Changing habits, lifestyles and choices: The behaviours that drive feedback-induced energy savings

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Abstract
Advanced metering devices and new feedback programs and technologies are opening up a wide range of new opportunities to make energy consumption more visible to residential consumers and to engage individuals and households in more thoughtful energy use practices. Data from several recent studies suggest that feedback-induced energy savings can be significant (Darby 2006, EPRI 2009) ranging from 4 to 12 percent depending on the technologies employed, the characteristics of the program, and other relevant factors (Ehrhardt-Martinez et al. 2010). However few studies have considered the behaviors that underlie the energy savings achieved. Once people receive information about their energy consumption patterns, there are a wide variety of things they can do to reduce the amount of energy they consume. Energy savings are typically achieved as a result of three categories of action: 1) simple changes in routines and habits, 2) infrequent and low-cost energy stocktaking behaviors (i.e. replacing incandescent bulbs with CFLs, weather stripping, etc), and 3) consumer investments in new energy-efficient appliances, devices and materials. Evidence from several feedback studies suggests that most of the energy savings achieved through feedback programs results from changes in behaviors (not investments) although people who invest tend to save the most energy. This paper provides an assessment of the behaviors that drive feedback-induced energy savings as they have been documented in an innovative new meta-review of feedback studies.

Introduction
A variety of new feedback initiatives are making energy resources visible to residential consumers throughout the United States (and many other developed countries). These initiatives are opening the door to potential, short-term, energy savings that, on average, can reduce individual household electricity consumption 4 to 12 percent (Ehrhardt-Martinez et al. 2010). In so doing, feedback is proving a critical first step in engaging and empowering consumers to thoughtfully manage their energy resources.

While it is clear that feedback programs have resulted in significant reductions in energy use and that more sophisticated forms of feedback offer the promise of even greater levels of savings, few studies have explored what actions people are taking to bring about these reductions. This knowledge is essential to assess patterns and trends in consumers' responses to feedback, identify the types of energy-saving behaviors that are not being stimulated by feedback, develop better feedback programs that engage households in a broader array of energy-saving behaviors, and to begin to recognize and address the variations that exist between households in how they translate feedback into energy savings.

This paper represents a first attempt to look inside the black box of American households to understand how they are translating energy feedback into energy savings. The paper begins with a discussion of energy as an invisible resource in modern society and a description of current patterns of household energy consumption. The following section introduces a categorization scheme that serves to classify different types of energy-saving behaviors into three broad categories. The third section provides preliminary evidence regarding energy-saving actions in households, and the paper concludes with a discussion of lessons learned and future research directions.

The invisibility of energy resources and characteristics of residential energy consumption

Household energy resources are in many ways invisible to residential energy consumers. This makes energy management and conservation practices both difficult and unusual. When compared to the use of wood and coal, the more modern energy resources provide an increasingly *invisible* means of meeting demands for heating, cooling, lighting, refrigeration, food preparation and entertainment. Today, both natural gas and electricity supplies flow seamlessly and silently into our homes, fueling our furnaces, powering our air conditioners and other equipment, and meeting our demands for a wide variety of energy service demands without any notable trace of their presence.

For most people, the only measure of their energy consumption is the bill that they receive up to 45 days after consumption. Unfortunately, the monthly bill – even for the best energy detective and the most energy-conscious consumer – is an inadequate tool for managing energy resources. Monthly bills may report the number of kilowatt-hours (kWh) of electricity consumed and the costs that are incurred, but they don't indicate which end-uses are demanding the most energy, how energy intensive or energy-efficient existing appliances might be, and how changes in our own choices and behaviors can either enhance or offset energy demands associated with changing weather patterns, new appliances, and other electronic equipment. Unfortunately, most people in the United States are among the energy blind; we cannot see the energy that we consume.

