13. Pursue Behavioral Efficiency Programs

1. Profile

"Energy efficiency" refers to technologies, equipment, operational changes, and in some cases behavioral changes that enable our society to enjoy equal or better levels of energy services while reducing energy consumption.[1] Efforts to improve efficiency in the generation, transmission, or distribution of electricity are covered in Chapters 1 through 5 and in Chapter 10. In contrast, Chapters 11 through 15 address different policy options for making the end-user's consumption of electricity more efficient. Chapter 11 focuses on policies that establish mandatory energy savings targets for electric utilities, the achievement of which is generally funded through revenues collected from customers themselves. Chapter 12 focuses on policies that create or expand the opportunities for voluntary, market-based transactions that promote energy efficiency as an alternative or supplement to government-mandated programs or regulatory requirements. This chapter, Chapter 13, focuses on an emerging type of energy efficiency program, behavioral energy efficiency, that is worthy of separate treatment because it is sometimes included within the mandated programs described in Chapter 11 and sometimes implemented as a voluntary effort outside of those programs. Chapter 14 covers mandatory appliance efficiency standards that are imposed on manufacturers, and Chapter 15 covers mandatory building energy codes that are imposed on builders and developers.

Some energy efficiency programs use information dissemination, social interaction, competition, and/or potential rewards, rather than direct financial incentives, as the primary mechanisms for changing energy consumption behavior. These programs are known as "behavioral energy efficiency programs."[2] To date, most energy efficiency programs have focused on realizing savings through technical approaches, such as replacements, upgrades, and modifications to equipment and buildings.[3] However, program administrators are increasingly considering behavioral energy efficiency programs for inclusion in their portfolios, and these programs are becoming more mainstream.[4]

Behavioral efficiency programs are sometimes included in a broader portfolio of programs used by a utility to satisfy state energy efficiency mandates, but they can also be offered as standalone or voluntary programs. This is one rationale for devoting a separate chapter to behavioral programs. It is also true that behavioral approaches are newer than the types of mandatory programs described in Chapter 11; they are less familiar to many regulators, and they are a focal point for new research and pilot testing.

Behavioral energy efficiency programs offer significant potential savings: a 2013 study by McKinsey & Company identified 1.8 to 2.2 quadrillion BTUs[5] per year of

1 In contrast, some people use the term "energy conservation" to refer to actions that reduce energy consumption but at some loss of service. Neither term has a universally accepted definition and they are sometimes used interchangeably.

2 As the term is used in this chapter, a behavioral energy efficiency program can include approaches promoting behaviors that result in use of less energy (i.e., energy conservation), as well as approaches that encourage implementation of energy efficient technologies by raising awareness of consumption and efficient alternatives. The distinction between "energy conservation" and "energy efficiency" is thus blurred in the case of behavioral programs.

3 Frankel, D., Heck, S., & Tai, H. (2013). *Sizing the Potential Of Behavioral Energy-Efficiency Initiatives in the US Residential Market.* McKinsey & Company. Available at: http://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/epng/pdfs/savings_from_behavioral_energy_efficiency.ashx

4 Russell, C., Wilson-Wright, L., Krecker, P., & Skumatz, L. (2014). *Behavioral Effects: How Big, How Long, From Whom, How Best?* 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.aceee.org/files/proceedings/2014/data/index.htm

5 A BTU is the amount of heat required to increase the temperature of a pint of water (which weighs exactly 16 ounces) by one degree Fahrenheit.

untapped non-transportation residential energy efficiency potential from behavioral adjustments that have no or minimal impact on consumers' lifestyles.[6] That potential is equivalent to 16 percent to 20 percent of current US residential energy use.[7] These programs can be moderately to very cost-effective, with a cost of saved energy[8] ranging from $0.01 per kilowatt-hour (kWh) to $0.08 per kWh according to a 2013 study of ten such programs.[9] They may also be more time efficient: behavioral programs do not require as much time to implement and accumulate savings as some other types of energy efficiency programs, such as those focused on market transformation. However, the body of research on savings, persistence, and customer responses to behavioral energy efficiency programs is somewhat sparse.[10]

Behavioral efficiency programs bypass barriers faced by more traditional energy efficiency programs, because they do not require capital investment or installation of measures.[11] Moreover, they can be designed to address other key barriers, including lack of consumer awareness of the benefits of energy efficiency and lack of information on efficient products.

For some types of behavioral energy efficiency programs, the benefits (including energy savings and associated emissions reductions) are difficult to quantify and may not persist after the stimulus is removed. The vast majority of these programs have not been subject to rigorous evaluation, measurement, and verification (EM&V),[12] although peer comparison feedback programs such as those provided by Opower and others have been rigorously evaluated by independent evaluators for many utility programs over the past five years or so. In addition to encouraging energy conservation efforts (e.g., turning off lights, increasing air cooling temperature set points), another key benefit of behavioral energy efficiency programs is that they help to increase participation and savings in other, more traditional energy efficiency programs, but this complicates how savings and costs are attributed and tracked for each program.[13] States may encounter challenges related to measuring and verifying energy and carbon dioxide (CO_2) emissions savings, given the limited experience in this area. Responding to these issues, efforts are underway to develop standard recommendations for estimating cross-program energy savings impacts resulting from behavioral energy efficiency programs.

This chapter discusses in more detail the types, benefits, and limitations of behavioral energy efficiency programs, as well as program administrators' and states' experiences in addressing barriers to implementing them.

Characterizing Behavioral Energy Efficiency Programs

In a 2013 report, Mazur-Stommen and Farley of the American Council for an Energy-Efficient Economy (ACEEE) developed and presented taxonomic classifications for the universe of behavioral energy efficiency programs, based on a sample of 281 programs in operation from 2008 to 2013. This chapter considers four types of behavioral energy efficiency programs described in the 2013 ACEEE report: (1) communication, social media, and education; (2) social interaction; (3) home energy reports; and (4) games.[14]

6 The behavioral adjustments for which McKinsey & Company estimated energy savings include, for example, increasing air cooling temperature set points, decreasing air and water heating temperature set points, reducing time showering, changing dishwasher and clothes washer/dryer operation settings, and turning off lights and electronics when they are not in use.

