

**Tracking Utility Behavior-Based Energy Programs
Against the Behavioral Theories
and Principles that Inspired Them**

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Trend toward Behavior-based Energy Reduction Programs

“Energy-efficient technologies, in the end, are what will allow us to address the climate imperative through cost-effective energy bill savings, but efficiency-related institutions will play an equally important role: enabling the smart applications of technology and acting as a powerful force for or against new innovations (p2).”¹

In the past three decades technology, energy policy, and regulation have been the major drivers of efforts to improve energy efficiency and reduce carbon emissions in the United States. As a result: appliances and heating and cooling equipment use less energy; the walls, roofs, and windows of residential and commercial buildings have less thermal gain and loss; and total energy use in U.S. residential buildings has decreased slightly (from 10.58 to 10.55 quads).² However, over the same period, the proportion of residential electricity used by appliances and electronics nearly doubled (from 17 to 31%) and plug loads from personal electronics in commercial buildings have been increasing steadily. The energy saving gains realized by more efficient major appliances, equipment, and building design and construction are being offset by the increase in consumer electronics (e.g., laptops/notepads, smart phones, electronic games, etc.) and, more recently, electric vehicles plugging into the electric grid.³ It is estimated that plug loads account for approximately 20% of residential and office energy use and will continue to increase.⁴

Studies suggest that energy efficiency technologies do not always achieve the energy savings expected or predicted from modeling or simulations.⁵ One reason appears to be how the technologies are introduced and used. Much technology is made available to the public without adequate instruction and support. Programmable thermostat features, for example, are often not fully utilized because they are (or are perceived to be) difficult to program and operate.⁶ High performance/green buildings also frequently fail to live up to their potential or predicted energy savings when occupants do not know how to effectively use their green design features or actively work to defeat them. The common “wild card” in the effectiveness

¹ Laitner, JA, Ehrhardt, K & Knight CP (2009). The climate imperative and innovative behavior: Encouraging greater advances in the production of energy-efficient technologies and services. California Institute for Energy and Environment (CIEE) Behavior and Energy Program. University of California Berkley, Revised November 2009.

² EIA 2009 Residential Energy Consumption Survey. <http://www.eia.gov/consumption/residential/> Accessed 22May12.

³ EIA 2009 Residential Energy Consumption Survey.

<http://www.eia.gov/consumption/residential/reports/electronics.cfm> Accessed 22May12.

⁴ Melton, P (2011). “Occupant engagement—Where design meets performance” *Environmental Business News*. <http://www.buildinggreen.com/auth/article.cfm/2011/11/1/Occupant-Engagement-Where-Design-Meets-Performance/> Accessed 4Nov11.

⁵ “Implementing sustainability: The behavioral-social-cultural dimension.” Draft guidance for federal agencies in implementing strategic sustainability performance plans. Federal Energy Management Program (FEMP), July, 2011.

⁶ Sanquist, T (2011). “A behavioral analysis of home energy management (HEM) tools as consumer enablers of smart grid benefits.” Pacific Northwest National Laboratory, August 22, 2011

of energy efficient technologies and building design is the human in the loop.⁷ Energy efficient designs and policies are often based on hopeful or unrealistic assumptions about how people will interact with technology.

Generally, engineers and designers have dealt with the effects of humans on energy systems through more efficient design and greater automation that effectively designs the human out of the system and eliminates the need for human input or action. While this approach may address energy consumption concerns in the short run, resourceful humans who want some control over their environment find a way back into the loop—and not necessarily in an energy saving way. People will try to change, customize, disable, or otherwise interfere with technology and design features to achieve or maintain a level of comfort they have come to expect at home, at work, and on travel.

Fortunately, a growing number of engineers, designers, and policy makers have begun to take energy consumer behavior more seriously. More efficient design, technology and energy-related policy acknowledge that appliances, equipment and buildings are created for people to use and that people use energy.⁸ Rather than take humans out of the energy loop, effective long-term strategies engage them directly in efforts to reduce energy consumption.

Acknowledging humans as an active part of the energy system has led to efforts to better understand how people interact with energy. It has also stimulated the development of behavior-based energy reduction and demand response programs that attempt to change how and when people use energy and how much they use at particular times.⁹ This paper will explore the drivers of energy use behaviors, research on behavior and behavior change, and the behavior-based programs adopted by utilities charged with reducing the energy consumption of their residential and small commercial customers. It will also present researchable recommendations on how utilities can improve the effectiveness of behavior-based energy programs.

Behavior-based Programs

“Utilities face growing pressure to help customers reduce overall energy consumption.”
(Wilson, 2012)¹⁰

⁷ Melton, P (2011). “Occupant engagement—Where design meets performance” *Environmental Business News*. <http://www.buildinggreen.com/auth/article.cfm/2011/11/1/Occupant-Engagement-Where-Design-Meets-Performance/> Accessed 4Nov11.

⁸ *Case Study of CALSTRS Headquarters, West Sacramento, California Final Report: August, 2011*. Center for the Built Environment. http://www.cbe.berkeley.edu/research/pdf_files/calstrs-final-2011.pdf Accessed 4Nov11.

⁹ www.aceee.org/glossary/

¹⁰ “C3 acquire Efficiency 2.0, creating integrated energy efficiency SaaS software solution for the utility industry” <http://www.msnbc.msn.com/is/47243646> Posted May 1, 2012. Accessed 18May12.

Behavior-based energy efficiency (BBE) programs attempt to influence customer energy use behavior through feedback, comparison, outreach, education, competition and rewards. They focus on both ongoing, habitual behaviors (e.g., turning off lights in unoccupied rooms) and one-time behaviors (e.g., installing CFLs, installing energy efficient windows). Recommendations about energy efficient products also target purchase behaviors and may be combined with rebates, rewards and other programs.¹¹

Behavior-based energy efficiency efforts have recently gained a broader measure of acceptance and support from California, Massachusetts and Minnesota. These states allow utilities to count savings due to behavior-based programs toward their energy efficiency goals, at least as part of a pilot program.¹² Acceptance by state public utility commissions has been facilitated by demonstrated impacts on savings from more efficient technologies and the growth of third party service providers that use existing technology to encourage and support changes in how residential and commercial customers use energy. These third party service providers allow utilities to focus on their primary missions rather than developing the capabilities and infrastructure to support the operation, maintenance and measurement of behavior-based programs.

In California, third party service providers have been engaged by the state's independently owned utilities (IOUs) to meet the California Public Utilities Commission (CPUC) requirement of a universal audit tool (UAT) as customer engagement tools that provide residential and commercial customers with information and feedback on their energy use. While each of the state's major IOUs is working with a different third party service provider, their behavior-based programs follow a similar approach: (a) inform and educate customers about their current energy use and alternatives, (b) facilitate/ encourage positive attitudes about reducing energy use, and (c) get customers to commit to energy conservation actions. The tools available from the third party providers create a one-stop interactive resource for customers providing information and recommendations well beyond the basic information provided in the old monthly utility bill. The programs appear to be achieving some measure of success, although some studies report widely varying energy savings from behavior-based programs.¹³ For behavior-based programs to be consistently effective in affecting energy use, the behavioral and situational drivers of changing energy use behavior should reflect realistic assumptions about how people think about and use energy.

Unique Challenges Facing Public Utilities to Implement Behavior-based Energy Reduction Programs

¹¹ "Evaluation, measurement and verification (EMV) of residential behavior-based energy efficiency programs: Issues and recommendations." Report by the State and Local Energy Efficiency Action Network. May, 2012

¹² <http://www.institutebe.com/Existing-Building-Retrofits/behavior-based-energy-efficiency.aspx>

¹³ Granderson, J; Piette, MA & Ghatikar, G (2010) "Building energy information systems: User case studies." Published online at <http://www.Springerlink.com>, 16June2010.

Decades of research on human behavior have produced at least one consistent finding: a lasting change in behavior is difficult to achieve. Anyone who has made and followed through on a personal new year's resolution knows that even self-initiated and intrinsically motivated behavior change is hard. The difficulty grows exponentially when someone else (e.g., a change agent) is trying to change others' behavior.

There are obvious advantages of self-initiated behavior change. Individuals choose what behavior to change and are self-motivated (it's something they want to do). They (presumably) have sufficient self-understanding to know how to approach changing their own behavior—although the health of the self-help industry suggests people still need some help,—have self-set goals, and usually have family and friends to provide encouragement and support.

There are also numerous challenges to self-initiated behavior change, most important being well-learned habits that are resistant to change. Additionally,

- conscious effort is required to engage in the new behavior;
- there may be unanticipated consequences (e.g., weight gain and mood changes with smoking cessation) that undermine efforts to change behavior;
- it's demotivating when it takes longer to reach the goal than planned or expected;
- family and friends may not provide the level or duration of encouragement and support needed to achieve the goal;
- selected goals are too easy or too hard; and
- no or insufficient learning from previous, unsuccessful attempts.