The dysfunctionality of our current energy system has been recognized for many years. More than a quarter century ago, Kempton and Montgomery (1982) illustrated the paradox of consumption without meaningful information in the following way:

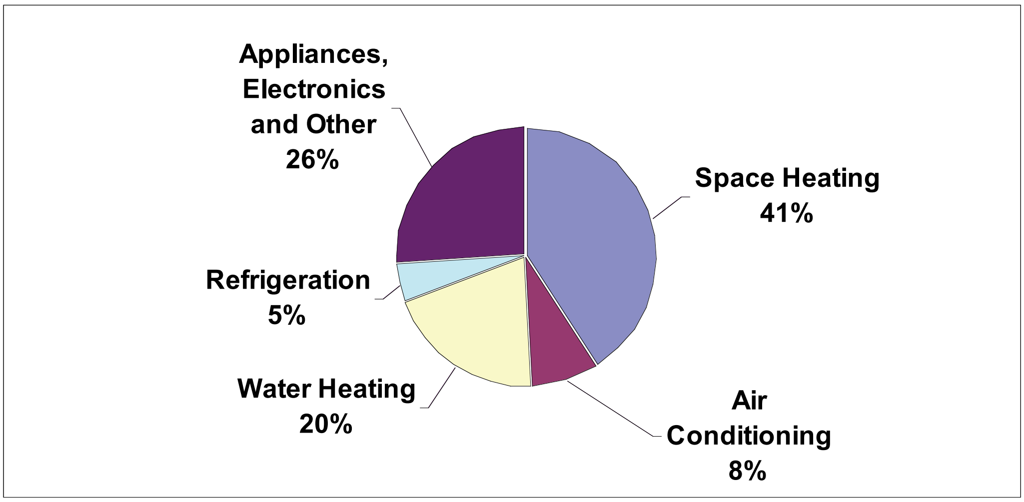
> [Imagine a grocery] store without prices on individual items, which presented only one total bill at the cash register. In such a store, the shopper would have to estimate item price by weight or packaging, by experimenting with different purchasing patterns, or by using consumer bulletins based on average purchases.

The invisibility of modern energy resources also impedes the establishment of social norms concerning "appropriate" levels of energy consumption. Not only are most energy consumers blind to their own level of energy consumption, but they are also equally unaware of the energy consumed by others. Without an appropriate frame of reference, individuals and households have a hard time determining whether their patterns of energy consumption are excessive or moderate and whether some type of intervention is warranted.

In the U.S., homes are responsible for approximately 21 percent of the nation's energy demand or roughly 22 quads of energy in 2010. Notably, total residential energy demand has grown by roughly 30 percent since 1978 despite a much more rapid growth in the prevalence and use of energy consuming technologies. During the past 30 years, efficiency-oriented, and technology-focused efforts have been the primary driver of the majority of the energy savings that have been achieved. Nevertheless, many of the recent efficiency gains have been offset by three countervailing trends: an increase in the number of households, larger residences, and an increase in energy service demand associated with changing behaviors and lifestyles.

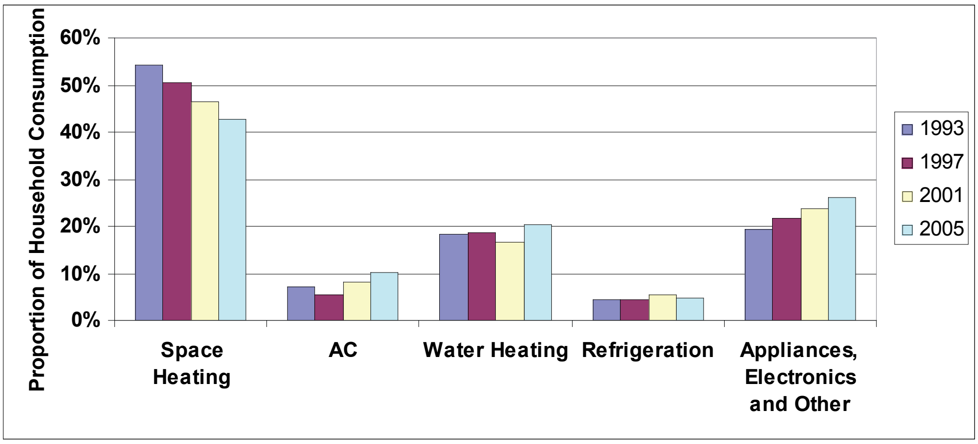
At the household level, heating and cooling currently account for about 49 percent of total residential energy consumption (see Figure 1), somewhat less than in 1993 when heating and cooling were responsible for 58 percent of total household energy use. In absolute terms, average energy consumption for heating declined dramatically from 56.3 million Btus per household in 1993 to just 40.5 million Btus per household in 2005. Conversely, the proportion of energy used for air conditioning and for appliances and electronics has experienced a notable increase during the same period as shown in Figure 2. Most recently, consumer electronics have come to represent one of the fastest-growing segments of residential energy use.