7 Supra footnote 3.

8 Cost of Saved Energy equals the program costs divided by program energy savings.

9 Mazur-Stommen, S., & Farley, K. (2013). *ACEEE Field Guide to Utility-Run Behavior Programs.* ACEEE Report No. B132, p. 32. Available at: http://www.aceee.org/research-report/b132

10 Supra footnote 4.

11 Ibid.

12 Supra footnote 9 at p. 11.

13 Goldman, M., & Dougherty, A. (2014). *Integrating Behavior Programs into Portfolio Plans to Encourage Cross-Program Effects.* 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.aceee.org/files/proceedings/2014/data/index.htm

14 Mazur-Stommen and Farley (ACEEE) categorize behavioral energy efficiency programs into three families: cognition (including communication, social media, and education), social interaction, and calculus. According to Mazur-Stommen and Farley, the calculus grouping includes behavior programs that rely on consumers making economically rational decisions, such as real-time and asynchronous feedback, games, incentives, home energy audits, and direct installation of measures. For the calculus category, this chapter describes home energy reports — a

continued on next page

Communication, social media, and education programs are primarily focused on delivering information to customers. These programs use various channels for reaching energy consumers, including mass-market media, targeted communication efforts, social media, classroom-based education, and training.

- Mass-market media campaigns use television, radio, printed media, and billboards to broadcast to a relatively undifferentiated audience. These programs offer no direct means for the consumer to respond to the program administrator, and generally their impacts are not tracked.[15] These campaigns are fairly widespread.
- Social media, such as Facebook, Twitter, and blogs, also broadcast to an undifferentiated audience. Unlike mass-market media, these platforms enable the public to redistribute content, potentially reaching far beyond the program administrator's service area. Generally the impacts and budgets of these programs are not tracked or reported separately.[16]
- Targeted communication efforts include enhanced billing (bill inserts and bill redesign to improve consumers' ability to interpret and use energy consumption information) and direct mail campaigns. These efforts target customers or groups of customers about whom the program administrators have already collected and analyzed data.[17] (Customer-specific home energy reports are discussed in "Peer Comparison Feedback Programs," below.) Targeted communication efforts are common.
- Classroom education uses age-appropriate material for students, from kindergarten through higher education, to encourage changes in energy consumption behavior. Most programs focusing solely on classroom education do not report or track program outcomes. Based on the Alliance to Save Energy's PowerSave Schools Program, ACEEE estimated an average cost of saved energy of approximately $0.06 per kWh, assuming that savings persist for 1.5 years on average.[18] Education programs can be combined with energy efficiency initiatives to improve energy performance in schools; for example, Schools for Energy Efficiency is a comprehensive program that provides K-12 schools with educational awareness materials to engage staff and students, and a plan to save energy and money for the school.[19] Curriculum materials for grades K-12 are readily available, for example from the US Department of Energy's Energy Education & Workforce Development searchable resource library.[20]
- Training often targets the commercial, industrial, and institutional sectors. These programs frequently take place in the workplace, allowing consideration of site-specific issues and processes. Program impacts (e.g., participation and savings) are usually not reported.[21] However, efforts to facilitate tracking and claiming savings by program administrators are underway for the US Department of Energy's Superior Energy Performance program.

Social interaction programs are driven by the human need for sociability. The interaction can be in person or online, for only a few minutes or for longer periods. Group structure ranges from one-on-one interactions, such as with Progress Energy's Neighborhood Saver program, to small groups of people organized as eco-teams, to community-wide efforts such as community-based social marketing (CBSM) campaigns.[22]

- Implemented at the community level, CBSM seeks to influence a targeted behavior (such as energy consumption) through social and behavioral factors. The results of CBSM can be much deeper savings than those achieved by programs that only use economic and attitudinal traits as motivation. CBSM follows five steps: (1) selecting behaviors that will achieve

Footnote 14, continued from previous page

form of asynchronous feedback — and games. Other mechanisms in the calculus category are described elsewhere in this guide: real-time feedback, an enabling technology for demand response, is discussed in Chapter 23, and financial incentives, home energy audits, and installation of measures are discussed in Chapter 11.

15 Supra footnote 9 at pp. 12-15.

16 Ibid, p. 15.

17 Ibid, p. 14.

18 Ibid, p. 16.

19 See: http://www.class5energy.com/schools-for-energy-efficiency-see-program

20 See: http://www1.eere.energy.gov/education/lessonplans/#more_resources

21 Supra footnote 9 at p. 17.

22 Ibid, p. 26.

program outcomes; (2) identifying and addressing historical local barriers and benefits as experienced by a specific, local audience; (3) developing strategies based on social science tools to address identified barriers; (4) piloting the strategies; and (5) implementing the strategies on a broad scale and measuring the outcome.[23] CBSM programs have been implemented by both public power and investor-owned utilities, with a wide range in numbers of participants. (In its sample, ACEEE found a range of just 1000 participants to as many as 200,000.) Participation rates tend to be high: for example, Tucson Power's Community Education program reported 45-percent participation. Project Porchlight, a CBSM campaign that has been implemented in a range of settings, has proved highly cost-effective: the sample of four campaigns analyzed by ACEEE achieved a cost of saved energy of just $0.01 per kWh.[24] (See Section 3 for more information about Project Porchlight.)

- Online forums that allow people to share experiences and information and that focus on peer-to-peer or community-based communication fall into the social interaction family of programs. The success of these forums has been mixed, but the limited, initial experience with this strategy suggests that it can be successful (e.g., the Cape Light Compact reported that users saved nine percent off their monthly bills on average during the first phase of a pilot featuring an online social forum).[25]
- Gifts, such as giveaways of items like compact fluorescent light (CFL) bulbs, can encourage behavior change by triggering the recipient to reciprocate — that is, by saving energy. These programs are typically counted as marketing, and usually the savings from them are not tracked.[26]

Peer comparison feedback programs (or home energy reports) provide one-way feedback on a household's energy use as compared to that of similar households, and offer energy saving tips and information about other programs offered by the program administrator. The feedback is intended to induce behavior changes to bring energy consumption in line with a more efficient baseline, presented as a social norm. Reports can be mailed to participants or be presented online, and they can be delivered regularly (e.g., monthly or quarterly) or irregularly (e.g., when prompted by an action by the customer, such as visiting a website to view energy account data). Participation rates are generally very high for these programs, and they are moderately to very cost-effective.[27] Peer comparison feedback programs are described further in Section 3.

Games, including competitions, challenges, and lotteries, use a combination of social interaction and rewards as their primary mechanism. Competitions seek to motivate individuals or groups of people to change energy use behavior relative to another group, such as another neighborhood or city. Games can also take the form of challenges, which focus on an individual, group, or community reducing energy use relative to its own baseline. Lotteries offer an economic reward to the winner, selected at random. Participation in a lottery can be tied to a behavior change, such as participation in a home energy audit.[28]

Program Administration

Behavioral energy efficiency programs can be implemented and administered by utilities, state and local governments, nonprofit entities, private businesses, and even groups of public citizens. Often the entity that administers traditional, measures-focused energy efficiency programs will also offer behavioral energy efficiency programs, but that need not be the case. In addition to the administrators of traditional energy efficiency, other entities such as school districts, colleges and universities, and state departments of education or energy are very good candidates to undertake classroom education, general communication, online forums, and social media campaigns. As another example, challenges, competitions, and community-based social marketing efforts can be implemented by teams or other groups.[29]

23 Vigen, M., & Mazur-Stommen, S. (2012). *Reaching the "High-Hanging Fruit" Through Behavior Change: How Community-Based Social Marketing Puts Energy Savings within Reach.* ACEEE. Available at: http://www.aceee.org/white-paper/high-hanging-fruit

24 Supra footnote 9 at p. 27.

25 Ibid, p. 29.

26 Ibid, pp. 29-30.

27 Ibid, pp. 20-21.

28 Ibid, pp. 22-23.

29 Supra footnote 23.

2. Regulatory Backdrop

Behavioral energy efficiency programs have not been the subject of specific state legislation or regulations, but have evolved in many jurisdictions as a component of broader efficiency policies and programs such as those summarized in Chapter 11. In still other jurisdictions, behavioral programs have been launched without any regulatory driver whatsoever.