People who want to change their behavior can also utilize a change agent—e.g., a personal coach or personal trainer, or self-help group to help overcome challenges.

Now consider a situation where the goal to change behavior belongs to someone else, e.g., a spouse, family member or friend, a commercial enterprise, or a government agency. In this circumstance, the change agent's task includes convincing, compelling or forcing one or more people to do (or refrain from doing) something they may not want to do (or stop doing), or may not care about. The difficulty of the change agent's task is compounded if (a) some or all of the people are unknown to a change agent; (b) the change agent knows little about their motivations, habits, and abilities; and (c) a majority of the group does not want to change their behavior or has different beliefs about the extent to which they are willing to change.

However, the change agent may have resources to support change attempts and sustain the change (e.g., a person, group or entire marketing organization responsible for maximizing the success of change attempts).

Commercial enterprises constantly attempt to change others' behavior. Their success greatly depends on influencing the behavioral choices of potential customers. To that end, commercial businesses determine the markets they want to develop and serve, and tailor their marketing to their specific customer base. In the U.S. and other countries, regulations that encourage competition and prevent monopolies give customers choices among commercial enterprises for

goods and services. In exchange for better service or rewards, customers may share personal information about themselves with the businesses they choose.

Utilities and commercial enterprises share a common interest in trying to influence their customers' behavior. Whereas commercial enterprises emphasize purchasing behaviors, utilities are concerned with both purchasing and saving behaviors. Additionally, influencing customer savings is not a recent phenomenon associated with current concerns about human-induced climate change. For example, energy efficiency in the US gained prominence during World War II;¹⁴ for over 20 years, Commonwealth Edison, a public utility company in Illinois, promoted energy savings in its advertising through its company logo, "Little Bill," and its light bulb marketing ("Lights up your house for pennies a day").¹⁵ However, there is a fundamental difference in the relationship between utilities and their customers. Utility companies do not choose their markets, but serve the diverse customer base in their operating region. Similarly, customers generally have no choice in their utility company. While forced relationships can be positive for both sides, the lack of choice about energy providers can affect how customers feel about their energy provider and their willingness to share information with them.

Before there were oil embargos, energy shortages, increased emphasis on sustainability and customer service, changing business environments, and an awareness of energy insecurity as a matter of national security, utilities had little reason to engage with their residential and small commercial customers beyond basic information about services and costs. While utilities have always been responsible to their governing authorities for managing energy supply and demand for their customers, the growth in both the residential and small commercial sectors—each of which have different energy needs and usage patterns and different drivers of their energy use—has significantly complicated this responsibility. To be successful in meeting their goals and requirements, utilities must develop and utilize strategies that maximize energy efficiency (supply) and effectively manage and influence their customers' energy use (demand). Long-standing models and assumptions about customer energy use behaviors based on reasoned and instrumental decisions have incorporated more holistic management strategies to affect energy consumption.^{16,17} Utility companies have begun to complement their energy efficiency portfolios with BBE programs to gain a better understanding of their customers and influence their customers' energy behaviors.

The following section discusses relevant behavioral theory and research that have shaped behavior-based energy programs.

¹⁴ <http://www.zimbio.com/Energy+Conservation/articles/sl8FV3Aagcq/History+Fluorescent+Lighting>

¹⁵ <http://www.flickr.com/photos/popkulture/5714530900/>

¹⁶ Randazzo, KV & Peters, JS. "Reconsidering what we measure: A white paper. Residential decision-making and proposed standard questionnaire items." Paper prepared for Southern California Edison and Pacific Gas & electric. Study ID: SCE0305, August 2011.

¹⁷ Lutzenhizer, L. (2009) *Behavioral Assumptions Underlying California Residential Sector Energy Efficiency Programs*. Berkeley, Calif.: California Institute for Energy and Environment.

Overview of Relevant Theory and Research on Behavior and Behavior Change

Several thorough reviews have been completed on behavior theories and research relevant to energy use behavior and behavior change. Rather than revisit reviews, this paper will briefly summarize what is known about human behavior as it relates to energy use and, where appropriate, refer to the findings of earlier reviews. This review and discussion will add to the body of knowledge on the drivers of energy consumption, help frame the development of recommendations to Southern California Edison's (SCE's) behavior-based energy programs for residential and small commercial customers, and identify research gaps that SCE's behavior-based energy program can begin to address.

Most reviews of theories of behavioral change include the awareness-knowledge-attitude approach to behavior change. The discussion of behavioral theories presented here considers awareness as the result of ***selective attention to what is salient and important*** to individuals. People will pay attention to things they care about or are important to them. ***Communications to make people aware of things they do not value or consider important are less likely to be attended to or recalled.*** The theories presented and discussed here focus on the factors that will influence people to attend to information that leads to/prompts action on the information.

Habit and Routines

Most behavior—including energy use behaviors—is habit or routine based, meaning it is well-established in a stable context and changes little over time.

While habits may evoke a negative connotation suggesting inflexibility, they are very useful in negotiating daily life by improving both cognitive and behavioral efficiency.¹⁸ Habits or routines generally develop around behaviors that are easy to perform and have either positive outcomes (e.g., same desirable result every time) or strong sanctions associated with them (e.g., related to personal hygiene). Many people are familiar with daily morning and evening routines, smoking a cigarette with coffee or after a meal, turning on a light upon entering a darkened room, snacking while reading or watching TV. Each routine consists of a sequence of learned behaviors established to maximize efficiency, minimize effort, or experience pleasure while achieving some other purpose (e.g., getting to work or school, completing an activity, or relaxing). Once learned and established, habits don't require much thought; they are

¹⁸Lutzenhizer, L. (2009) *Behavioral Assumptions Underlying California Residential Sector Energy Efficiency Programs*. Berkeley, Calif.: California Institute for Energy and Environment. **Also**, Sullivan, M. (2009) *Behavioral assumptions underlying energy efficiency programs for businesses*. California Institute for Energy and Environment.

performed automatically, freeing up capacity to do other things that require cognitive effort. As anyone who has experienced an unexpected change in getting to work or completing a routine task knows—interruption in or disruption of a well-established habit can adversely affect the rest of the day.

Breaking a habit or changing a routine is difficult partly because people do not pay much attention to them. There are also incentives associated with habits that have developed overtime that maintain the behavior. To break a habit one must:

- become aware of the behavior (think about what you are doing),
- remove the incentives supporting the behavior,
- avoid or control the negative consequences from not performing the routine behavior, and
- find rewarding alternatives.

The last two steps are especially important. Habits can be tenacious because of the rewards and pleasure they provide. If there is only pain associated with replacing a habit and no tangible and equally pleasurable gain, the habit is likely to persist.

While the steps to breaking a habit appear straightforward, personal experience should suggest that challenges at each step can undermine even the highly committed and motivated individual. Because habits and routines are embedded in larger, interrelated and often complex behavioral units or sequences that accomplish specific objectives (e.g., getting ready for the day, getting to work), once the sequence is initiated, each subsequent behavior in the sequence is a trigger for the next behavior. Attempting to change a single behavior in the sequence requires deconstructing the routine, adding a new behavior and consciously thinking about and performing the behaviors until they become a new routine. How hard is that to do? Studies suggest it takes from three weeks (for a simple habit) to 8 months (for a complex one) to form a new habit.¹⁹

Key to influencing and changing how people use energy is determining and changing all the behavioral sequences or routines in which energy use is a part. With increasing numbers of electronic devices used in all aspects of life, energy use behaviors are part of home, work and social activities, and habits.

Changing energy use that is part of a habit or routine behavioral sequence means deconstructing the routine, attending to the energy use behaviors, altering the energy behaviors, and re-establishing a new routine. A successful outcome of changing a habit also requires time and commitment.

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http://www2.fiu.edu/~oea/InsightsFall2004/online_library/articles/daily%20activities%20to%20help%20change%20habits.htm Also <http://www.psychologytoday.com/blog/creatures-habit/200912/how-long> Also <http://psychcentral.com/blog/archives/2009/10/07/need-to-form-a-new-habit-66-days/> Also <http://www.ucl.ac.uk/news/news-articles/0908/09080401>

Deconstructing a common routine reveals how many different behaviors comprise it and how much energy use can be automatic. A typical morning routine in a US household would likely include the following behaviors for a single individual:

- an electronic alarm turning on
- turn on lights in the bedroom, then bathroom; possibly turn on TV for news, weather and traffic information; unplug mobile or smart phone (that had charged overnight)
- use hot water to wash up; take a shower; use an electric razor or use hot water to shave with a manual razor; possibly press an article of clothing
- turn on lights in kitchen, possibly other rooms
- make coffee, tea, breakfast; possibly use other appliances (stove top, microwave oven, oven)
- use computer, laptop, mobile device.