In addition to the overall trends, it is equally important to take note of the variation that exists in residential energy use across households. This variation is not simply the result of



Source: EIA, Residential Energy Consumption Survey (2005)

Figure 1. Energy End Uses as a Percent of Total Residential Energy Consumption, 2005.



Source: EIA Residential Energy Consumption Surveys (1993, 1997, 2001, 2005)

Figure 2: Average Household Energy Use by End Use, 1993–2005.

differences in design or technology but is also a function of socio-demographic differences (household size, member's ages, income, ethnicity and race) as well as differences in values, beliefs, norms and habits. In fact, non-physical factors have resulted in variations of as much as 3 to 1 in homes with similar construction (Hackett and Lutzenhiser 1991). So where do we turn for additional energy savings? Technology? Or, behavior? Which holds the larger energy saving potential? According to Gardner and Stern (2008), readily available technologies provide the opportunity to reduce current residential sector energy demand by more than 25 percent:

Potential Technology-Based Efficiency Gains:

- Upgrading attic insulation (up to 7 % of total)
- More efficient Heating, Ventilation, and Cooling systems (up to 5 %)
- Use of Compact Fluorescent Lamps (up to 4 %)
- Caulking/weatherstripping (2.5 %)
- Efficient refrigeration (1.9 %)
- Efficient water heater (1.5 %)
- Projection versus plasma TV (1.3 %)
- Efficient clothes washer (1.1 %)

However, it is also important to recognize that technology adoption doesn't occur in a social vacuum. Social and behavioral considerations are important because they both shape and constrain technology adoption decisions, technology choices, and the operation and everyday use of technologies. In addition, behavioral approaches can also reduce energy consumption more directly by changing habits, lifestyles and everyday energy use practices. From a technology perspective, consumers must choose whether or not to buy a new technology (such as an HVAC system, lighting, refrigerator, water heater, TV or clothes washer) and which technology to buy. Proper use includes decisions and choices associated with the installation, maintenance, and use of equipment while habits and lifestyles include choices about how we live, where we live, how much we consume, how much we travel, and how we otherwise spend our time.

In summary, total residential energy consumption has increased over the past 30 years but at a much slower rate than might otherwise be the case due to significant efficiency gains achieved through new, more efficient technologies. These gains have allowed residential energy use per household, per capita, and per square foot to remain relatively stable despite significant increases in energy service demands. Nevertheless, substantial amounts of potential energy savings continue to be left unrealized. Therein lays the challenge. An expanded model of energy savings that recognizes and addresses the human dimensions of energy consumption offers the promise of notable declines in residential energy consumption whether by means of the expanded adoption of more efficient technologies, more thoughtful energy use choices, or less energy-intensive lifestyles and energy use habits.

