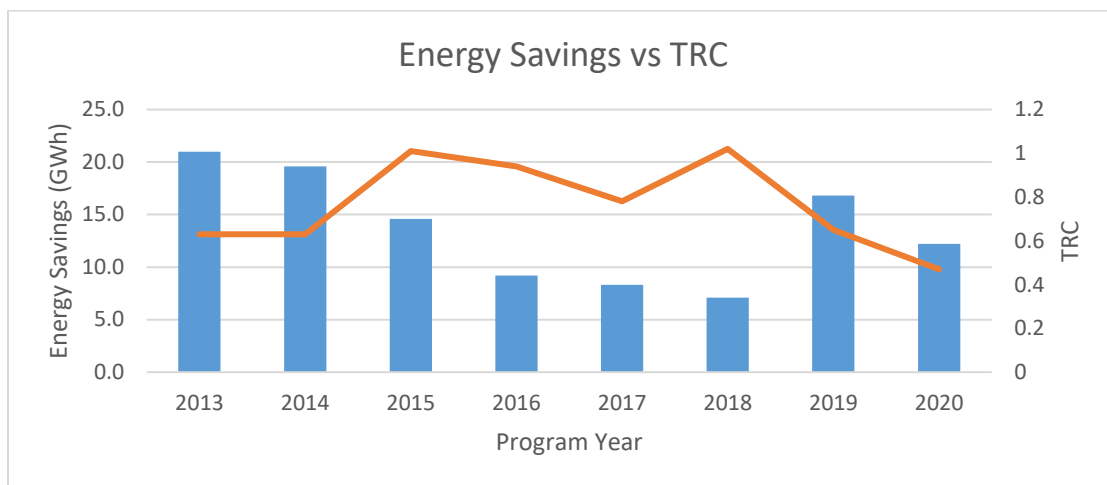


Figure 1. HAP has delivered significant energy savings from 7 to 21 GWh from 2013 to 2020. Despite the savings, the program exhibited benefits-costs ratio for the TRC test below the cost effectiveness benchmark of 1.0 for majority of the program years.

Result of the NEB Study

In an effort to improve and to demonstrate a more accurate picture of the cost-effectiveness of programs, particularly enhancing TRC test, the IESO completed a study on NEBs in 2021 which aimed to quantify Ontario-specific NEBs for different sectors including the low-income sector as shown in the table below.

Table 2. Ontario-Specific Non-Energy Benefits for Different Sectors

Non-energy benefits	Non-energy benefits (\$/kWh)						
	Consumer	Low Income	First Nation	Commercial	Institutional	Industrial	Agricultural
Reduced Financial Stress	0.03	0.09	0.09				
Thermal Comfort	0.11	0.08	0.09	0.05	0.25		0.003
Reduced building and equipment O&M	0.02			0.08	0.11	0.03	
Improved indoor air quality	0.05	0.02	0.06	0.007	0.27		0.002
Sense of control over energy decisions	0.06						
Improved lighting levels			0.08				
Reduced spoilage				0.0002			0.001
Improved business outcomes						0.04	0.09
Improved product quality						0.01	

Based on the results of the NEBs study for the low-income sector, three NEBs were identified as providing high value benefits and these are: 1) reduced financial stress; 2) thermal comfort; and 3) improved indoor air quality. Depending on the measures being offered in the program, the low-income sector may potentially get additional NEBs benefits of \$0.19/kWh.

Reducing financial stress has the highest NEB value for the low-income sector since reducing bills can help low-income populations to meet other basic needs. Thermal comfort was rated as the second high value NEB directly impacting health and providing psychological and social benefits by relieving participants from the constant reminder of inadequate housing. This is especially relevant to Canada given the extreme weather conditions that can be seen across seasons that participants expect that their home can provide shelter against a range of weather conditions. Hand in hand with thermal comfort, the low income sector put value in the improved indoor air quality from installed weatherization measures.

In terms of cost effectiveness evaluation, the resulting TRC for HAP as applied from 2015 to 2017 program implementation has improved demonstrating that the assumed 15 percent adder underestimated the non-energy benefits of the program. It was found that the quantified NEBs for the low-income sector are valued at 27 percent to 31 percent of the benefits derived from energy savings as shown on the table below:

Table 3. Summary of Benefits Derived from Energy Savings

	TRC Benefits	TRC Costs	TRC Ratio	15% Adder	Total Gross Verified (kWh)	NEBs for Low Income	Total Benefits with NEB	Ratio	% Adder
2015	11,474,013	11,362,814	1.01	1,496,610	16,052,556	3,049,986	13,027,388	1.15	31%
2016	5,617,781	5,983,121	0.94	732,754	7,133,035	1,355,277	6,240,304	1.04	28%
2017	6,761,636	8,775,299	0.77	881,953	8,240,967	1,565,784	7,445,468	0.85	27%

PSE Case Study

Background

PSE is a regulated investor-owned electric and gas utility in Washington State, the largest private utility in the state. PSE customer-funded energy efficiency programs follow the National Standard Practice Manual (NSPM) for assessing cost-effectiveness, and is required by regulation to achieve a portfolio TRC test score of 1.0 or greater.