Depending on the individual's routine, electronics and lights could remain on throughout the entire routine. Some might remain on all day (computer, laptop) or until the last person in the household left for the day (or turned them off).

Theories of Planned Behavior or Reasoned Action

Theories of planned behavior or reasoned actions encompass those behaviors which are not habits or under autonomic control. They focus on behavior which requires some cognitive effort (usually choice from among options) to complete. Theories in this category consider both internal and external factors that affect behavioral choices. Internal factors include attitudes, values, norms or capabilities and encompass issues of what people want to do, believe they should do and believe they are capable of doing. External factors include contextual, circumstantial and physical supports or constraints to behavior, e.g., cost, policies and regulations and physical capabilities.

Most of the research on energy use behaviors has drawn on theories of planned behavior or rational action to explain choices made by energy users and try to influence the selection and performance of energy-saving behaviors. Most frequently mentioned theories in this category include reinforcement theories of motivation, goal-setting and the Theory of Planned Behavior. Less frequently mentioned behavioral theories that have been applied in other contexts are Expectancy Theory (e.g., work performance) and the Theory of Interpersonal Behavior (e.g., more researched in Europe than the U.S.). Each of these theories will be briefly described and their relationship to energy use research briefly discussed.

Reinforcement Theories of Motivation

Reinforcement theories of motivation explain behavior as a function of its consequences. Humans and animals learn to engage in behaviors that have been associated with rewards and avoid behaviors that have been associated with punishment. Essential to effectively using reinforcement or punishment to motivate individuals to perform (or not perform) specific behaviors are knowledge of what individuals *perceive as rewarding or punishing* and the

schedule of reinforcement to establish and maintain a desired behavior.²⁰ Because rewards can be either external (e.g., money, gifts, services, recognition) or internal (e.g., feelings of accomplishment, belonging, satisfaction), *determining which types of rewards are more important to individuals can make the difference between effective and ineffective behavior-based programs*. Maintaining the best *schedule of reinforcement* can be complicated when the number of target individuals is large and there are a variety of rewards available. Finally, the *timing of the rewards* is important in establishing a new behavior and inconsistent reinforcement at that stage can undermine the reinforcement approach.

These elements of the behavior-reward connection should be considered when deciding how to influence energy use behaviors in customers over which a utility has little control. Current BBE programs appear to recognize that a variety of rewards is necessary to ensure that rewards are valued across customer groups. The rewards are mostly external (e.g., money saved, discounts at local or national businesses, rebates), although much of the positive feedback provided for reduced energy consumption over a period of time can generate a sense of accomplishment that is internally rewarding. However, BBE programs may not be able to administer an effective reinforcement schedule to establish and strengthen the connection between reduced energy consumption and rewards.

Because of the size and diversity of their customer base, utilities cannot tailor the rewards and schedules of reinforcement of BBE programs to individual residences or small commercial businesses. However, some level of individualization can be created by focusing on customer segments. Through demographic, personal and market data and consumption patterns, utilities are able to identify customer groups that may share similar characteristics and values and target program communications and rewards to these customer segments. By varying when specific rewards are available and in what quantity, utilities can achieve some diversity in the schedule of reinforcements for energy reduction behaviors. *The timing of rewards is dependent on both customer reporting* about their energy reduction behaviors (e.g., through rebate programs and self-report on utility websites) *and compilation of energy measurements for billing purposes and reward distribution*.

The longer the delay between actual energy reduction behavior and rewards, the weaker the connection between behavior and reward, and the less powerful the effect of the rewards over time.

Goal Setting

The use of goals to guide behavior and performance is hardly new. They were an inherent part of the time and motion studies that led to the development of Frederick Taylor's principles of scientific management over 100 years ago.²¹ At its core, this approach to achieving an

²⁰ Wagner, John A., III & Hollenbeck, John R. (1992). *Management of organizational behavior*. Englewood Cliffs, NJ: Prentice Hall.

²¹ Taylor, FW (1911). *The principles of scientific management*. New York: Harper Bros.

objective—whether on a personal, group, organizational or societal level—is to set a goal and work towards it. One of the most memorable/dramatic and successful examples of how goal setting can lead to a desired outcome is the challenge President John F. Kennedy put to the nation on May 25, 1961 to...“put a man on the moon and return him safely to Earth before the end of the 1960s.”²² The challenge came after several wins by the Soviets in the cold war space race between the USSR and the U.S. The goal, accomplished on July 20, 1969 with man’s first step on the lunar surface, was a major technological and national achievement.

If just setting a goal and working towards it was always successful, there would be little need for the extensive research that has been conducted over more than 40 years to determine the attributes of an effective goal and the circumstances in which a good goal is most likely to motivate and direct our own and others’ actions. What we’ve learned is that goals need to be: specific rather than vague (e.g., “reduce energy use in your home/office by 5% over the next 6 months” vs. “try to save more energy in your home/office this year”), and challenging, but reachable. Specific and difficult goals encourage greater effort and persistence²³ and help focus efforts on what’s important and what level of performance is needed to reach them.²⁴ Feedback on one’s progress toward the goal keeps people on track by maintaining or changing their effort as required.

Several behavior-based energy programs incorporate the lessons of goal-setting research by asking customers to set goals or select from goal options. For example, OPOWER and Efficiency 2.0 behavior-based energy programs ask customers to choose from goals of 5%, 10% or 15% reduction in energy usage for different rewards at each goal level, and provide feedback on monthly progress toward customer goals (e.g., saved less or more than their set or selected goal). Such programs provide additional information to customers who are below their goal about actions to help them reduce their energy consumption and achieve their goal. These programs also suggest a higher goal level to customers whose energy savings are above their goal level.

An important factor in whether goals will be met is an ***individual’s commitment*** to that goal. The higher the commitment, the more likely the goal will be achieved. The more difficult or challenging the goal, the more important goal commitment becomes.

None of the BBE programs reviewed for this paper asked for or measured customer commitment to the energy reduction goals they were encouraged to set. While selecting a

²² <http://www.space.cpm/117744-jfk-speech-moon-exploration-kennedy-congress-50years.html> Accessed 30May12.

²³ Locke, EA; Shaw, KN; Saari, LM & Latham, GP (1981). Goal setting and task performance: 1969-1980. *Psychological Bulletin*, Vol. 90, 125-152.

²⁴ Locke, EA & Bryan, J (1969). The directing function of goals in task performance. *Organizational Behavior and Human Performance*, Vol. 4, 35-42.

specific goal on a utility's website could be seen as a public commitment to achieve a goal, one's personal account page generally would not be considered an example of participation in a public forum (e.g., a group setting, in a community/neighborhood meeting). The offer of rewards for reaching goals may help overcome resistance to energy goals, however, the rewards may become an end itself. Studies have shown that goal-directed efforts drop off when rewards they were associated with are discontinued—i.e., new behaviors extinguished without reinforcements to help the behaviors become routine.²⁵ Lower than expected energy reductions by customers who set energy consumption goals may reflect a lack of goal acceptance and/or low commitment to the goals.

Finally, some research suggests that while setting goals tends to facilitate performance on all tasks, the size of the effect is larger for simple versus complex tasks.²⁶ The implication for energy consumption behaviors is that goal setting is likely to have a greater effect when the behaviors are relatively easy to perform (e.g., switching to CFL bulbs, turning off lights in unoccupied rooms) than when the behaviors are more complex (e.g., installing high efficiency windows; adding insulation; switching to renewable energy sources). Ironically, the more complex energy use actions are also the ones likely to reduce energy consumption the most.²⁷

Theory of Planned Behavior

The theory of planned behavior²⁸ was developed to predict and explain behavior in specific contexts and has been used as a basis for several energy-related behavioral interventions.²⁹ Central to understanding and predicting behavior in this approach is a person's intention to perform a specific behavior. However, *intentions come into play only if the behavior is under a person's control—they can decide to act or not act in a specific situation*. Intentions are also influenced by the *context and other external factors* (e.g., having opportunities and adequate resources [skills, time, money, etc.] to perform the behavior). Intentions to act or not act are dependent on an individual's *attitude toward the behavior* (and beliefs about the likely consequences of performing the behavior), *their perception of social pressure to act or not act* (subjective norm), and *perceived control* over performing the behavior. In general, favorable attitudes toward the behavior, strong subjective norms and perceived behavioral control will result in strong intentions to perform a specific behavior.

²⁵ Locke, EA; Shaw, KN; Saari, LM & Latham, GP (1981). Goal-setting and task performance: 1969-1980. *Psychological Bulletin*, Vol. 90, 125-152.

²⁶ Wood, R., Mento, A. & Locke, E. (1987). Task complexity as a moderator of goal effects. *Journal of Applied Psychology*, Vol. 17, 416-425.