Categories of energy-saving behaviors

While efforts to reduce energy consumption require a well-researched understanding of existing energy end-uses and everyday practices, they also benefit from an understanding of the malleability associated with these actions. By recognizing which behaviors are the most malleable, policymakers and program managers can determine which behaviors and interventions are likely to yield the most energy savings and can target their efforts appropriately. However, feedback initiatives are different from standard efficiency programs in several important ways. Rather than requiring a discrete focus and advocacy for engagement in a particular energy saving behavior, feedback programs let the consumer decide which actions he or she finds most appealing or most feasible. As such, feedback initiatives themselves can provide valuable insights into the malleability of different types of behaviors while allowing for greater flexibility in how people meet their energy saving goals.

Whether defined by end use or malleability there are hundreds of different types of behaviors that people can choose to engage in to save energy. A useful way to simplify this very long list of behaviors is to categorize them by significant attributes such as the economic costs associated with a particular activity and the frequency with which people need to engage in the behavior. Cost can be an important barrier that will keep many

Frequency of Action

	Infrequent	**Frequent**
Low-cost / No-cost	**Energy Stocktaking Behavior and Lifestyles Choices** Reprogram the thermostat Install weather stripping Replace furnace filter Caulk windows Lower temperature on hot water heater	**Routine and Habitual Behaviors** Wash only full loads of laundry Wash clothes in cold water Air dry laundry Reduce oven use Use window fans instead of AC
Higher Cost / Investment	**Consumer Behaviors and Technology Choices** Purchase new EE Appliances Purchase new insulation Purchase a new EE Furnace Purchase new EE Windows Purchase new EE electronics	

Figure 3. Energy Behaviors as a Function of Frequency and Cost (Adapted from Laitner et al. 2009).

people from engaging in a particular behavior, while the frequency of the action will be an important factor in determining the types of programmatic support that are likely to be most effective. Figure 3 provides a typology of energy behaviors as a function of the frequency of the action taken and the economic cost associated with the undertaking of the action (Laitner et al. 2009). When broken down in this way, three categories of behavior emerge.

The first category of behaviors includes those that are performed infrequently and at a relatively low cost (or at no cost) such as installing compact flourescent lamps (CFLs) and weatherstripping or choosing to live in a smaller house or apartment. These might be thought of as *Energy Stocktaking Behaviors* and *Lifestyle Choices*. The second type of behavior involves energy saving actions that must be performed or repeated frequently. These are generally referred to as *Routine or Habitual Behaviors* but they may also involve some lifestyle choices. Examples include laundry routines and whether we tend to wash our clothes in cold water, use a mechanical dryer, or air dry our clothes and linens. This category of behaviors also includes habits associated with appliance use and lighting and the frequency with which we turn off computers and other devices when not in use. The final type of actions involves infrequent but higher-cost behaviors. These actions are generally referred to as *Consumer Behaviors*, *Technology Choices* or *Purchasing Decisions* and involve the purchase of more energy-efficient products and appliances (Laitner et al. 2009).

Providing consumers with feedback on their energy consumption patterns has been shown to have an impact on a variety of different behaviors associated with each of the three categories. The fact that people have multiple means of reducing their energy consumption means that some people/households may be more likely to pursue energy savings through investment decisions in more energy-efficient technologies while others prefer to take stock of their energy consumption patterns to make thoughtful adjustments in everyday practices. The following section discusses some of the specific ways in which people have responded to feedback and which of the three categories of behaviors best represents the types of behaviors that people are most likely to engage in. These findings are then compared to research on behavioral responses to information campaigns and energy crises.

Preliminary evidence of feedback-induced, energy-saving behaviors

What are the means by which feedback results in residential sector energy savings? Many utilities and researchers have begun to explore this topic with greater interest as a result of the push for the development of a more modern and technologically sophisticated electric grid in the United States and the opportunities that such a system holds for providing millions of consumers with real-time feedback. While these studies continue to collect evidence that must be brought to bear in future assessments, this paper relies primarily on the findings of 16 historical studies. Among the most influential is a 2004 study of the impact of a pilot residential time-of-use pricing program in Sacramento, California in which researchers explored energy-saving behaviors in the most detailed fashion (see Wood et al. 2004). In addition, this assessment draws from the insights provided by 13 additional feedback studies that report on associated changes in behavior (Elliot et al. 2006, Martinez and Geltz 2005, Sulyma et al. 2008, Sipe and Castor 2009, Hayes and Cone 1977, Abrahamse et al. 2007, Benders et al. 2006, Haakana et al. 1997, Mountain 2008a, Mountain 2008b, Ueno 2006, and Kantola and Syme 1984). Finally, the insights from the feedback studies are compared to two studies that looked at the effect of energy crises on energy-related

Table 1. Categories of Change and Behaviors in Sacramento Study.