PSE's approach to NEIs has typically been conservative. Its use of NEIs was limited to fairly easy-to-quantify impacts such as reductions in water and sewer use. PSE relies on the Regional Technical Forum (RTF), a technical advisory committee established by the Northwest Power and Conservation Council in 1999, which provides energy and non-energy analysis to utilities in the Northwest. On occasion, PSE would sponsor or co-sponsor primary research to define NEIs for use in its programs. In addition, the Northwest Power Act (1980) directed utilities to assign a 10 percent adder to advantage conservation when making resource selection decisions in order to capture the benefits conservation that aren't included in energy prices, and this adder is included in the benefit side to PSE's TRC calculations.

The reduction in carbon emissions is often used as a non-energy impact, but Washington State handles carbon a little differently. Since 2018, the Washington State Utility and Transportation Commission (WUTC) has required utilities to use a measure called the Social Cost of Carbon, which provides prescriptive values of upstream and downstream carbon emissions associated with energy generation. Rather than include these as non-energy impacts, Washington State utilities include these costs in their integrated resource planning. As a result, PSE's energy efficiency programs include this cost as part of the avoided cost of energy, which impacts both the utility cost and total resource cost tests and is not included as an NEI.

Policy Changes for NEIs

In 2019, PSE submitted its 2020-2021 Biennial Conservation Plan to WUTC. In accepting the plan, the WUTC proposed a number of conditions to PSE. The conditions required PSE to "demonstrate progress toward identifying, researching and developing a plan to properly value nonenergy impacts that have not previously been quantified" (PSE 2019). The WUTC further proposed that PSE include categories of NEIs not previously used, such as public health benefits, environmental benefits, and energy security.

In 2020, PSE's evaluation contractor, DNV, proposed a solution they had developed. DNV had created a database of NEIs from various jurisdictions across North America, and developed a methodology by which NEIs can be transferred from one utility jurisdiction to another, generally based on the principles articulated in Lawrence Berkeley National Laboratory's 2020 study, *Applying Non-Energy Impacts from Other Jurisdictions in Cost Benefit Analyses of Energy Efficiency Programs* (Sutter et al. 2020). The methodology involved matching characteristics from the primary studies with similar characteristics of PSE program measures. For example, a study conducted on low-income programs would be matched to PSE's low-income weatherization program measures. The methodology also included adjustment factors to take into consideration the rigor of the primary research, the age of the study, economic differences between jurisdictions, and other factors.

Seeing the potential benefit of incorporating this external research, PSE collaborated with two other Washington State utilities to contract with DNV for its services. Collaborating with utilities also under the regulatory jurisdiction of the WUTC provided an excellent way to review the output from DNV's process, share technical knowledge, and ensure consistent messaging with state advisory groups.

Result of the NEI Project

The overall effort to develop new NEIs for measures took less than a year, and PSE received a final list of NEIs in August 2021. DNV managed to match NEI values to over 780 PSE measures. Each NEI value was provided in dollars per kWh (or per therm for gas). The new NEIs greatly expanded the categories of NEIs used by PSE, which include productivity, health and safety, property values, thermal comfort, fire and insurance avoided losses, and product spoilage or defects. In addition to the NEI values themselves, DNV provided a list of measures which didn't receive an NEI match, as well as the measures where matching fell below a certain confidence threshold. This output allows PSE to direct future research in a cost-effective way, having identified measures that might be a viable NEI with a relatively small amount of incremental research.

Throughout the process, PSE worked with its stakeholder advisory groups and the WUTC, keeping them informed and presenting the results of the project. Overall feedback was positive, with some stakeholders stating that they thought the results may be *too* conservative, and may still not adequately capture the value to society, ratepayers and the utility of energy efficiency. No NEIs values were deemed unacceptable however, and the overall result was very positive for PSE. In the coming months, PSE will be conducting further research on both the NEIs received from DNV as well as those identified as potential benefits that could be realized with further analysis. PSE found the DNV methodology to be extremely cost-effective when compared to the cost of primary research that would have been required to derive similar benefits. The amount of research and work done by other jurisdictions can be a benefit to utilities when applying a careful, methodologically sound process of adjusting them to fit the jurisdiction into which they are being transferred.

Concluding Thoughts and Next Steps

Members of the CEE Evaluation Committee and Center for Equity and Energy Behavior have recognized the renewed importance of NEIs to program administrators as administrators seek to address new goals and objectives with their programs in sometimes difficult industry

conditions where the cost-effectiveness of some programs continues to diminish. The nature of NEIs often makes them difficult, and thus expensive, to study empirically. The extensive and ongoing conversations about NEIs at CEE have confirmed that program administrators find value in establishing common language in the energy efficiency industry, and that validated claims that can be considered among utilities and other agencies is also of use. Program administrators have expressed that understanding peers' practices will better enable them to make effective changes to their own programs.

The ongoing work on NEIs at CEE, informed by the priorities and motivations described in the survey of program administrators, will enable members to better leverage the research undertaken by their peers. The characterization effort to be completed by CEE's Center for Equity and Energy Behavior will set the stage for members to prioritize resources effectively to capture the most important NEIs for underserved audiences, both to help improve equitable participation in and benefit from energy efficiency programs. The unique behavioral lens of the Center may also provide an opportunity to examine how customers engage with a given energy saving solution and make decisions beyond basic economics, giving further weight to the effort of the Center to prioritize important NEIs for future study. As this work is underway, the Evaluation Committee's lunch-and-learn discussion series will continue to offer immediate opportunities for peer learning; the Committee will seek additional examples from other program administrators to enable a robust assessment of significant NEIs, defining characteristics and associated methodologies for quantification and monetization and will inform the contemporaneous work of the Center.

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