²⁷ Gardner, GT & Stern, PC (2008). The short list: The most effective actions households can take to curb climate change. *Environment Magazine*, September/October. Updated December 15, 2009.

²⁸ Ajzen, I (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, Vol. 50, 179-211.

²⁹ Abrahamse, W & Steg L (2011). Factors related to household energy use and intention to reduce it: The role of psychological and socio-demographic variables. *Human Ecology Review*, Vol. 18 (1), 30-40. **Also**, Rendazzo, KV & Peters, JS. "Reconsidering what we measure: A white paper. Residential decision-making and proposed standard questionnaire items." Paper prepared for Southern California Edison and Pacific Gas & electric. Study ID: SCE0305, August 2011.

Two important qualifications to predicting the performance of a specific behavior are the ***relative importance of the attitude, subject norm and perceived behavioral control***, and the ***actual control an individual has over performing the behavior***.

Application of the theory of planned behavior to energy behaviors has focused primarily on changing personal beliefs about specific energy reduction behaviors and about how important others evaluate specific energy reduction behaviors, and, to a lesser extent, influencing one's perceived ability to perform the energy behaviors. As a first step, it's crucial to make certain that people are actually capable of performing specific energy reduction behaviors. For simple energy reduction behaviors (e.g., changing light bulbs, installing low flow faucets), no or minimal instructions may be adequate to ensure that people have the ability and resources to perform the behavior.³⁰ For more complex energy reduction behaviors (e.g., installing and programming a programmable thermostat, installing a more efficient water heater or solar panels), it is more important to provide information on professional and financial resources available to assist (e.g., recommended contractors, rebate programs or low cost loans).

The core of Duke Energy's BBE program is the Home Energy House Call whereby energy specialists complete an on-site inspection and will install several no-cost energy saving items during the visit.

A major challenge for BBE programs incorporating a reasoned action approach is determining and affecting a sufficient number of salient beliefs or introducing new beliefs to change an attitude toward a specific energy reduction behavior. Most BBE programs include general information to customers to clarify uncertainties, correct inaccurate beliefs, or dispel fear or concerns about consequences of performing specific energy reduction behaviors (e.g., energy 'vampires'--amount of energy used by appliances or personal electronics when in sleep mode).

Consistent across behavioral theories is the need to connect behavior with valued outcomes. If people do not see the connection between a change in their behavior and valued outcomes, the desired behavioral change may not occur or may not be sustained over time. Also, the elements of the BBE program must be specific and relevant to the target population. This latter requirement means utilities must determine relevant customer segments likely to share similar characteristics, values and beliefs.

Application of a theory of planned behavior to BBE programs involves customer communication and commitment to perform specific energy reduction behaviors. Like goals, intentions must be specific (where, when, how, how much). Although the theory of planned behavior does not require that intentions be challenging, it is clear that customers must not only believe they are

³⁰ For some customer groups (e.g., elderly, disabled), even relatively simple energy reduction behaviors may require additional assistance. Some community-based BBE programs include assistance in both acquiring and installing CFLs through door-to-door neighborhood sweeps. (See, for example: <http://www.projectporchlight.com/content/what-we-do>)

able to perform a specific behavior, they must actually have the ability to perform the behavior. Utilities have only energy usage measures and self-report to verify whether the intended behaviors have actually been performed. The three BBE programs reviewed in this paper all request that customers set goals and affirm their intention to reach them (e.g., “I will install low-flow showerheads.” “I will dry 3 loads of clothes on an air drying rack or clothes line.”)

The heavy emphasis on changing or introducing new beliefs to make people more favorably disposed to energy reduction behaviors may have unintended negative consequences for the application of the theory of planned behavior in BBE programs. People must see the connection between a change in their energy use behaviors and valued outcomes—whether personal or societal. If the expected outcomes (external or internal rewards) do not occur, or are not considered sufficiently rewarding, behavioral change will be short-lived and customers may begin to distrust the current and future BBE programs.

Expectancy Theory and the Theory of Interpersonal Behavior

Less frequently considered behavioral theories of reasoned action in energy-related research that have had greater impact in other contexts include Expectancy Theory (well-researched in work performance) and the Theory of Interpersonal Behavior (researched more in Europe). Both theories share an underlying framework with the Theory of Planned Behavior and Goal Setting that choices about behavior are under an individual’s control. Both also have unique elements that can inform BBE efforts and overcome some of the shortcomings of other theories of reasoned action.

Expectancy Theory

In Expectancy Theory, the key determinant of behavioral choices is motivational force—or relative pull or push—of potential behaviors.³¹ Motivational force is a function of three factors:

- perceived value or desirability of outcomes available for various behaviors including inaction (e.g., how valuable are the potential outcomes for performing each potential behavior)
- expectation or belief that effort will lead to a desired level of performance of a behavior (e.g., I have the ability to achieve a specific level of performance, so if I act, I should achieve the performance level that leads to desired outcomes)
- expectation or belief of a positive relationship between the level of performance and getting the desired outcomes (e.g., If I achieve a specific level of performance, I will get the valued/desired outcome. **The level of performance really matters—if any performance is rewarded, there is no incentive/force to exert greater effort**)

Individual needs, goals, values, and preferences affect the perceived value of potential outcomes. Expectations about whether exerting effort will lead to a specific level of performance are determined by past experience, beliefs about one’s abilities (self-efficacy), the

³¹ Vroom, VH (1964). *Work and motivation*. New York: Wiley.

perceived difficulty of the performance level (goal difficulty), and one's perceived control over the goal (external factors that affect what level of performance can be achieved— e.g., strong norms against too high a level of performance, equipment constraints, time constraints). Lastly, expectations about the relationship between levels of performance and outcomes are affected by one's control over the situation in which performance occurs, trust (that commitments made about outcomes will be honored), and policies that support achieving higher levels of performance of specific behaviors.

Applying Expectancy Theory to BBE programs requires that utilities understand customer beliefs about whether efforts they make to perform energy-related behaviors will lead to valued outcomes. This means gathering information from customers or making inferences based on marketing and other research on customers' perceived abilities to perform various energy-related behaviors, their past experience performing energy-related behaviors at home or work, the desirability of various outcomes for performing specific levels of energy reduction behaviors, their perceived and actual control over performance to achieve energy savings, and the level of trust customers have in the utility to honor its commitments to reward energy reduction behavior.

Behavior-based energy programs that incorporate some or all of expectancy theory tenants— whether explicitly or inherently—involve customers in identifying energy-saving behaviors they have control over and believe they can accomplish. The programs also provide a variety of outcomes for performing energy-related behaviors and allow customers to select from among outcomes. BBE programs that follow expectancy theory also provide support (advice, resources, training) that will increase customer capabilities in performing energy-related behaviors that they may not have had past experience with. Especially important is that BBE programs establish and maintain customers' trust that the utility will honor its commitments in the program. While programs that include in-person contacts with customers may be more resource intensive and may not reach as many customers, they have the potential to achieve long lasting changes in energy behaviors.

Theory of Interpersonal Behavior

The Theory of Interpersonal Behavior explicitly considers the role of habit in understanding and predicting behavioral response.³² According to this theory, behavior in any situation is neither completely reasoned nor automatic nor completely social. Rather, it is a function of intention, habitual responses, and situational constraints and conditions. Intention is influenced by social and affective factors and cognition (reasoning). Social factors include both group (i.e., norms or social rules about behavior; and roles or sets of behaviors expected of people in specific positions) and personal constructs (i.e., perception of self, personal goals, and predispositions to behave in certain ways). Affect or attitudes represent the individual's emotional response to specific behaviors and choices.³³

³² Triandis, HC (1977) *Interpersonal behavior*. New York: Wiley.

³³ http://energy-behave.net/odf/Triandis_theory.pdf Accessed 4Nov11.

The theory of interpersonal behavior also treats habit as a complex set of responses versus a separate action or response unrelated to other behaviors. There may be numerous elements to a habitual response, all of which are interrelated and key for the response to be fully completed. This theory also specifically incorporates roles as social factors influencing intention. The roles may be within formal and informal groups and may be different for the same individual across different groups and situations (e.g., being a decision maker in one's family, but not at work). Because of the expectations associated with particular roles, the behaviors of a person in a particular role may affect the behavior of others in the group.