Type of Change	Behavior	Percent
New Routines and Habits	Shifted Usage	95%
	Checked thermostat display for critical periods	83%
Energy Stocktaking	Repaired air ducts	8%
	Changed default temperatures on thermostat	42%
	Installed CFLs	59%
Higher-cost Investments	Replaced single with dual-pane windows	11%
	Replaced inefficient refrigerator	9%
	Replaced inefficient air conditioning	5%
	Installed ceiling or wall insulation	5%

Source: Wood et al. 2004

behaviors (Lutzenhiser et al. 2003 and Leighty and Meier 2010) in order to assess the similarities and differences between feedback-induced behaviors and crises-induced behaviors.

Although the survey results from Wood et al. (2004) are not based on a representative sample, the study's findings provide some preliminary insights as to the ways in which people choose to change their routines, habits, stocktaking behaviors and choices in ways that result in energy savings. Participation in the Sacramento feedback program was voluntary and most participants reported that they chose to participate either because they wanted to save money (88 %) or because they wanted the ability to control their energy usage (54 %). In addition, roughly one-third indicated that their participation was motivated by a concern for the environment. In terms of actual energy savings, the study's findings showed a high level of participation: 86 percent of participants used less energy during high or critical periods and 67 percent of participants used less energy overall. Moreover, the energy savings that resulted from the program were significant. Energy use during critical price periods declined by 16 percent, while overall energy use declined by 4 percent. But how did people achieve these savings?

As shown in Table 1, households were found to engage in a variety of different activities to save energy. Nearly all participants (95 %) reported engaging in new routines and/or habits in ways that minimized energy use during critical price periods. The principal strategy involved shifting usage to nonpeak periods. In particular participants were less likely to use air conditioners, dishwashers, and clothes washers during peak periods. They also reported taking fewer showers or baths during these periods and cooking indoors less often.

Respondents also reported the use of energy stocktaking behaviors including replacing incandescent bulbs with CFLs (59 %), repairing air ducts (8 %), and changing the default temperatures on their thermostats (42 %). Notably, among the respondents who saved the most energy overall were those that invested in energy-efficient products. However, a relatively small proportion of households invested in more costly energy-efficient upgrades to their homes including new windows (11 %), a new refrigerator (9 %), a new air conditioner (5 %), or added insulation (5 %).[1]

These findings contrast with an earlier and larger study of conservation behaviors by residential consumers during and after the 2000–2001 California energy crisis (Lutzenhiser et al. 2003). The 2003 study used data obtained from 1666 in-depth telephone interviews with randomly selected residential households in five major California utility service territories. Some interesting findings from the 2003 study indicate that "more than 75 percent of households participating in the survey reported taking one or more conservation actions", and that reductions in energy demand were largely due to changes in behavior (65–70 %) as opposed to investments in hardware solutions or on-site generation projects (25–30 %). Table 2 shows reported conservation behaviors. Note that the top three behaviors involved no-cost or low-cost changes in behaviors as opposed to investment decisions.[2]

Another important difference between the two studies involved the question of motivation. In Figure 4, from a study by Lutzenhiser et al. (2003), survey respondents reported that their conservation efforts were motivated by a wide variety of factors. While minimizing energy costs was among the principal motivators, respondents also reported being motivated by their desire to avoid blackouts (82 %), to use energy resources as wisely as possible (77 %), to do their part to help Californians (73%), and to protect the environment (69 %). According to the report, "qualifying for a utility rebate was the least common motivation, and available utility rebates were not relevant to most of the actions consumers took."