In those jurisdictions where behavioral programs have been included within a portfolio of mandated efficiency programs, energy regulators have often approved the programs on a pilot basis, at least initially. This approach indicates that behavioral approaches are indeed new and unfamiliar to many regulators, and that there is (or has been) a degree of skepticism about the expected results and cost-effectiveness of such programs. Regulators want to be certain that ratepayer money invested in behavioral programs will be cost-effective. Nevertheless, more and more utilities and third-party program administrators have been convinced that the programs can be cost-effective and have decided in recent years to include behavioral programs in their portfolios.

If programs are developed using ratepayer funds, program administrators generally need to submit program plans to regulators for review and approval on a regular basis (usually every one to four years). Program plans generally describe the program, its objectives and goals (e.g., in terms of units of energy saved), the target customer segment, a marketing and program delivery strategy, and budget; other factors may also be considered.

Many administrators must issue annual or periodic reports showing actual program results, which typically include participation rates; electric energy, electric demand, and other fuel savings; and expenditures. In addition, program administrators are often required to submit EM&V plans and study results to regulators for review. Although no standard EM&V methods exist to estimate savings from education and marketing-focused programs and cross-program savings from other types of behavior programs, standard or best practice EM&V methods exist for certain behavioral efficiency programs (e.g., home energy reports and efficiency measures installed as a result of a CBSM campaign).[30]

Energy efficiency plays a prominent role in the emissions guidelines for CO_2 emissions from existing power plants that the Environmental Protection Agency (EPA) proposed in June 2014, citing its authority under Section 111(d) of the Clean Air Act, as part of its "Clean Power Plan." The EPA determined that the "best system of emission reduction" for existing power plants under the Clean Air Act consists of four "building blocks," one of which is end-use energy efficiency. Although states will not be required to include energy efficiency in their 111(d) compliance plans, the emissions rate goals for each state are based on an assumption that a certain level of energy savings (and thus, emissions reduction) is achievable. The level of savings that the EPA used to set each state's emissions rate goals is based on the demonstrated performance of leading states with respect to the kinds of ratepayer-funded energy efficiency programs described in Chapter 11 and a meta-analysis of energy efficiency potential studies. The EPA did not explicitly include or exclude behavioral efficiency programs from consideration when determining the level of achievable energy savings, but behavioral programs can clearly contribute to achieving the assumed level of savings. It appears likely that the final rule will allow behavioral efficiency programs to be included in state compliance plans, regardless of whether the behavioral programs stand alone or are incorporated into a portfolio of mandated programs as described in Chapter 11. However, as with other types of efficiency programs, states would need to have a solid plan for tracking and evaluating energy savings and avoided emissions if complying with a rate-based approach. This issue could be mitigated if a state chooses a mass-based approach to demonstrate CO_2 emissions reductions.

30 For example, traditional EM&V methods (i.e., a combination of engineering estimates of per-unit energy savings and participant counts) can be used to estimate the portion of savings from CBSM programs that involve direct installations of certain low-cost energy efficiency measures (e.g., CFL bulbs). For peer comparison feedback (or home energy reports) programs, a standard EM&V method is to establish both a treatment group and a control group, and estimate statistically significant differences in household consumption between the two groups. Details of this approach are discussed in Section 3 in this chapter and provided in the references in Footnote 37. Methods to estimate cross-program savings are discussed in Section 7.

3. State and Local Implementation Experiences

This section describes experiences with two types of behavior programs: peer comparison feedback programs by Opower and others, and Project Porchlight, a successful CBSM campaign by One Change Foundation.

Peer Comparison Feedback Programs

Utilities are increasingly considering and implementing peer comparison feedback programs. Evaluation studies show that peer comparison feedback programs are cost-effective energy efficiency programs, costing from $0.03 to $0.08 per kWh.[31] Their savings range from 1.5 percent to as much as 12 percent (as discussed in the following section, Greenhouse Gas Emissions Reductions). Among various entities, Opower is the most widely used platform for peer comparison feedback programs. Others include Tendril, Aclara, and C3. In partnership with local utilities and third-party administrators, Opower has offered behavioral programs to over 70 utilities in the country.[32]

Peer comparison feedback programs compare a household's energy use to that of similar households and provide relevant, personalized energy conservation tips. They also provide customers with information about other programs offered by their local utilities or efficiency program administrators.[33] Peer comparison programs using home energy reports take advantage of social norms to enhance the reception of their message. Home energy reports establish social norms and encourage participants to conform as closely as possible to sets of established norms.[34] In fact, a recent survey conducted for a study of Connecticut Light and Power's home energy reports program revealed that the comparison to neighbors was the most important aspect of the program for program participants. Through telephone surveys, almost 90 percent of households mentioned the neighborhood comparison when asked what information they remember from the reports. Furthermore, focus group attendees indicated the reports "sparked a 'competitive spirit,' motivating them to try to maintain a favorable status in comparison to their neighbors."[35]

Participation rates for home energy report programs are generally very high (upwards of 90 percent for a sample of Opower programs) because they are typically opt-out, rather than opt-in like most traditional energy efficiency programs. For example, a 2013 program evaluation on behavioral programs in Massachusetts found that Western Massachusetts Electric Company reached over 100,000 participants in its Opt-Out Home Energy Report programs, but reached only about 8000 customers in its opt-in programs. Together with other program administrators, the state's opt-out behavior programs have reached about 550,000 participants to date.[36]

A peer comparison feedback program often establishes both a treatment group and a control group, and estimates statistically significant savings by examining household consumption between the two groups.[37] Individuals in these groups are randomly selected. This experimental program design (using a randomly selected, large population) is another unique feature of peer comparison feedback programs, and is the feature that makes it possible to develop precise and unbiased savings estimates.[38]

31 Allcott, H. (2011). Social Norms and Energy Conservation. *Journal of Public Economics* 95:9-10: 1082-1095. Available at: http://www.sciencedirect.com/science/article/pii/S0047272711000478; Supra footnote 9 at pp. 21-22.