It is worth noting that the theory defines norms as social rules about acceptable behavior in specific situations. Many BBE programs that base some of their communications to customers on 'social norms' or 'injunctive norms'³⁴ do not actually tap into social norms to affect customer behavior. Rather they provide comparative information about the energy use of others (most often neighbors) that—depending on the cohesiveness of the neighborhood—may or may not be important to customers. At the least, information about neighbor energy consumption may stimulate an evaluation of one's own energy usage as being in line or out of line with assumptions about the number of energy consuming devices neighbors have or how much they use energy consuming products. ***Whether or not BBE programs are tapping into social norms is important because of the power of social norms to influence behavior.***

Social Norms and BBE Programs

Because norms are shared beliefs about appropriate behavior, they are a property of a group, not an individual. Groups do not create and enforce norms for all behaviors and all situations, but only for behaviors that are important to the group.³⁵ In summarizing key research on group norms, Feldman (1984) noted that norms generally develop gradually and informally.³⁶ However, the process can be accelerated when people bring norms that have been effective in similar groups and situations to a new group or situation. Other factors that can speed the typically slow development of group norms are (a) explicit statements made by group leaders or other influential group members; (b) important events in the group's life that had highly rewarding or punishing consequences for the group; and (c) effective initial interactions and behaviors adopted because they simplify subsequent interactions (e.g., how a meeting is run, how group members share information or otherwise communicate with each other, etc.).

Kansas City Power & Light have provisions in their BBE program to establish communities for sharing information and providing responses to customer questions. In addition to having an expert available to respond to online questions from customers, KCP&L also supports customer blogs that can lead to some customers becoming influential community members.

³⁴ Behaviors perceived as approved or disapproved by others within a culture.

³⁵ Shaw, M. (1981) Group dynamics: The psychology of small group behavior. 3rd Edition. New York: McGraw.

³⁶ Feldman, DC (1984). "The development and enforcement of group norms," *Academy of Management Review*, January, 47-53.

Groups will enforce norms to maintain internal cohesion, the group's relationships with other groups and entities, and—as part of its survival mechanism—norms that define the range of acceptable behaviors the group will tolerate. Groups also enforce norms that help members anticipate how other members will behave in different situations and reinforce behaviors that have become expected of specific members who occupy informal group roles (e.g., peacekeeper, group historian, tension reliever (aka comic), or task minder). Especially important are norms that reduce the likelihood of interpersonal conflict by defining acceptable or taboo topics of discussion and help all members maintain their self-image. Finally, groups enforce norms that express to others “this is who we are and what we value.” These expressive norms also define the group's boundaries and distinguish it from other groups.

Unless there is a strong sense of being a group among the households in a neighborhood or community, it's unlikely that information provided by a third party about energy usage in the area will have the same effect as a social norm. If there is a strong sense of community and close interactions among neighbors, it's likely they already have a good idea of how much energy each other uses. To the extent that saving energy is important, that information can be a powerful motivator to examine one's own energy consumption. However, absent the perception of being part of a group (e.g., neighborhood or community) and energy consumption being an important behavior to the group, norms about energy usage or a sustained effect from comparative usage information on household energy behaviors are unlikely.

Illogical/Unreasoned, but Predictable Behavior

“[T]he perceiver is an active interpreter, one who resolves ambiguities, makes educated guesses about events that cannot be observed directly, and forms inferences about associations and causal relations (p 43).”³⁷

Like habits, heuristics are generally applied automatically. They can also be highly effective for making judgments or inferences under conditions of uncertainty. However, heuristics are often applied inappropriately without sufficient consideration of situational details³⁸ or in clear contradiction of the rules of probability. The tenaciousness of heuristics as a common cognitive strategy has led to their use being referred to as illustrative of illogical or unreasoned, but predictable, behavior. Heuristics use is prevalent among both the general public and expert researchers who understand statistics and probabilities, when either group is asked to make judgments about uncertain events.

Tversky and Kahneman (1974) described three common heuristics principles people rely on when confronted with probabilities: availability, representativeness, and adjustment and

³⁷ Nisbett, Richard & Ross, Lee (1980). *Human inference: Strategies and Shortcomings of Social Judgment.* Prentice-Hall, Inc.: Englewood Cliffs, NJ.

³⁸ Ibid.

anchoring.³⁹ Under the **availability heuristic**, the ease of access of events or objects in memory and perceptions influences judgments we make about the relative frequency of the events or objects. The more familiar people, events or things are to us or the more similar we perceive people to ourselves, the more likely we are to notice and store them in memory and recall at a later time. Highly unusual events, people and objects are also more likely to be attended to and stored in memory. Some examples of how the availability heuristics can influence judgments include overestimating the crime rate in one's community after crimes have been reported in or close to one's neighborhood; over- or underestimating the number of personal electronics owned by one's next door neighbor based on the number of personally owned electronics.

The **representativeness heuristic** is frequently used to answer questions about the probability or likelihood that a specific object or event belongs to or is representative of a class or category or that an event was generated by a specific process. For example, if presented with a description of a person (e.g., list of characteristics) and asked to decide the likelihood the person is in a specific occupation, people will make a judgment based on a comparison of the description with their stereotype of people in various occupations. The "gambler's fallacy" is another example of the representativeness heuristic. Its use is seen when people use their expectations of what a process should look like to make judgments (bets) on specific events (e.g., Knowing that coin tosses or roulette wheel spins are examples of random processes, after seeing 6 heads in a coin toss or 6 blacks on a roulette wheel, people believe there is a higher probability that tails/red will come up next—there's not).

Adjustment and anchoring heuristics are evident when people arrive at a final judgment or estimate by adjusting their starting or initial estimate. Using this heuristic, the adjustments typically are insufficient and biased toward (or anchored by) the initial or starting value. Even with arbitrary initial estimates and additional information, people remain anchored near their starting points.

An understanding of commonly used heuristics can provide insights into how most people are likely to behave in uncertain situations when minimal information is available. Heuristics principles suggest that under uncertainty, people will make decisions using information that is easily recalled from memory. To be stored and available for recall, information about people/things/events must be noticed. Information about people and objects that are familiar or highly unusual is most likely to be noticed, stored and subsequently recalled. BBE programs that tap into things that are familiar to customers or that are highly unusual are most likely to be attended to and recalled at a later time when a judgment or decision is required.

When information is limited, people will also rely on stereotypes (for people) or scripts (for events) to make decisions because it's more efficient and can be effective to use them, especially if the judgment is not about an important issue. Because BBE programs cannot

³⁹ Tversky, A. & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, Vol. 185, 1124-1131.

control the stereotypes or scripts people have learned through experience, the programs should provide a lot of information to customers to minimize customer reliance on heuristics.

When people begin with a starting value about an object, person or event (e.g., the amount of energy they/their neighbors use over a period of time), that value becomes an anchor against which future decisions are made. Adjustments to that value will generally be smaller than they should be as new information is acquired. People also tend to have a narrow confidence range about the accuracy of their estimates, including their adjustments. BBE programs that hope to see large adjustments to estimates (e.g., of the amount of energy a household can save in a period of time) based on accurate data are not likely to see them. The adjustment and anchoring heuristic can affect successive goal setting in BBE programs by leading to smaller goal increases that would be expected based on achieved goals.

Relevance to Energy Use Behaviors

All of the theories discussed above are relevant to and can be used to help improve the design and implementation of BBE programs. The subtleties of the theories underscore the complexities of behavior and behavior change. Although the theories based on cognitive choices people make can improve strategies to influence energy use by utility customers, their contribution to behavior change may be less direct than the results of research on habits and heuristics.

Habits and heuristics are likely to control most energy related behaviors for the majority of the population—whether residential or employees of small commercial businesses. Habits can be changed, but it requires time and commitment from the individual whose behavior is under consideration for change and from the entity attempting to affect the change. Heuristics may have limited relevance for the kinds of decisions and judgments made about energy use.

Regardless of behavior theory, it is clear that unless the types of behaviors under consideration are important to customers (residential or employees of small commercial businesses), behavior change programs are likely to have smaller than hoped for effects. Changes that do occur are unlikely to be sustained over time. For example, trying to influence customers to make major energy investments in their homes or replace appliances with more efficient ones is not likely to be effective with customers who don't value home improvements or care what type of appliances they have. Some of these customers may be considering moving or selling their homes and do not want to make an investment they cannot recoup. People who do not believe that human activity is affecting our climate are unlikely to maintain behavioral change induced by appeals from their utility company to turn off lights in unoccupied rooms or use cold water for washing clothes. People who disagree with government-legislated discontinuation of incandescent light bulbs are unlikely to be influenced by appeals to replace their bulbs with more efficient CFLs.

Similarities and Differences between Residential and Small Commercial Customers

Although their customers use the same energy, utilities recognize that residential and commercial customers have very different energy requirements and have different expectations of their energy providers. Utilities typically have separate organizational units to deal with residential and commercial customers. They often further distinguish between large and small commercial. To improve the chances of success of BBE programs, it is also useful to consider differences in these two customer groups in several areas/regards:

- how people perceive and use energy when at home and at work
- motivations and incentives to save energy or change energy use behaviors (e.g., demand response), and
- nature and potential sources of influence over energy use behavior.