These findings are further supported by the evidence of thirteen additional studies on the effect of feedback on energy-related behaviors (Elliot et al. 2006, Martinez and Geltz 2005, Sulyma et al. 2008, Sipe and Castor 2009, Hayes and Cone 1977, Abrahamse et al. 2007, Benders et al. 2006, Haakana et al. 1997, Mountain 2008a, Mountain 2008b, Ueno 2006, and Kantola and Syme 1984). According to the evidence from nearly all 13 studies, people were most likely to report turning off lights, replacing incandescent bulbs with CFLs, and/or changing their thermostat setting. Among the other frequently reported behaviors were: reducing the use of or turning off the air conditioner, turning down the temperature on the space heater, reducing the use of the clothes washer, using cold water to wash clothes, and reducing the length/number of showers. Common but less frequently reported behaviors included reducing the use of certain appliances including the clothes dryer,

1. Higher-cost investments were relatively rare despite the fact that the sample population was found to have higher incomes compared to the general population in the same geographic area. More specifically, 50 percent of pilot participants had annual incomes over $100,000 per year compared to 12 percent of people in the general population.

2. Similar results are reported by Leighty and Meier in their 2010 report on the impact of a recent energy crisis in Juneau, Alaska.

Table 2. Behaviors in Response to California Electricity Crisis as a Function of Technology Categories.

Type of Behavior	Description	Category of Behavior	Percent of Households
Lights Behaviors	Behaviors related to turning off lights or using fewer lights	Routines and Habits	65.5%
Other Heat/Cool Behaviors	Behaviors related to heating and cooling other than not using the AC at all (e.g. using AC less, using ceiling fans, changing thermostat, etc)	Routines, Habits and Stocktaking	48.5%
Small Equipment Behaviors	Behaviors related to household appliances (using them less, turning them off and unplugging them)	Routines, Habits and Stocktaking	32.2%
Light Bulbs	Hardware related purchase/use of CFLs or other energy saving bulbs	Stocktaking	22.2%
Peak Behaviors	Behaviors related to using energy during off-peak hours	Routines and Habits	20.0%
H20 Behaviors	Behaviors related to using less water or using less hot water (e.g. shorter showers, wash in cold/warm water, turn water heater down, etc)	Routines, Habits and Stocktaking	12.2%
Appliances	Hardware-related purchased/use of new non-fixed appliances (e.g. refrigerator, washer/dryer, window AC, fans, etc.)	Combination of all three	10.4%
Turning off AC	Behavior related to not using the AC at all	Routines and Habits	9.6%
Shell Improvement	Hardware related to one-time improvements to the house (e.g. windows, insulation, a new piece of fixed equipment such as water heater, AC, furnace, etc.)	Consumer Investments	7.9%
Large Equipment Behaviors	Behaviors related to pools, spas, irrigation motors (e.g., turn off, use less often)	Routines, Habits and Stocktaking	6.0%

Source: Adapted from Lutzenhiser et al. 2003

dishwasher and electric oven, and reducing the use of computers and standby settings in all electronics.

On the other hand, few people reported having reduced their use of electronic devices such as televisions, stereos. Table 3 illustrates the frequency of different energy saving behaviors as reported by the various study participants. Caution should be used in interpreting the results since many of these programs provided specific energy saving tips or suggestions as to the actions that households could or should take to save energy and these tips may have influenced both actual and reported behaviors.

The findings from the combined group of studies clearly suggest that:

- behavior-related energy savings opportunities are readily available in the residential sector,
- people are willing to change their energy-related behaviors, and
- feedback is likely to be an effective mechanism for unlocking potential energy savings.

