
Minnesota Energy Efficiency Potential Study: 2020–2029

**Appendix D: Behavior-based programs,
strategies, and measures**

Contract # 121430
Publication Date: March 27, 2019

Conservation Applied Research and Development (CARD) FINAL Report

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Contract Number: 121430

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ACKNOWLEDGEMENTS

This project was supported by a grant from the Minnesota Department of Commerce, Division of Energy Resources, through the Conservation Applied Research and Development (CARD) program, which is funded by Minnesota ratepayers.

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Overview

The full report that this appendix supports, *Minnesota Energy Efficiency Potential Study: 2020-2029*, is available for download on the [project website](#).

Minnesota has a thirty-plus year history of leadership in energy efficiency policy and achievements. In order to continue to maximize the benefits of cost-effective energy efficiency resource acquisition by utilities, the project team, consisting of Center for Energy and Environment (CEE), Optimal Energy (Optimal) and Seventhwave, was commissioned to:

- Estimate statewide electric and natural gas energy efficiency and carbon-saving potential for 2020-2029;
- Produce data-driven and stakeholder-informed resources defining market segments, end uses, measures, and programs that could be targeted in the decade ahead to realize the state's cost-effective energy efficiency potential; and
- Engage stakeholders in order to help advance robust energy policies and energy efficiency programs in the state, and to inform future efficiency portfolio goals.

Over the last decade, there has been growing interest about behavior-based energy efficiency programs and measures. In contrast to asset-based or traditional programs, behavioral-based programs and efforts rely on operational change to achieve energy savings. The actions taken by customers in a behavioral program rely on having an external influence motivate individuals to make changes. The behavioral programs included in this potential study include:

- Home energy reports (residential)
- Smartphone feedback apps (residential)
- Operational savings and behavior (OSB) (commercial)

While this potential study provides modeling results in terms of behavior-based programming, it is also important to recognize that there are a variety of ways to incorporate behavior-based elements into many, if not all, programs. With that in mind, this study makes a distinction between programs, measures, and strategies. In this appendix, the study team discusses these distinctions as well as highlights modeling results from the potential study and provide recommendations for incorporating behavior-based programs and strategies into energy efficiency programming.

Behavior-based programs

Behavior change *programs* are defined by Sussman and Chikumbo as programs that are based on social science theories of behavior change that can be measured through systematic evaluations.¹ They typically do not include traditional program strategies such as rebates, incentives or policy changes. Behavioral programs can be divided between three distinct categories: information-based programs, social interaction programs and cognition or education/training programs. Each program category is defined by the behavioral elements that are incorporated into the program design. Individual measures may be included in each of these program categories, but the way the programs are administered varies across category (Table 1).

Table 1. Three categories of behavior programs

Category	Example program
Information-based	<ul style="list-style-type: none"> • Home or business energy report • Real-time feedback • Energy audit programs
Social Interaction	<ul style="list-style-type: none"> • Competition and games • Community-based programs
Cognition or education/training	<ul style="list-style-type: none"> • Training • Strategic energy management • K-12 and campus education

The most well-known example of the information-based program are home energy reports (like OPower), which has been implemented by some Minnesota utilities (more details on that below). This study included two programs of this category in our model, Home Energy Reports (HERs) and Smartphone Feedback App. Home energy reports deliver information to participants on their home or business energy use. These reports are delivered on an intermittent basis, such as monthly or quarterly, but differ from typical energy bills in that they apply the power of social-norms to encourage behavior change. The information provided in the HERs encourage a person to take action to reduce energy use. The actions may include thermostat setbacks, turning down temperatures of hot water heaters, or taking steps such as cold-water washing or not using the heat-dry option on dishwashers. The savings from the HERs rely on having high participation rates (and are typically opt-out programs), which are implemented and evaluated using a control group in a randomized control- treatment (RCT) design. There is a relationship between how much savings a household can achieve and how much annual energy they consume; for this reason, this study divided the residential sector into five quintiles based on energy consumption and varied the savings rate.

¹ Sussman, R. and M. Chikumbo. 2016. Behavior Change Programs: Status and Impact. Washington, DC: ACEEE.