This section will focus on identifying similarities between two utility customer groups: residential and small commercial. Utilities generally consider commercial business as small or large by the amount of energy they use. Small commercial include usage rates of 200 kilowatt hours (kWh) or less per premise. For the purposes of this discussion, we focus only on small commercial customers.

Most of the research on energy use behaviors has considered/involved residential energy use. We will note where the findings and recommendations from research on residential customers can be generalized to small commercial settings and each group requires separate attention.

It's not surprising that ***very similar behaviors occur across residences*** regardless of where they are located (e.g., cooking, cleaning, lounging, sleeping, washing, etc.). Any observed differences are in the relative amount and timing of these activities, the number of people in the household, the times during the day when people are home, and the nature of their hobbies or entertainment. The energy-related activities of employees in ***small commercial businesses*** will include some common behaviors (e.g., use of office machines, desk computers or laptops, telephones, lighting, etc.), but will differ based on the business enterprise (e.g., manufacturing, restaurant/food service, retail, wholesale, warehouse ops, etc.), the energy requirements of the enterprise, and the business hours of operation.

Residential communities and small commercial businesses may have a similar level of diversity across their populations and a similar range across some demographics (including socio-economic status, education level, age, gender). However, each small commercial business may have ***greater diversity in backgrounds, beliefs, and other characteristics*** among their employees than in any particular residence. Small commercial businesses also have ***more varied types of energy users***: owner, operators, users/customers, visitors, etc., ***with different motivations and interests in saving energy or restricting its use*** during business hours of operation. A significant difference between residential customers and small commercial businesses is that residential customers typically pay for the energy they use at home;

employees do not pay for the energy they use at work. Energy is provided by businesses to support the performance of work and to provide some level of comfort and well-being to employees while they are at work. Because the business owner needs to supply energy to operate their enterprise, employees may not think about their energy use at work. Overall, employees tend to use more energy than they might at home either because they are not attending to the usage or as a means of retaliating against the employer for perceived slights or injustices. Energy use as retaliation hits the employer directly with higher energy costs and no cost to employees.

With the exception of the person responsible for household expenses, family members, like employees, do not pay for the energy they use at home. For older children or adult family members, excessive energy use can also be a retaliatory response to a perceived wrong.

There are distinctions in the dynamics of some social processes between residences (and neighborhoods) and small commercial businesses. Like neighbors, there may be close ties among employees in small businesses extending beyond work and into social activities. However, whereas neighbors may see each other daily, on weekends, or only occasionally, employees—at least those working the same shift—typically see each other daily for several hours. The extent of interactions among employees has implications for the development of close relationships and group norms that maintain certain work behaviors and sanction others. Importantly, employee groups are more likely than neighborhoods to develop and enforce strong norms about acceptable behavior.

Neighborhoods may have formal associations that regulate some resident behaviors and informal expectations for how members of the community behave (e.g., loud parties, appearance of one's house and yard, helping other neighbors). Whereas close knit neighborhoods can rely on informal norms and legal methods (to the extent allowable by law) to enforce acceptable behavior, employees have only group norms to enforce their informal expectations for group members. While neighbors can punish a transgressor by isolating them from the social fabric of the neighborhood, employees can punish a deviant group member by isolating them socially, sabotaging their work, or excluding them from work opportunities. Because employees share the same physical location, transgressions against social and work place norms may be more observable and, therefore, more open to group sanctions.

Utilities generally have a direct relationship with their residential customers—through service, maintenance and repairs and billing. For small commercial business customers, utilities have a direct relationship with the business owner, not with the employees. However, as a service provider, utilities can offer inducements to both residential customers and the owners of small commercial customers to reduce energy consumption or alter energy use during periods of high demand. While utilities can discontinue service for lack of payment and can use rewards and other inducements to influence behavior, utilities have little control over their direct customers.

Just as energy conscious neighborhoods can try to influence community members to reduce energy consumption, the owners of small commercial businesses can try to influence the energy use behaviors of their employees. Formal neighborhood associations and small commercial business owners also have additional means by which to affect energy use behavior. Through association rules/by-laws, neighborhood associations can enforce rules that govern shared property and services (e.g., neighborhood lighting, exterior lighting on houses, etc.) that can reduce energy consumption. Small commercial business owners have some control over employee behaviors at work through the conditions of employment, which could include energy use at work. Small commercial businesses and neighborhood associations that employ facility/building managers or custodial staff have additional means of enforcing group norms for energy reduction through reminders from these staff to households or employees about energy policies and policy violations.

In addition to their direct influence through inducements and rewards, utilities can indirectly influence residential neighborhoods and small commercial businesses involvement in local and state zoning and regulations that impact energy use and demand. By supporting zoning for sustainability, utilities can help create external forces for change in energy use whether through tax incentives for green residential and small commercial business developments or green leases which carry expectations or requirements of renters and leases. Support for local and state efforts can also spur the development of formal and informal residential and commercial associations that can leverage group norms to affect behavior changes in energy use.

Privacy concerns have been noted as one of the obstacles for greater acceptance by residential customers of automatic metering devices to track energy use and control demand under voluntary demand response programs. Utilities are using rewards to motivate residential customers to have the devices installed to provide better usage information to households for budgeting and to utilities for managing demand. Many small commercial businesses may already have energy and water use linked to a tracking system. Moreover, because much of the information about a small commercial company is already public record (e.g., number of employees, square feet of facilities, energy systems in place, etc.), privacy is less of an issue for small commercial businesses.

Regardless of whether customers are residential or small commercial businesses, they share a common characteristic related to readiness for change of energy use behaviors. Research on residential customers has consistently shown that it is easier to change another's behavior when they are ready for the change. Because readiness for change will vary across people and businesses, it is a difficult hurdle to surmount. It requires sufficient knowledge of what is important to people and what motivates them. Once understood, this information can be used with residential and small commercial businesses to create the conditions that will stimulate readiness for change.

Table 1. Similarities and Differences of Residential and Small Commercial Customers

	<i>Residential Customers</i>	<i>Small Commercial Customers</i>
Demographics	Depending on neighborhood, limited or considerable diversity in socioeconomic status, ethnicity, educational level, size of household and range of ages	Depending on size and type of business, greater diversity in ages, backgrounds, beliefs, socioeconomic status, ethnicity; if family owned, may have highly similar characteristics
Characteristics related to Energy Use	<p>Very similar types of energy use behaviors (e.g., cooking, cleaning, sleeping, washing, lounging, etc.) and use of telephones, computers or laptops, radios, TVs, electronic games</p> <p>Similar types of energy users (residents, visitors, service staff)</p> <p>24/7 use, although energy use may peak during certain hours</p>	<p>Some common behaviors (e.g., use of office equipment, desk computers or laptops, phones, lighting, etc.), but will differ based on nature of business (e.g., service, manufacturing, restaurant, retail, etc.)</p> <p>Varied energy users (owner, employees, visitors, customers, vendors, service staff)</p> <p>Some 24/7; many between 8am and 6pm 5 days/week; peak may depend on nature of business</p>
Motivations and incentives to reduce energy use/ demand response	<p>Range of motivations and interest in energy reduction and demand response; size of range may depend on neighborhood, own vs rent, etc.</p> <p>Owner/renter typically pays for energy used; visitors and service do not</p> <p>Energy use behaviors are less observable by others</p> <p>Privacy concerns over use of advanced metering infrastructures (AMI)</p> <p>Unlikely to change unless and until ready (readiness for change)</p>	<p>Range of motivations and interest in energy reduction and demand response across businesses and stakeholders (owners with higher motivation and interest than employees, customers, vendors, etc.)</p> <p>Owner typically pays for energy used; employees, customers, visitors, vendors do not</p> <p>Energy use behaviors are observable by others</p> <p>No privacy concerns over advanced metering infrastructures (AMI); much information already part of public record</p> <p>Unlikely to change unless and until ready (readiness for change)</p>
Nature and Sources of Influence on Energy Use Behaviors	Social, potentially close ties between (at least, proximate) neighbors	Social, potentially close ties between owner and employees and among employees more likely because of frequency and duration of interactions

	<p>If home owners association or other association, potential for rules or by-laws governing some behaviors; informal norms among neighbors about acceptable behaviors</p> <p>Transgressors may be isolated from social life of neighborhood</p> <p>Utilities have direct relationship with residents (head of household)</p> <p>Energy reduction rewards and incentives to residents (head of household)</p> <p>Utilities can influence state/local zoning and regulations affecting energy use</p>	<p>Greater likelihood and enforcement of group norms among employees about acceptable behaviors. Conditions of employment may stipulate acceptable employee behaviors</p> <p>Transgressors may be isolated by other employees, their work may be sabotaged, may be excluded from work opportunities</p> <p>Utilities have direct relationship with owner; no relationship with employees, customers, etc.</p> <p>Energy reduction rewards and incentives accrue to owner only</p> <p>Utilities can influence state/local zoning and regulations affecting energy use</p>
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Brief Overview of Current Behavior-based Energy Programs and Tools

Comparison of Tools

This section briefly compares three BBE programs and audit tools currently in use in California and other states: Aclara, OPOWER and EE2.0 (now part of C3 Systems). Because one must be a customer of a utility using any of these third party providers, the comparison is based only on information available on each provider's website and any comparative information found in an internet search.