32 Opower. (2012). *Successful Behavioral EE Programs.* Available at: https://opower.com/uploads/files/BEE_Whitepaper.pdf

33 Supra footnote 9 at pp. 20-21.

34 Ibid.

35 Supra footnote 4 at p. 7-281.

36 Opinion Dynamics Corporation, Navigant Consulting, & Evergreen Economics. (2013, June). *Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report.* Available at: http://www.rieermc.ri.gov/documents/2013%20Evaluation%20Studies/ODC_2013_Cross_Cutting_Behavioral_Program_Evaluation.pdf.

37 Supra footnote 36; KEMA (2012, April). *Puget Sound Energy's Home Energy Reports Program – Three-Year Impact, Behavioral and Process Evaluation.* Available at: https://conduitnw.org/_layouts/Conduit/FileHandler.ashx?RID=849; Supra footnote 4 at p. 7-281; Smith, B. A., & and Morris, L. (2014, August). *Neighbor Comparison Reports Produces Savings, but HOW?* 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.aceee.org/files/proceedings/2014/data/index.htm

38 KEMA, at supra footnote 37.

Project Porchlight CBSM Program

Project Porchlight is a very cost-effective, highly successful CBSM program developed by One Change Foundation. The program mobilizes a significant number of volunteers and community networks to encourage members of a community to switch from inefficient incandescent light bulbs to new, energy-efficient CFL bulbs. By providing people with a free CFL bulb and information about energy conservation, the campaign aims to convert awareness into action by making first steps toward more energy-efficient practices (i.e., changing to a CFL bulb) accessible to all people.[39] One Change has run Project Porchlight campaigns in over 900 communities since 2005, and has been sponsored by a number of utilities and agencies in North America, including Puget Sound Energy (PSE), the New Jersey Board of Public Utilities, Ontario Power Authority, and SaskPower.[40]

One of the major benefits of a CBSM campaign is that it can reach out to numerous people with various backgrounds within a community, including those who are not aware of utility energy efficiency programs. CBSM does this first by addressing the specific barriers and benefits to energy efficiency and conservation within a given community. Second, CBSM relies on non-profit community organizations and local volunteers to conduct community outreach and to deliver credible messages, in that they have no commercial gain from participation.[41] Unlike utilities, local non-profit organizations leading a CBSM campaign can also take "a more light-hearted, nimble and fun tone in their communications."[42] Lastly, a successful CBSM campaign motivates a large number of volunteers to participate in the campaign by generating a sense of community, connection, and contribution.[43]

Using these approaches, Project Porchlight/One Change Foundation reached a significant number of households with various demographics in numerous communities, and in some cases reached 100 percent of the households in a community. For example, One Change Foundation's evaluation data on Project Porchlight in New Jersey (shown in Figure 13-1) show that the participation in four counties ranged from 48 percent to 100 percent of households and together reached about 45,000 households in these counties. The diversity of income levels and racial demographics in the figure also implies that people with various backgrounds have participated in the program, given the high participation rates.

Figure 13-1

Participation Rate and Demographics of Project Porchlight in New Jersey[44]

Phase Two (2009)

Location	Completed Deliveries	Household Count*	% Households Delivered	Population*	Income Levels (K/yr)* 25–35	Income Levels (K/yr)* 35–45	Income Levels (K/yr)* 50–75	Racial Demographics Caucasian	Racial Demographics African American	Racial Demographics Chinese	Population Density* (pers./sq. mi.)
Bergenfield Bergen County	4,572	7,491	61.0%	26,247	14.9%	21.3%	16.8%	62.9%	6.9%	20.4%	9,065
Newark Essex County	15,490	15,488	100.0%	278,980	12.9%	13.9%	14.3%	26.5%	53.5%	1.2%	11,400
Jersey City Hudson County	5,719	12,158	47.0%	242,389	12.9%	15.5%	17.3%	34.0%	28.3%	16.2%	16,045
Paterson Passiac County	19,020	39,750	48.0%	149,222	14.3%	16.6%	16.8%	30.8%	32.9%	1.9%	17,675

39 See: http://www.projectporchlight.com/content/what-we-do

40 Summit Blue. (2010, April). *Evaluation of Consumer Behavioral Research.* p. 21. Available at: https://www.nwcouncil.org/media/5449/Consumer_Behavioral_Research_Report___Summit_Blue.pdf; OneChange. (2008). *Impact and Evaluation Summary.* Available at: http://www.onechange.org/wp-content/doc_impact_and_evaluation_summary.pdf; Supra footnote 9.

41 Summit Blue, at supra footnote 40 at pp. 21-22.

42 Ibid, p. 21.

43 Ibid, p. 22.

44 OneChange, at supra footnote 40 at p. 3.

Another benefit of a CBSM campaign is that it raises individuals' awareness of the benefits of energy conservation as well as of local energy efficiency programs. For example, a single county in New Jersey in which the Porchlight volunteers brought information about refrigerator recycling to consumers' doors accounted for 25 percent of the state's refrigerator recycling program. In the campaign sponsored by BC Hydro Power, 41 percent of those who received a Project Porchlight bulb rated BC Hydro's Power Smart program "very favorable" in a survey, whereas just 27 percent of those who did not receive a bulb rated the program "very favorable." In the same survey, 17 percent of those who received a bulb rated Energy Star® "very favorable," and 13 percent of those who did not receive a bulb rated Energy Star® "very favorable." This indicates increased awareness of energy conservation among those who received a bulb, but also an increased awareness of and positive attitudes toward BC Hydro's program (given the "very favorable" rating for BC Hydro's program was much higher than the rating for Energy Star®).[45]

Lastly, Project Porchlight campaigns have been proven to be very cost-effective in a number of utility- and state-sponsored programs. Table 13-1 presents costs and estimated savings associated with this campaign sponsored by four entities in North America. The cost of saved energy ranged from 1.2 cents to 1.6 cents per kWh, with an average of 1.4 cents. However, if savings persist beyond the initial year, the cost of saved energy would be lower than these estimates. As explained in the Costs and Cost-Effectiveness section that follows, a 2013 report by ACEEE assumed the savings last 1.5 years on average for various behavior programs. Using this assumption, the average cost of saved energy for Project Porchlight is just about one cent per kWh.

4. Greenhouse Gas Emissions Reductions

As explained in Chapter 11, the magnitude of emissions reductions attributable to energy efficiency measures depends first and foremost on the amount of energy that was (or will be) saved. However, the emissions reductions that result from those energy savings also depend on when energy was (or will be) saved, and which marginal electric generating units (EGUs) reduced (or will reduce) their output at those times.[47] Over the longer term, the more significant impact of energy efficiency programs and policies is that they can defer or avoid the deployment of new EGUs. Over that longer term, the avoided emissions will thus depend not so much on the characteristics of existing EGUs, but on the costs and development potential for new EGUs.