Smartphone feedback apps rely on increasingly ubiquitous smartphones that most people engage with daily. These programs move beyond simple in-home displays (IHDs) which were popular in recent years but are likely to fall out of favor due to the increasing prevalence of smart phones. Smartphone feedback apps are relatively new to the energy efficiency program arena but offer many of the same benefits of the IHDs. To implement this program at scale and most efficiently, a customer would need to have a smart meter installed. The utility would link that smart meter data to the app to provide near real-time feedback on energy consumption. These apps communicate directly to the customer and can encourage behavior change through nudges, reminders to take action, or social networking among users. The types of actions taken by program participants to reduce energy consumption would likely be similar to HER actions.

Operational savings for buildings (OSB), the only behavioral program included in the potential study for commercial buildings, incorporates many of same behavioral techniques that make industrial strategic energy management (SEM) programs effective: goal setting, training, finding an energy champion, and creating a plan. The study team has seen holistic commercial programs that utilize external energy coaches or program implementers that help a building owner or manager better understand their energy use and provide a holistic set of goals for energy reduction. These focus on the low-cost/no-cost measures such as thermostat setbacks, HVAC and refrigeration maintenance, manual kitchen exhaust controls, lighting optimization and plug-load optimization. In the potential study model, the study teams differentiate between those facilities that have a building automation system versus those that do not; the study team assumes that the savings from operational changes made in those buildings with automation persist longer than those facilities without automation, as reflected in an increased measure life.

Behavior-based measures

This study defines behavior change measures as follows, with distinction between residential and commercial measures:

- **Residential behavioral measures** are any low/no-cost elective action or default that manages the use of equipment or space in a home.
- **Commercial behavior measures** are any elective action, policy or default that manages the use of equipment (or space) in a business. This includes, but is not limited to:
 - Employee behaviors;
 - Building operator behaviors and maintenance practices; and/or
 - Management or control of equipment or space that is facilitated by technology, such as occupancy sensors or Energy Management System / Building Automation System timers (which could also include a measure-based solution to managing equipment).

For this potential study, the study team originally considered a number of measures that fall under these definitions of behavior measures, such as cold water washing in residential homes or turning off lights at the end of the day in commercial buildings. However, because the individual measures on their own often have a small impact and can be difficult to implement, quantify, and evaluate, those

measures were not included in the model and the study team does not recommend that utilities develop programs around individual behavior-based measures. The programs mentioned above by nature encompass the many actions a person can take to reduce energy consumption and rely on the population as a whole to demonstrate an energy savings reduction; more research is often needed to identify the exact measures that are taken to reduce energy. When evaluating programs, the study team recommend working to identify the measures or actions a person or businesses takes.

Behavior-based strategies

While the individual measures are not modeled in this study, the study finds that there is ample opportunity to incorporate behavioral-based *strategies* into many, if not all, types of utility energy efficiency programs. The behavioral-based strategies are couched in behavioral or cognitive psychology research and most can be incorporated into traditional demand-side management programming. They can be thought of as the foundation for all behavior-based interventions, whether they address energy consumption, health choices, or financial decisions. Rather than generating energy savings on their own, they should be considered as methods to increase participation and effectiveness of programs. The strategies, as compiled by Dougherty et al., include²:

- Commitment or goal-setting;
- Feedback;
- Follow-through;
- Framing, nudges, or strategic default options;
- In-person interactions;
- Rewards or gifts (which are different than financial incentives);
- Social norms;
- Multi-pronged approaches that use two or more of the above approaches.

An example of where behavioral strategies may be incorporated into a typical DSM program might be an energy audit completed by a trusted HVAC contractor (in-person interaction) who asks for an energy-saving goal to be set and put on paper. When a traditional DSM program is developed, this study recommend that program planners work to incorporate behavioral-based strategies into program design to increase uptake and effectiveness of the program.

Sussman and Chikumbo highlighted the most effective persuasive messages and in-person strategies that should be applied when developing both traditional DSM program and behavioral programs.³ The

² Dougherty, A., C. Henderson, A. Dwelley, and M. Jayaraman. 2015. Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines. Prepared for: Minnesota Department of Commerce, Division of Energy Resources.

³ Sussman, R. and M. Chikumbo. 2016. Behavior Change Programs: Status and Impact. Washington, DC: ACEEE.

study team has summarized a number of strategies below that are recommended for consideration in Minnesota DSM programming.