Overall, there are more similarities across the three programs and tools than differences. All three are software programs that request personal and household information from customers and provide feedback on energy use (either tailored to specific households or household prototypes based on geographic location and other generally available information about households in a region). For personalized estimates on likely energy use, residential customers must input a substantial amount of information about themselves, their houses, energy using appliances, electronics, etc. The process can be time consuming and although they may be accompanied by colorful graphics, the estimates of energy usage provided in return are not substantially different from that available on paper energy bills.

All three programs also have reward programs based on energy reduction. Currently most are based on self-reports, but require confirmation by reduced energy consumption over time before rewards are given. Rewards may include points which can be redeemed with local and national retailers for products and services. Most rebates are tied to federally sponsored energy efficiency programs. All programs offer very similar tips or suggestions for reducing energy consumption and information to address energy-related questions. These tend to be in the form of responses to what are frequently asked questions.⁴⁰ The programs provide comparative feedback about similar households/neighbors, recognition for achieved savings (e.g., "good job"), or suggestions for improving missed goals.

Finally, all programs ask customers to indicate specific actions they intend to take which may be referred to as part of a "savings plan," and to indicate what actions have been completed (e.g., check a box next to a list of suggested actions that can constitute the energy savings plan). Each tool typically provides two or more possible levels of participation in recommended energy reduction actions and provides estimates of the expected energy and cost savings for each level.

Although the author was only able to test drive Efficiency 2.0, the screen shots available for Aclara and OPOWER software were sufficient to get a sense of the customer experience when using the tools. All appear to be relatively easy to navigate and provide many visuals and

⁴⁰ Efficiency 2.0 has an option for sending a specific question to receive a personalized response. The author was able to test out that option. A request submitted for more information on solar energy use was acknowledged, but did not receive a response.

graphics for displaying information. As noted above, there is little difference across tools in what information they provide and their look-and-feel is similar.

None of the programs ask customers what their level of commitment is to any goal selected.

All three programs apply elements of reinforcement and goal setting: rewards are available as incentives to setting and achieving energy use goals. However, in order to participate in most of the incentive programs, customers must provide considerable information about themselves, their homes and their energy use. While this may constitute some level of commitment to a goal by a portion of the utility's customers, for other customers it may simply be another form of (now) routine exchange of personal information for a discount on goods and services or preferential treatment (e.g., bought brand loyalty). If the discount or rewards are reduced or eliminated, the customer may no longer continue the relationship. If discounts or rewards are an important reason for customers to participate in a utility's BBE, changes to the program perceived by customers as no longer rewarding may extinguish any motivation or incentive to continue.

The following section provides a brief overview of each tool.

Aclara

Aclara provides an interactive experience for residential and commercial customers beyond the typical online energy bill. *Bill Analysis* is the now typical online energy bill where customers view basic information on account balances and compare their current energy use with the previous month. It provides explanations for why the current charges are higher or lower than the previous month (e.g., weather, rate increases, etc.). This aspect of the tool presents comparative information for other 'average' households in the area and links for a distribution of energy use (water, lighting, heating, etc.) and suggestions for saving energy.

Energy Analysis provides the same type of information as the Bill Analysis and adds day-to day comparisons of use. It has an interactive component that recommends actions the customer can take based on their energy analysis and energy use history. It also profiles the user for targeted information related to energy use reduction.

OPOWER

OPOWER describes itself as the industry leader in energy reporting for residential (home) and small businesses. It claims high customer engagements rates resulting in energy cost savings and customer satisfaction from customized energy reports that "likely offer the best energy-efficiency advice you've had in years."⁴¹ OPOWER's website has links to research on behavioral-based energy efficiency programs that support its behavioral-based approach to engaging utility customers to reduce their energy consumption.

⁴¹<http://opower.com/what-is-opower/reports>

The primary component of OPOWER's service is its *Home Energy Report* which provides comparisons of energy usage with similar households in the area and offers energy saving tips. Through their *Home Energy Reports*, customers can obtain information on rate options, monthly energy usage with explanations for increased or decreased use (e.g., weather/temperature), breakdown of usage (appliances, lighting, heating, etc.), comparisons with neighbors of kWh used, and tips on how to manage critical peak usage—again using neighbors as a comparison. The focus on comparisons with neighbors is the heart of OPOWER's approach in tapping into 'injunctive norms' (i.e., behaviors that are perceived as approved of by other people) to reduce energy consumption in households. Blogs, webinars and reports lay the foundation for communicating social norms about energy efficiency and keeping customers connected to the website.

The high-energy feel of OPOWER's website is calculated, and the service provider's strategy is reflected in its advertising: "How much time do you spend browsing your utility's web portal? For most people, the answer is just about none. OPOWER is trying to change that, by turning utility websites into engaging and highly personalized energy management tools for customers." The strategy appears to be working. OPOWER boasts an impressive set of customers: 70 utilities and over 10 million households. Through OPOWER's dynamic reporting tool, utilities evolve from being power companies to energy management service providers. Dramatically, OPOWER's "Ometer" link keeps a running count of the number of kilowatt hours saved by its customer households. A comparison across utilities using OPOWER's *Home Energy Reports*, shows average energy savings of 1.5-3.5% sustained over almost 4 years.

Efficiency 2.0 (now C3)

Similar to Aclara and OPOWER, Efficiency 2.0 will provide personalized, estimated monthly energy use by source (space heating, cooling, appliances, and water heating) and estimated monthly savings based on customer profiles. Information for the profiles is gathered online by questions about the customer and the household (including the number of people in the household; age, size and type of building and exterior; and household income), about heating, cooling and water heating equipment (e.g., gas or electric powered; equipment age; capacity), and about lighting and appliances (e.g., number of lights and average time on during the day; type of energy used for clothes dryer and cooking; number of TVs in the household; presence of a dishwasher, office machines, freezer; etc.).

Efficiency 2.0 provides recommendations on actions a household can take to save energy, availability of rebates for actions (e.g., installing solar panels), estimated cost and savings for specific actions and availability of rewards points that can be redeemed at national and local vendors. The program encourages customers to select energy savings actions they will perform as part of an energy savings plan. After checking an action, the customer must indicate very specific actions they intend to take ("I will replace my conventional showerhead with a flow of [xx] gallons per minute (GPM) with a low flow showerhead of [xx] GPM." "I will dry [xx] loads of clothes a [week/month] on a drying rack or line rather than my [gas/electric] dryer.") and provide additional detailed information, where required, about current energy or appliance

usage (e.g., number of showers taken per week and average time of showers taken by household members; shower temperature and age of water heater). The program provides an estimate of the expected savings and potential rewards by committing to each action, but makes clear that actual energy savings based on the selected actions determine what rewards are received.

A useful feature of the program is the Learn tab which provides basic, easy to understand information about several topics (advice on air conditioning, home ventilation, CFLs, etc.) and allows customers to request information on topics not covered.⁴²

Recommendations and Research Ideas

Overall, the three BBE programs used by major utilities and discussed in this paper have recognized the value of drawing from behavioral research in trying to engage and influence the energy use behaviors of their customers. However, the BBE programs have also been selective in what they incorporate from the research and how they implement it. ***Fundamental to behavior change is focusing on the behaviors (and associated values and beliefs) that are important to an individual or group.*** While rewards and incentives may initially attract some people to participate in a BBE, they may not be large enough or appealing to some people and are unlikely to hold the interest or participation of those for whom energy reduction is not as important as other things. Because the BBE programs briefly reviewed here are online-based programs, they are limited in the extent to which they can engage customers. They are also based on the marketing assumption that customers will share detailed personal information on themselves, their residences and their energy use for a small reward. The exchange is primarily an economic one and, overall, pushes information out to customers rather than engaging them. While this may work well for some customers, it will not work well for others. Without the luxury of being able to select and serve a specific niche or market, utilities must consider other ways of improving the reach and value of their BBE programs.

Behavioral research suggests that utilities need to get closer to their customers to understand what is important to them. Online programs, colorful graphics and the promise of detailed energy use information may attract attention (an important first step), but may not sustain it or help utilities learn more about what matters to their customers. Online surveys, administered as part of a BBE, to assess what people value and think important may be seen as intrusive and invasive of privacy and may elicit socially desirable responses. While there are methods for controlling for social desirability, they involve using additional survey items and may increase potential privacy concerns. How, then, can utilities understand what matters to their customers to leverage that information for energy use reduction?