In either the near term or the longer term, greenhouse

Table 13-1

Costs and Savings of Project Porchlight Campaigns[46]

	Year	Duration (y)	Customers Served	Program Costs	Savings (MWh)	Cost of Saved Energy (cents/kWh)	Savings (kWh) per Participant
Ontario Power Authority	2007	0.3	12,851,821	$3,500,000	300,800	1.2	23
Puget Sound Energy	2009	0.5	957,025	$1,700,000	129,700	1.3	136
New Jersey Board of Public Utilities	2008	4	8,864,590	$10,942,383	690,515	1.6	78
SaskPower	2008	0.5	490,000	$1,440,000	94,000	1.5	192
Total			23,163,436	$17,582,383	1,215,015	1.4	52
Average		1.33	5,790,859	$4,395,596	303,754	1.4	52

45 Summit Blue, at supra footnote 40 at p. 22; One Change, at supra footnote 40 at p. 4.

46 Based on: Supra footnote 9. The final column (cost of saved energy) was calculated based on data in the source document, based on an assumption that savings persist for one year.

47 For example, the average CO_2 emissions rate from natural gas power generation in the United States is about 1100 lb per megawatt-hour (MWh), whereas the average emissions rate from coal power plants is twice as much as this rate. See: http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html

gas (GHG) emissions reductions are proportional to energy savings, but not necessarily on a one-to-one basis (i.e., a one-percent reduction in energy consumption could reduce emissions by more or less than one percent, depending on how the emissions rates of the marginal or deferred EGUs compare to the system average emissions rates). Chapter 11 describes three methods for quantifying the short-term emissions impacts of energy efficiency programs: the average emissions method, the marginal emissions method, and the dispatch modeling method. Over a longer time period, the emissions rates of new natural gas-fired EGUs may represent a better proxy for avoided emissions.

In this section, we will summarize some of the currently available information on how much energy has actually been saved by behavioral programs, and how much could potentially be saved. However, information on GHG emissions reductions achieved through behavioral efficiency programs is unfortunately scarcer than similar information regarding standard energy efficiency programs.[48]

It has been several years since behavior-based utility energy efficiency programs were first developed. Although experience is still limited, the growing number of impact evaluation studies suggests that energy savings and associated GHG emissions reductions from behavioral energy efficiency programs can be significant. For the residential sector, annual energy savings could be about 1.5 to 2 percent of annual electricity consumption from households at a minimum, and possibly last more than a year after the program intervention (such as sending a home energy report) ends.

A 2013 paper by the University of California, Los Angeles presented a comprehensive meta-analysis of information-based energy conservation experiments conducted to date.[49] The study examined in detail 59 unique journal papers, representing 156 field experiments in 13 countries from 1975 to 2012, and estimated energy savings from the information-based strategies such as savings tips, energy audits, peer comparison feedback and pecuniary feedback, and pricing strategies. On average, the study found that individuals in the experiments saved electricity consumption by 7.4 percent. It also reviewed savings by program types. Among others, the study revealed energy savings tips, individual usage feedback, and social comparisons reduced energy use by 9.6 percent to 11.5 percent on average, and audits and consulting reduced energy use by 13.5 percent. However, the study also indicated that these savings effects may be overstated, because average savings effects from high-quality experiments (that include statistical controls such as weather, demographics, and a control group) within the 156 experiments were approximately two percent. Unfortunately it is not clear from the study which types of programs were included in the selected high-quality experiments.

More recent experiments on residential behavioral energy efficiency programs found similar levels of energy savings overall and revealed more details, such as savings for average energy users versus high energy users, and savings persistence in the time period following intervention. A 2014 study of Connecticut Light and Power's home energy reports program found that while receiving home energy reports, households with typical energy consumption levels achieved savings of 1.17 percent on average, whereas high energy use households achieved an even higher rate of 2.31 percent. On average, households achieved savings of 1.82 percent.[50] The study also observed continued energy savings for more than a year after home energy reports were suspended. Other recent reports observed that energy savings persisted for roughly two years at around 1.5 to 2.5 percent per year; in some cases, savings rates grew over time.[51] It is also notable that one of the behavioral programs, offered by Cape Light Compact in Massachusetts, showed a much higher savings rate, at about eight to nine percent over three years with a slight savings decrease in the second and third years.[52]

There are two national energy savings potential studies

48 Although the EPA has not been clear about how it intends to verify emissions reductions, the draft Clean Power Plan states that additional information and reporting may be necessary to accurately quantify the avoided CO_2 emissions associated with demand-side energy efficiency measures, such as information on the location and the hourly, daily, or seasonal basis of the savings. See: US EPA. (2014, June). *40 CFR Part 60 – Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule.* Federal Register Vol. 79, No. 117. p. 34920. Available at: http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf

49 UCLA Institute of the Environment and Sustainability. (2013, February). *Information Strategies and Energy Conservation Behavior: A Meta-Analysis of Experimental Studies from 1965–2011.* Available at: http://www.environment.ucla.edu/media/files/Delmas-Fischlein-Asensio.pdf

50 Supra footnote 4.

51 Supra footnote 38; Supra footnote 36.

52 Supra footnote 36.

focusing on behavioral energy efficiency programs. A 2013 preliminary study by McKinsey & Company examined the energy savings potential associated with behavioral adjustments by residential energy consumers that have little or no impact on their lifestyles. Although the scope of the study is not clear, the study found a total of 1.8 to 2.2 quadrillion BTUs per year of untapped residential energy efficiency potential, equivalent to 16 to 20 percent of current US residential energy use.[53]

Another study conducted in 2014 by Opower, one of the largest providers of residential behavioral programs in the nation, estimated savings potential from Opower-type peer comparison feedback programs for the entire country by state. This study relied on a dataset based on 218 programs in operation at 88 utilities, and estimated both energy and peak load savings.[54] The peak load savings estimates are based on a subset of data points, in which Opower observed that savings are 1.5 times higher during the peak hours. Overall, the study found behavioral programs are cost-effective for 79 million households, or about 60 percent of the US population. More specifically, the study estimated a potential of about 18,700 gigawatt-hours (GWh) of annual energy savings, about 3.2 gigawatt (GW) generation capacity savings, and 10 billion metric tons of CO_2 savings for the entire nation (see Table 13-2). According to the study, this level of energy savings represents about 1.6 percent of current residential electricity use, and is enough energy to take the entire state of Arkansas off the grid for a year, or to take 2.1 million cars off the road. At the state level, the highest relative amounts of energy savings were found in California, Texas, Florida, New York, Pennsylvania, and Ohio, attributable in part to these states' high populations, high avoided costs, and/or high air conditioning loads (see Figure 13-2).