Persuasive messaging

The following strategies can be incorporated as elements of an information-based program to make the message more effective. These strategies are based on recent behavioral research as noted in Sussman and Chikumbo:⁴

- **Financial versus non-financial appeals:** People may react to messages that focus more on money-related benefits or penalties, or non-financial appeals, which may focus on health or comfort implications.
- **Avoiding choice overload:** When presented with too many options, people may find it more difficult to make any decision. It is important for energy efficiency programs to limit the number of choices a participant needs to make.
- **Selling comfort rather than energy savings:** Comfort may be more of a driver than energy savings for a variety of energy efficiency measure.
- **Prompting:** This type of message provides relevant information at the point where an action may be taken. For example, a sticker could be placed above a light switch to remind people to turn off lights when exiting the room.
- **Changing defaults:** People tend to stick with what they already have, rather than having to make an additional choice. This is the reason why opt-out programs are much more successful than opt-in programs.

In-person strategies

These strategies are based on primarily smaller academic studies detailed in Sussman and Chikumbo, but address ways to encourage energy savings from behavior change.⁵

- **Foot-in-the-door:** This strategy involves asking a person to do a larger task after completing a smaller task. For example, a direct install program that changes out light bulbs may have more success in implementing larger measures rather than trying to first implement the larger measure.
- **Public commitment:** Having a person or company make a public commitment makes it more likely that the action will be followed through.
- **Observability:** People or companies may be more likely to follow through on a commitment if they know that their actions are being observed.
- **Goal Setting:** Rather than an external entity setting an energy reduction goal, a person or entity is more likely to meet that goal if the goal is set internally.

⁴ Ibid.

⁵ Sussman, R. and M. Chikumbo. 2016. Behavior Change Programs: Status and Impact. Washington, DC: ACEEE.

- **Social networks:** These social networks can be leveraged to increase participation in programs.
- **Energy champions:** Energy programs that are implemented within a group setting (like in a business or school) may be more effective if an individual feels responsible for the energy savings within the group. This individual can play a strong role in encouraging others to change behaviors or take action.

Current behavior-based programming in Minnesota

To date there have been a few a few behavior-based programs in Minnesota, which are highlighted in Table 2 and described in detail in Dougherty, et al.⁶

Table 2: Minnesota behavior-based programs

Utility	Program name	Sector	Estimate of Annual Savings	Effective behavioral elements
Xcel Energy	Home Energy Reports	Residential	2.1% electricity 0.6% natural gas	<ul style="list-style-type: none"> • Information feedback • Social norms
Minnesota Power	Real-time feedback program	Residential	No significant savings	<ul style="list-style-type: none"> • Information feedback • Nudges
Multiple Coops	MyMeter Online Tool	Residential	Savings range from 1.8% to 2.8% electrical savings	<ul style="list-style-type: none"> • Information feedback • Goal setting • Nudges and notifications
Minnesota Energy Resources Corporation	Commercial community-based pilot programs	Commercial	Small number of projects (5), show some gas savings (~1.7%)	<ul style="list-style-type: none"> • Social norms • In-person interactions
Xcel Energy	Process and Commercial Efficiency: Industrial and large commercial strategic energy management	Industrial and Commercial	Unavailable	<ul style="list-style-type: none"> • Goal setting • Follow-through • In-person interactions

Home Energy Reports have been implemented in Minnesota by Xcel Energy which showed an electric savings of 2.1% and a gas savings of 0.6% among the program's 32,000 participants. Real-time feedback programs have been piloted by Minnesota Power. With nearly 3,000 participants, the program did not show any significant savings. Additionally, the MyMeter online tool is currently being implemented in a

⁶ Dougherty, A., C. Henderson, A. Dwelley, and M. Jayaraman. 2015. Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines. Prepared for: Minnesota Department of Commerce, Division of Energy Resources.

number of cooperative utilities – they have seen electrical savings ranging from 1.8% to 2.8%.⁷ The MyMeter online tool and program encourages program participants to engage by viewing comparative usage, setting bill threshold alerts and participate in energy challenges.