Not all utilities have embraced the online BBE programs. Utilities in several states are experimenting with different program formats to eliminate a 'one size fits all' type of program.

⁴² As noted earlier, requested information may not be received or received when needed.

Even with various options, an online program is still an online program. Massachusetts NSTAR and Duke Energy both have intensive in-person home programs and online programs which create opportunities for establishing a closer, trusting relationship with the customer, gathering important information about the customer's home context and energy use, completing the installation of basic energy saving measures (e.g., replacing incandescent lights with CFLs, installing low-flow shower heads), and providing extensive, individualized recommendations for additional energy savings from the in-home audit. While the upfront effort is greater, the potential for immediate and sustained energy savings is substantial. Moreover, through the in-home audit and customer engagement, the utilities can directly obtain commitment to an individualized course of action for energy reduction. The utility representatives and vendors involved with the programs can incorporate more of the factors that behavior theories indicate are important to behavior change: provide relevant, highly specific information on energy use, determine what matters to the customer, develop a plan for energy savings (goal setting), install lights and water flow devices for immediate savings (immediate rewards; make it easy for the customer to participate), if the customer agrees to other improvements, obtain commitment to a course of action (intention), identify funding assistance sources (e.g., NSTAR 0% HEAT loans over a 7-yr period), and in some cases, complete a contract for the recommended work (commitment).

Kansas City Power and Light (KCPL) has an intensive community type online program that also incorporates face-to-face customer interaction. The BBE program uses numerous communication and engagement tools (kiosks, mobile apps, social media, email communications, in-home and field demonstrations of advanced metering infrastructure (AMI) tools, and direct mail) to encourage customers to join the smart grid (AMI). In a pilot of the program, KCPL learned that customer adoption of a product (AMI) was not equivalent to engagement users and used the information to establish other mechanisms for information exchange than one-way communications and social comparisons. In essence, KCPL created a community that included options for interacting with one's peers (community blog for asking questions and providing comments), identified community leaders (top energy savers—who can opt out of being identified as energy saving leaders and providing recommendations to others), and an expert forum (ask the expert). In a 100 home pilot, 10% energy savings were sustained over 2.5 years with 90% customer satisfaction. The pilot was replicated 2 years later showing 9% savings. An interesting finding was the positive correlation between the number of log-ins to the site and energy savings.

Recommendation 1: Several successful BBE programs rely on more than online interactions and one-way communications to engage customers and affect behavior change. SCE should consider testing the efficacy of various formats for BBE programs by comparing in-person, on-line community, and more typical BBE online programs to determine which are most effective for specific customer segments.

Behavioral research shows the power of group norms in affecting and maintaining behavior. However, key to leveraging group norms is the existence of an intact group with which members identify. Although some BBE programs may claim they are leveraging social norms

via the communications sent about neighbors, at best, these BBE programs are providing social comparisons which may or may not be relevant to customers. Neighbors can be important influencers of behavior, but it is unrealistic to assume all neighborhoods and neighbors can be effective change agents. By utilizing what's known about the development and maintenance of group norms, utilities can create the environment in which neighborhood groups supportive of energy reduction can emerge.

Recommendation 2: SCE should consider sponsoring a one or two year demonstration project in several neighborhoods within its customer population. A majority of the residences in the neighborhood would need to agree to participate in regularly-scheduled gatherings to discuss the progress of the energy efficiency and demand response demonstration. SCE would offer to install AMI meters and other energy efficiency measures (e.g., alternative energy sources, energy efficient windows), in the participating houses. Residents in participating houses would meet as a group with SCE representatives to determine which energy efficiency measures the neighborhood should demonstrate. In return for the energy efficiency improvements, the participating houses would agree to set energy reduction goals and host regularly scheduled meetings to discuss their energy savings with their neighbors. Importantly, SCE would provide an energy expert for the meetings to answer questions, provide comparative information on energy savings for the demonstration houses and the rest of the neighborhood, and discuss challenges to energy use reduction and demand response.

The demonstration project can be modeled after elements of "Cool Communities," a program in place in over 300 US communities across 36 states to reduce personal carbon footprints. The program requires commitment from local governments and environmental groups.⁴³

Recommendation 2 can be modified for small commercial customers by selecting local business areas and encouraging the businesses within it to participate. In addition to the energy efficiency device installations, SCE can also provide training for business owners on how to engage their employees in energy reduction.

Sometimes external drivers, such as legislation, are needed to change deeply engrained behaviors and habits. Despite consistent findings from extensive research about the role of seatbelts in saving lives and reducing the severity of injury, seatbelts were not widely used until they were required by law. Appeals to get people to refrain from smoking in certain areas or around groups especially susceptible to secondhand smoke were not as effective as laws prohibiting or restricting smoking. Brownouts created to reduce demand under excessive demand conditions is an immediate fix to an immediate need. There are other alternatives to reduce the incidence of excessive demand beyond voluntary participation in demand response programs.

⁴³ http://www.coolcommunities.org/what_is_cool_communities.htm Accessed 1Jul12.

Recommendation 3: Several US cities have established sustainability zones and an increasing number of facilities are implementing green leases to help reduce energy use and demand. For example, a new zoning code was created in Nashville, TN to target the preservation and reuse of existing buildings toward sustainability. One section of the city was re-purposed into the first LEED-ND-certified neighborhood. Community planning helped establish sustainability expectations for commercial enterprises and zoning for sustainability provided greater credibility and justification for greater energy efficiency and use of alternative energy policies at work.⁴⁴ State and local governments have played important roles in green leasing initiatives which provide—among other things—rules and regulations for the operation of a building to include recycling, opening windows, water use, etc. and allow the building landlord some oversight of tenant build-out.⁴⁵ New York recently announced a model green lease for commercial office space to promote increased energy efficiency and sustainability.⁴⁶

SCE should consider working with the Small Business Administration; local, regional and state governments and small commercial associations to develop industry standards, policies, and guidelines for incorporating sustainability as part of green leases for commercial businesses. SCE can also work with its small commercial business customers to develop green employee behaviors.

Recommendation 4: All businesses control the immediate physical work setting and work environment for their employees. Employee morale and motivation can be adversely affected by discomfort in the workplace caused by temperatures that are too warm or too cold, poor air quality, bad lighting, and noise. Because commercial business owners control the physical work environment, workplace discomfort can be perceived as an emphasis by management on profits and a lack of caring about employee welfare. Improving physical conditions at work can improve employee morale and motivation. It can also improve employee perceptions about management concern for their welfare.

Because some energy efficiency measures in the workplace can mean some adjustment and discomfort for employees (e.g., higher temperatures in the summer and lower temperatures in the winter; consolidating office equipment; prohibiting personal coffee pots and space heaters, etc.), measures that help employees commit to reducing the energy they use at work will benefit owners and employees.⁴⁷ SCE should consider programs to help small commercial businesses cover some employee incentives and rewards for keeping temperature higher in hotter months and lower in colder months (e.g., cool drinks, ice cream, hot drinks, sweaters, giving employees a portion of the savings from reduced energy bills, etc.). Engagement by SCE in programs with small commercial business should include informational programs on energy

⁴⁴Kaid Benfield (posted 29Feb12). "Zoning reform strengthens Nashville's impressive sustainability efforts."

http://switchboard.nrdc.org/blogs/Kbenfield/zoning_reform_strengthens_nash.html Accessed 19Mar12.

⁴⁵<http://leaselaw.wordpress.com/2009/05/05/emerging-trends-green-leasing/> Accessed 1Jul12.

⁴⁶http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=may_or_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2011a%2Fp_r109-11.html&cc=unused1978&rc=1194&ndi=1 Accessed 1Jul12.

⁴⁷ Davis, L.E. & Tyler, J,C, (1972). *Design of Jobs*. Harmondsworth, UK: Penguin Books.

reduction strategies at home and at work which can lead to increased savings at the commercial business and at employee residences.

Table 2. Comparison of Residential and Small Commercial Business Recommendations

<i>Recommendation</i>	<i>Residential Customers</i>	<i>Small Commercial Business</i>
<i>Rec-1.</i> Compare BBE program formats: in-person, on-line community, straight on-line	Highly relevant for residential customers	In-person and on-line community relevant for small commercial business customers. Encourage owners and employees to participate in a broader on-line community.
<i>Rec-2.</i> One-two year demonstration project: install EE devices; facilitate development of community norms	Relevant for residential customers	Highly relevant for small business customers (engage owners and employees)
<i>Rec-3.</i> Support creation and enactment of zones of sustainability and green leases	Highly relevant for residential customers	Highly relevant for small business customers (engage owners and employees)
<i>Rec-4.</i> Offset cost of employee incentive and reward programs for energy reduction; provide information on EE at work and home	Relevant for residential customers	Highly relevant for small business customers (engage owners and employees)