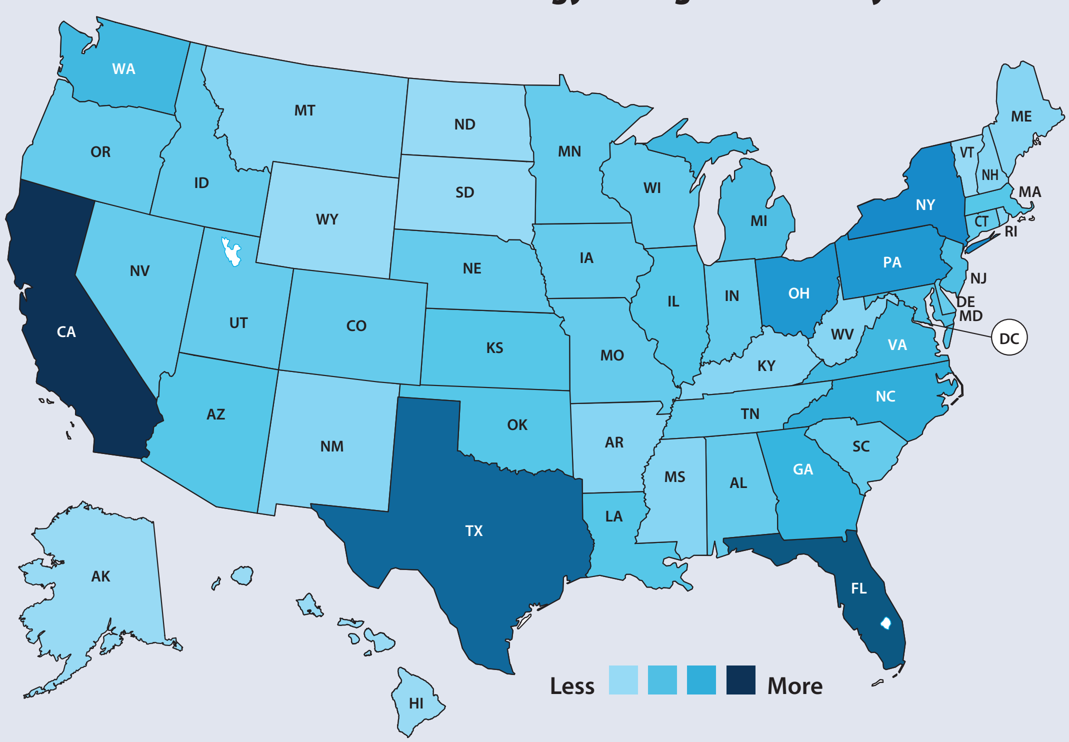
Table 13-2

Overview of Residential Electric Behavioral Potential Results[55]

Total Households	Technical Potential Households	Economic/ Achievable Potential Households	Annual Generation Savings (GWh)	Annual Capacity Savings (MW)	Annual CO_2 Savings (metric ton)	Annual Customer Bill Savings
110 million	96 million	79 million	18,679	3198	10,200,007	$2.2 B

Figure 13-2

Relative Residential Electric Energy Savings Potential by State[56]



54 Kane, R., & Srinivas, N. (2014, August). *Unlocking the Potential of Behavioral Energy Efficiency: Methodology for Calculating Technical, Economic, and Achievable Savings Potential.* Proceedings of the 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.aceee.org/files/proceedings/2014/data/index.htm

55 Ibid.

56 Ibid, figure 5 at p. 5-205.

Few if any studies have analyzed the CO_2 emissions savings from other behavior programs, or all behavior programs combined. The studies that do exist provide only rough estimates. For example, Opower's CO_2 savings estimate (discussed previously) is a rough estimate based on state-level carbon emissions rates.[57] This assumption implies that all types of power plants are ramping generation down in all of the hours that behavioral program savings actually occur. In reality, marginal generation, the type of generation that ramps up or down, differs by region and time of day or year. Detailed studies must use region-specific CO_2 emissions rates from marginal power plants. Fortunately studies and tools are available to estimate CO_2 reduction from marginal generation based on hourly or temporal savings profiles.[58]

Temporal savings profiles of behavioral programs were examined for the first time in 2013, made possible by the availability of new, detailed consumption data from smart meters.[59] One recent Lawrence Berkeley National Laboratory study examined Pacific Gas and Electric's home energy report pilot program for its hourly and peak load savings using smart meter data.[60] This pilot is one of the largest in the nation and includes 500,000 households. The study found energy savings during every hour, but observed higher savings during peak hours. The study results suggest that, to the extent that power plants with lower emissions outputs (e.g., combined-cycle natural gas or hydroelectric units) are used for meeting peak demands, the total CO_2 savings from behavioral programs are likely to be lower than what was estimated by the Opower potential study discussed previously. Conversely, if power plants with higher-than-average emissions (e.g., diesel backup generators or inefficient coal-fired units) are used to meet peak demand, the potential savings could be higher than estimated by Opower. However, in order to draw more definitive conclusions applicable to different regions of the country, more studies need to be conducted to evaluate hourly savings profiles of behavioral programs. States that intend to include behavioral programs as part of their 111(d) compliance plan could include a specific EM&V study plan to evaluate CO_2 emissions from behavior programs.[61]

To the authors' knowledge, the potential savings and emissions reduction benefits of commercial and industrial behavioral energy efficiency programs have not been rigorously studied and quantified.

5. Co-Benefits

As summarized in Table 13-3, behavioral efficiency programs provide a variety of co-benefits for society and the utility system beyond the GHG emissions reduction benefits described previously. The types of co-benefits are likely to be very similar to the types of co-benefits for traditional energy efficiency programs such as those described in Chapter 11; however, benefits from behavioral efficiency programs largely accrue to residential customers, as these programs tend to focus only on the residential sector.