For industrial and larger commercial customers, Xcel Energy also offers the Process Efficiency and Commercial Efficiency program, of which part of the program could be considered behavior-based. The program offers assistance to industrial and large commercial customers to create a holistic energy management plans, which incorporates the goal setting and in-person behavioral strategies. The program also identifies operational savings that can be implemented for no-costs. Certain aspects of the program should be considered more similar to standard efficiency program offerings, because they fund larger capital-intensive projects with financial incentives; however, incorporating behavior strategies (goal setting, making a commitment and follow-up by Xcel representatives) strengthen the program.⁸

Additional programs that incorporate behavior-based strategies include Energy Squads (Xcel), Residential Engagement Pilot (CenterPoint Energy) or School Education Kits (Xcel). These programs are not true behavioral-programs but apply many elements that are effective behavioral strategies. For example, the Energy Squads provide in-home audits to eligible participants which is a type of informational feedback.⁹ The Residential Engagement Pilot worked to increase conversion rates from visit to installation of recommended improvements through increased customer engagement efforts; the main behavioral element of this pilot was to reduce the number of choices or steps in the program, thereby eliminating the barriers to conversion.¹⁰

⁷ Dougherty, A. 2014. MyMeter Multi-Utility Impact Findings. Prepared for: Accelerated Innovations.

⁸ Xcel Energy, 2016. 2017/2018/2019 Minnesota Electric and Natural Gas Conservation Improvement Plan. Prepared for Minnesota Department of Commerce.

⁹ Syring, T., A. Gorell, D. Laube. 2013. Energy Management Teams – Coordinator Resource Pilot Project. Prepared for: Minnesota Department of Commerce, Division of Energy Resources.

¹⁰ Mark, N., A. Partridge, C. Dedolph, C. Nelson, I. Smith, P. Ebnet., and B. Dockter. 2016. Bridging the Gap Between Direct Install and Whole House Programs: Minneapolis Home Energy Squad Residential Engagement Pilot. Proceedings at the 2016 ACEEE Summer Study on Energy Efficiency in Buildings.

Results from model

The three behavioral measures included in this study's modelling comprise a small share of the total potential. Residential electrical behavior measures are estimated to comprise approximate 0.2% of residential commercial business segment and 0.1% of commercial measures. For natural gas, the only commercial measure, OSB, does not assume any gas savings; natural gas behavior measures for the residential sector comprise of 0.09% of residential sales.

Table 3. Statewide electric behavior program potential by sector, 2020-2029

Small commercial business segment	Projected mean annual 2020-2029 Sales (GWh)	Incremental achievable program potential*	
		(GWh)	% of sales
Residential	30,210	61	0.20%
Commercial	29,369	28	0.10%

*Mean of first-year savings potential for 2020-2029

Table 4. Statewide natural gas behavior program potential by sector, 2020-2029

Small commercial business segment	Projected mean annual 2020-2029 sales (BBtu)	Incremental achievable program potential*	
		(BBtu)	% of sales
Residential	157,048	141	0.09%
Commercial	Not applicable		

*Mean of first-year savings potential for 2020-2029

Evaluating behavior-based programming

Effective evaluation of behavioral programs is important to ensure that the appropriate savings are being attributed to the program effects. Before any behavior-based program is implemented, evaluation methods should be discussed and determined, so behavioral-based savings can be counted. Dougherty et al. (2015) provides a thorough and relevant discussion of the pros and cons of the range of evaluation techniques. As that report states, the evaluator’s primary objective in behavior-based programs is to “identify a rigorous counterfactual to support estimate of the program effects from consumption data.” Because the counterfactual can be difficult to identify, it becomes important to identify evaluation methods before program implementation. Oftentimes, the program itself needs to incorporate an experimental (with randomly-assigned treatment and control groups) or quasi-experimental design (with non-randomly chosen treatment and control groups) in order to quantify the counterfactual and understand the impacts of the program.

The table below provides a comparison of the experimental or quasi-experimental designs that are reviewed by Dougherty et al. (2015):

Table 5: Summary of Evaluation Methods by Program Class

Best for programs that...	Randomized Control Trial (RCT)	Randomized Encouragement Design (RED)	Recruit-and-Delay/Deny	Matched Comparison	Variation in Adoption	Preponderance of Evidence
Use an opt-out model	✓	✗	✗	✗	✗	✗
Use an opt-in model	✗	✓	✓	✓	✓	✓
Large percentage of customers expected to participate (opt-in or not opt-out)	✓	✓	○	✗	✓	○
Small customers of customers expected to participate	✗	✗	✓	✓	✗	✓
Equipment requires installation or is complex	✗	✗	✗	✓	✓	✓
Wide range of recruitment tactics or sign-up options	✗	✓	✓	✗	✗	✓

Key

- ✓ Advisable for this program design element
- ✗ Not advisable for this program design element
- Possible, depending on program design