Among the many potential types of energy efficiency and conservation behaviors, people were most likely to make changes in a wide variety of everyday practices and engage in some energy stocktaking behaviors. Notably, only a small proportion of people reported having made investments in more energy efficient products and appliances. Interestingly, however, investments in new equipment and appliances appeared more likely within more affluent populations and were generally undertaken in conjunction with a change of residence or a remodel or part of a stylistic (as opposed to functional) upgrade (Lutzenhiser et al. 2003). Longer term studies are needed to assess whether the behavioral effects of feedback are likely to change over time and whether short-term changes in routines and everyday practices may eventually translate into a higher likelihood to invest in new appliances and home retrofits.

It is important to note that each of the 13 referenced studies used to develop the information in Table 3 had a slightly different approach to collecting and reporting on the behaviors that households engaged in. Some of the studies reported on the proportion of households that reported having engaged in a particular behavior. Some of the studies simply listed the activities that the majority of households reported engaging in without an indication of the percent of households who took on each of the behaviors (Martinez and Geltz 2005, Hayes and Cone 1977). Other studies indicated whether there was a statistically significant difference in particular behaviors by comparing behaviors before and after the intervention and by comparing the behaviors reported by households in an experimental group (receiving feedback) to those of a control group (not receiving feedback) (Abrahamse et al. 2007, Benders et al. 2006, Kantola and Syme 1984). Ueno (2006) reports the actual energy reductions associated with specific behaviors. (See the final column in Table 3.) [3]

Table 3 presents data on five categories of behaviors: lighting and electronics, heating and cooling, appliances, hot water heating and use, and other types of behaviors. Within these five categories specific behaviors are identified and categorized as either pertaining to habits and routines (H/R) or energy stocktaking (ST). This list does not include investment activities because these were not reported among the behaviors that

3. One study reports on behaviors in three categories: heating, electricity, and water (Haakana et al. 1997). Their study found that the percent of households that reported taking energy saving measures associated with heating, electricity use and water use was 74 %, 81 %, and 70 %, respectively. The average number of actions taken in each of these three categories was 2.6, 4.1 and 2.6, respectively.