Emissions of non-GHG air pollutants will decrease as a result of behavioral efficiency programs, just as they are reduced by other types of efficiency programs. The air emissions co-benefits depend on the same factors that were discussed with respect to GHG emissions reductions. As indicated in a recent paper on a peer comparison/home energy report program by Pacific Gas and Electric, savings from this program were observed at all hours, with higher savings at peak hours. This implies that savings

57 Supra footnote 54 at p. 5-204.

58 US EPA. AVoided Emissions and geneRation Tool (AVERT). Available at: http://epa.gov/statelocalclimate/resources/avert/index.html; ISO New England. (2014, January). 2012 ISO New England Electric Generator Air Emissions Report. Available at: http://www.iso-ne.com/static-assets/documents/genrtion_resrcs/reports/emission/2012_emissions_report_final_v2.pdf

59 Stewart, J. (2013, November). *Peak-Coincident Demand Savings from Residential Behavior-Based Programs: Evidence from PPL Electric's Behavior and Education Program.* Cadmus. Available at: http://escholarship.org/uc/item/3cc9b30t

60 Lawrence Berkeley National Laboratory. (2014, June). *Insights from Smart Meters: The Potential for Peak-Hour Savings from Behavior-Based Programs.* Available at: http://emp.lbl.gov/publications/insights-smart-meters-potential-peak-hour-savings-behavior-based-programs

61 For more information on impact evaluation methods for behavioral energy efficiency programs, see: State and Local Energy Efficiency Action Network (SEE Action). (2012, May). *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations.* Available at: https://www4.eere.energy.gov/seeaction/system/files/documents/emv_behaviorbased_eeprograms.pdf. In addition, see various references in Footnote 37 under Section 3 in this chapter.

occur because of changes in equipment settings such as heating, air conditioning, water heating, and lighting timers.[62] The emissions rates of marginal generating units can vary substantially in different parts of the country and at different times of year. Thus, a behavioral program that reduces annual energy consumption by one percent, for example, could conceivably reduce emissions of various pollutants by more than or less than one percent.

Although not shown in Table 13-3, behavioral efficiency programs can also produce substantial benefits for the participating customers, including reduced future electricity bills, other energy and resource savings (e.g., heating fuels, water), and reduced operations and maintenance costs. Behavioral programs also provide low-income benefits such as reduced utility collection costs, to the extent that low-income customers reduce their energy bills and avoid or reduce non-payment incidents.

Behavioral efficiency programs could provide additional and different benefits if they increase participation in more traditional energy efficiency programs.

Table 13-3

Co-Benefits of Behavioral Energy Efficiency Programs

Type of Co-Benefit	Provided by This Policy or Technology?
Benefits to Society	
Non-GHG Air Quality Impacts	Yes
Nitrogen Oxides	Yes
Sulfur Dioxide	Yes
Particulate Matter	Yes
Mercury	Yes
Other	Yes
Water Quantity and Quality Impacts	Yes
Coal Ash Ponds and Coal Combustion Residuals	Yes
Employment Impacts	Yes
Economic Development	Yes
Other Economic Considerations	Yes
Societal Risk and Energy Security	Yes
Reduction of Effects of Termination of Service	Yes
Avoidance of Uncollectible Bills for Utilities	Yes
Benefits to the Utility System	
Avoided Production Capacity Costs	Yes
Avoided Production Energy Costs	Yes
Avoided Costs of Existing Environmental Regulations	Yes
Avoided Costs of Future Environmental Regulations	Yes
Avoided Transmission Capacity Costs	Yes
Avoided Distribution Capacity Costs	Yes
Avoided Line Losses	Yes
Avoided Reserves	Yes
Avoided Risk	Yes
Increased Reliability	Yes
Displacement of Renewable Resource Obligation	Yes
Reduced Credit and Collection Costs	Yes
Demand Response-Induced Price Effect	Yes
Other	Yes

6. Costs and Cost-Effectiveness

As noted in Chapter 11, energy efficiency measures vary in their costs and cost-effectiveness at reducing load. Because behavioral efficiency programs are a relatively new innovation, there are fewer data available on their costs than are available for other types of efficiency programs. However, the data that are currently available suggest that behavioral programs fall within the range of typical values for efficiency programs in general. And as is true for all efficiency programs overseen by utility regulators, behavioral programs will generally not be approved (even on a pilot basis) unless the benefits are expected to exceed the costs.

Recent studies across different regions suggest that residential behavioral programs are cost-effective, with a cost of saved energy ranging from $0.01 to $0.08 of program implementation costs per kWh of energy saved because of the program, according to a 2013 meta-analysis of cost of saved energy for behavior programs.[63] This study examined numerous programs from 50 entities for cost-effectiveness, and identified ten programs that provided both actual savings and program spending data. Given limited data availability of the measure life or savings persistence for behavior programs, the study assumed a standard measure life of 1.5 years. This assumed measure life is based on an assumption that some programs have no follow-up or program intervention (e.g., home energy reports to elicit behavior response) beyond the first year and savings decay in one year, and that other programs have follow-up and thus savings continue for another year or so. However, as discussed previously, a few recent studies found that energy savings continue even after program intervention is stopped. Therefore, one can say this study assumption of a 1.5-year measure life is

62 Smith, et al, at supra footnote 37.

63 Supra footnote 9.

Table 13-4

Cost of Saved Energy for Ten Electric Behavioral Programs[64]

Program Name	Number of Programs	Average CSE (cents/kWh)
Project Porchlight CBSM	4	1
Opower platform programs	3	8
PowerSave and others	3	8
Average		**1.61**

reasonable, but potentially conservative.

The 2013 ACEEE study provides cost of saved energy (CSE) in cents per kWh for ten electric behavioral energy efficiency programs representing three types of programs (see Table 13-4). The weighted average cost of saved energy is just 1.61 cents per kWh. Four of the programs were Project Porchlight programs in four different utilities and have been very cost-effective, at an average CSE of just one cent per kWh. Three programs using Opower's platform have an average CSE of eight cents per kWh. The last three programs, including different program types such as PowerSave Schools, were just under eight cents per kWh.

A recent research paper by ICF International examined the sensitivity of various key variables on the cost-effectiveness of residential behavior and real-time feedback programs using a probabilistic Monte Carlo approach.[65] The key variables include administration costs, discount rate, retail rates, avoided costs, annual savings, and program life. For example, the study considered a savings persistence of behavior programs ranging from one to three years, with two years most likely to occur with a 60-percent probability. There are also three scenarios for annual savings per household, with each scenario having minimum, most likely, and maximum values. The most likely savings values range from 1.38 percent to 2.5 percent, with 1.96 percent for the base case. The study examined cost-effectiveness of different demand-side management program tests and concluded that there is a high chance (71 percent) that behavior programs pass the Total Resource Cost test and Program Administrator Cost test.

It is also worth repeating, as noted in Chapter 11, that saving energy through behavioral or other energy efficiency programs can be considerably less expensive than generating energy by adding new resources to the electric grid. Recent reports from a number of sources estimate that the unsubsidized, levelized cost of energy exceeds six cents per kWh for new, natural gas-fired combined-cycle units and new, supercritical pulverized coal units without carbon capture. Nuclear cost estimates exceed nine cents per kWh for new units.[66] Furthermore, it is important to note that the total benefits of behavioral energy efficiency programs go well beyond the avoided costs of generation and capacity. As shown in Table 13-3, such benefits also include avoided cost of transmission, distribution, and reserves, as well as emissions reductions and various non-energy benefits. Even at the high end of the cited range in cost of saved energy (eight cents per kWh), it is likely that behavioral programs are cost-effective (i.e., the total value of all of the societal benefits exceeds the total costs).

7. Other Considerations

Concerns About Double Counting Savings

One of the key benefits of behavioral energy efficiency programs is that they help to increase participation and savings for energy efficiency programs, such as those described in Chapter 11 that promote more efficient technologies.[67] However, this benefit gives rise to concerns that savings will be double counted, that is, more than one program will take credit for the same unit of saved energy. One way that evaluators have handled this issue is to estimate the amount of these "joint" or "cross-program" savings and remove that amount from the savings credited to the behavioral program. For example, for an evaluation of PSE's Home Energy Reports program, KEMA compiled data on all rebated installations, for both a treatment group that received the energy reports and a control group that did not, to identify increased uptake of other PSE energy efficiency programs by the treatment group. To examine

64 Supra footnote 9.

65 Bozorgi, A., Prindle, W., & Durkee, D. (2014, August). *An Uncertainty-Based Analysis on Cost-Effectiveness of Feedback/Behavior-Based Programs within a DSM Portfolio.* Available at: https://www.aceee.org/files/proceedings/2014/data/papers/7-411.pdf

66 Refer to estimates by US Energy Information Administration at: http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. Also refer to estimates by Bloomberg New Energy Finance, cited in Chapter 6, and by Lazard at: Lazard Ltd. (2014). *Lazard's Levelized Cost of Energy Analysis — Version 8.0.* Available at: http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

67 Supra footnote 13.

double counting attributable to participation in programs for which there was no tracking data (i.e., PSE's lighting programs), KEMA developed estimates of increased uptake of efficiency measures using household survey data. The joint savings from the energy reports and the rebate program, and from the energy reports and lighting programs, were subtracted from the results credited to the energy reports program.[68]

Although subtracting cross-program savings from the savings attributed to a behavioral program avoids double counting, this approach tends to undervalue the contribution made by behavioral energy efficiency programs toward the portfolio. Moreover, their cost of saved energy and benefit-cost ratios look less favorable, because the costs of the behavioral energy efficiency program are compared to the benefits associated with a smaller number of units of saved energy than if the behavioral program was given credit for the increase in savings by other programs. This approach creates a disincentive for program administrators to implement behavioral energy efficiency programs.[69] Goldman and Dougherty propose three different methods for addressing this issue:

1. Allocating benefits to traditional and behavioral efficiency programs based on self-reported level of influence;
2. Attributing a marketing non-energy impact to behavioral energy efficiency programs (based on an estimate of marketing costs that can be avoided by increasing promotion of other programs in behavioral energy efficiency program materials); and
3. Reallocating behavioral energy efficiency program costs to marketing budgets for cross-program participation.

Goldman and Dougherty find that all three methods increase the benefit-cost ratios for the behavioral energy efficiency program, but that the marketing benefits and the marketing costs approaches (points 2 and 3 in the list above) are simpler and less costly to evaluate.[70]

State Plans for 111(d) Compliance

Because behavioral efficiency program savings are difficult to quantify, state regulators may be skeptical about their effects, and their potential use in state compliance plans may be limited. In order for the programs to be included in a state plan, the state will almost certainly need to have a solid plan to track and evaluate energy and emissions savings from such activities when a rate-based compliance approach is adopted.[71] If using a rate-based approach, states would need to include at least the following pieces of information in the plans they submit to the EPA for approval (as suggested by US EPA for a 111(d) plan):

- Description of the programs, and implementation schedules and timeframes;[72]
- Estimates of potential energy and CO_2 emissions savings;[73]
- Impact and process evaluation plans, including evaluation protocols and methods;[74] and
- Discussion of any uncertainty associated with savings and cost estimates.[75]

68 Supra footnote 38 at pp. 2-4, 4-11.

69 Supra footnote 13.

70 Ibid.

71 As noted previously, to some extent this issue could be mitigated if a state chooses a mass-based approach to demonstrate CO_2 emissions reductions. Also note that, although the EPA has not established guidance on appropriate EM&V methods, the EPA's Clean Power Plan draft discusses the industry-standard practices and procedures that are typically defined and overseen by state public utility commissions. See: US EPA, at supra footnote 48.

72 US EPA. (2014, June). *State Plan Considerations – Technical Support Document (TSD) for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units.* Docket ID No. EPA-HQ-OAR-2013-0602. pp. 76-78. Available at: http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-state-plan-considerations.pdf

73 Ibid.

74 US EPA, at supra footnote 48.

75 Supra footnote 72 at pp. 57-60.

8. For More Information

Interested readers may wish to consult the following reference documents and websites for more information on behavioral efficiency programs:

- Mazur-Stommen, S., & Farley, K. (2013). *ACEEE Field Guide to Utility-Run Behavior Programs.* ACEEE Report No. B132. Available at: http://www.aceee.org/research-report/b132
- Opinion Dynamics Corporation, Navigant Consulting, & Evergreen Economics. (2013, June). *Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report.* Available at: http://www.rieermc.ri.gov/documents/2013%20Evaluation%20Studies/ODC_2013_Cross_Cutting_Behavioral_Program_Evaluation.pdf
- Russell, C., Wilson-Wright, L., Krecker, P., & Skumatz, L. (2014). *Behavioral Effects: How Big, How Long, From Whom, How Best?* 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.aceee.org/files/proceedings/2014/data/index.htm
- State and Local Energy Efficiency Action Network (SEE Action) website. Available at: https://www4.eere.energy.gov/seeaction/topic-category/behavior-based-energy-efficiency
- Summit Blue. (2010, April). *Evaluation of Consumer Behavioral Research.* Available at: https://www.nwcouncil.org/media/5449/Consumer_Behavioral_Research_Report___Summit_Blue.pdf
- Vigen, M., & Mazur-Stommen, S. (2012). *Reaching the "High-Hanging Fruit" Through Behavior Change: How Community-Based Social Marketing Puts Energy Savings within Reach.* ACEEE. Available at: http://www.aceee.org/white-paper/high-hanging-fruit

9. Summary

Because of their significant energy savings potential and cost-effectiveness, behavioral energy efficiency programs are becoming increasingly popular with program administrators to improve energy savings results. By avoiding barriers faced by more traditional energy efficiency programs, behavioral energy efficiency programs may be able to tap energy savings potential that has been resistant to other initiatives. However, the energy savings and associated emissions reductions benefits associated with some types of behavioral energy efficiency programs may not persist after the stimulus is removed, and may not be attributed to the behavioral efficiency program if there is overlap with more traditional energy efficiency programs. Nonetheless, these programs appear to be cost-effective with savings from just the first year of operation. Measuring, verifying, and attributing energy and CO_2 emissions savings to these programs, while giving them credit for cross-program effects, is feasible but may pose challenges, given the limited experience in this area.