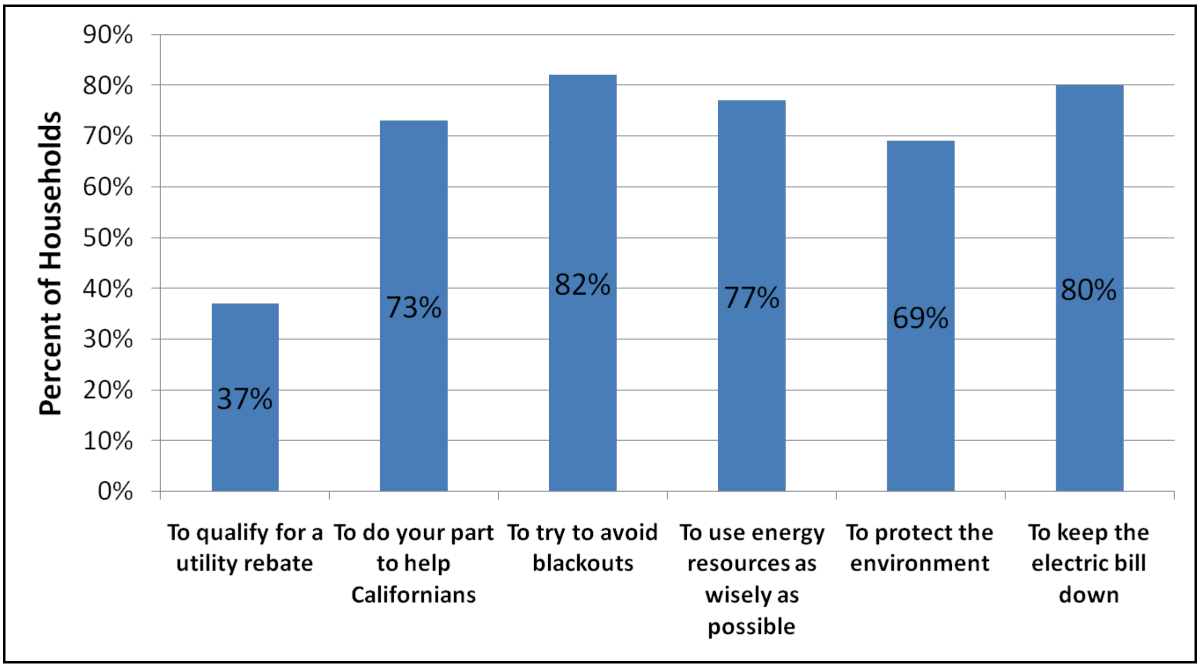


Figure 4. Motivations of California Households Reporting Various Conservation Behaviors 2001 (Source: Lutzenhiser et al. 2003).

people took in response to the feedback that they received. The table provides information concerning the relative importance of each of these different behaviors using four different means. The first means is a measure of the overall frequency with which households reported having engaged in the particular behavior. This measure is a categorical measure which combines information from reports that provide quantitative indicators of household engagement and those that simply provide lists of the most frequent behaviors. The second means is an indication of whether the studies found either a significant reduction in a particular behavior or if they found a significant difference between the behaviors of an experimental group and a control group following a defined period of intervention. The third means of measuring behavior change reports the proportion of households that reported engaging in a particular behavior. This measure is generally shown as a range to capture the variation across studies. The final means of measuring behavior change reports the average percent energy savings achieved by changes in a particular behavior.

Importantly, these energy-conservation behaviors are likely to be motivated by a variety of factors including self-interest (energy bill savings) as well as civic concerns and altruistic motives (Lutzenhiser et al. 2003). These findings suggest that narrowly defined energy-efficiency programs aimed at the installation of new, more energy-efficient technologies alone (the practice of traditional utility programs) are likely to realize only a small fraction of potential behavior-related residential energy savings. Similarly, programs that limit their appeal to self-interest alone are unlikely to leverage the broad range of factors that motivate people to action.

Conclusions

Providing households with contextualized feedback and targeted energy-saving tips holds the potential for large scale energy savings. Average program-level savings from past programs across several continents indicate savings in the range of 4 to 12 percent (Ehrhardt-Martinez et al 2010) but also show several instances where significantly higher levels of savings were achieved. Moreover, providing residential energy consumers with feedback is important because it makes energy visible, allows for active participation of households in energy management practices, and provides flexibility as to how energy savings are achieved. Among the many potential actions that people may choose to engage in to reduce their energy consumption, most people choose to make adjustments in their everyday habits and routines. Energy stocktaking behaviors are also important. Notably however, existing research indicates that only a relatively small amount of feedback-induced energy savings are likely to come from investments in energy-efficient technologies. More research is clearly needed to better understand this pattern and to determine if households are likely to engage in different types of behaviors as they receive feedback over longer periods of time. In other words, the first steps that people choose to take may be more likely to include new habits and routines, but as time passes and households begin to exhaust low-cost options and build their understanding of energy management options, they may be more likely to make investments in more energy-efficient appliances and products.

Of equal importance is the need for research that reveals the diversity of feedback-induced energy saving strategies across different types of households. This type of research should take into account the important ways in which socio-demographic and psycho-demographic variables are likely to mediate the relationship between feedback and energy conservation or energy efficiency behaviors. Such research could provide critical insights for program and policy designs and improve the accuracy of energy demand projections.

Table 3: Relative Frequency of Reported Energy-Saving Behaviors.

			Overall Frequency of HH Reporting this Beh.	Significant Reduction/ Significant Difference	% of HH Reporting this Behavior		Avg Energy Savings for Each Behavior
	Behavior Type	Conservation Behaviors			Peak Focus	Conserv. Focus	
Lighting, Electronics	H/R	Turned off lights	VH	sr / nsd	48-54%	54-91%	
	ST	Install energy efficient light bulbs	H	sr / sd		59-79%	
	H/R	Used task lighting	L				
	H/R	Reduced Television use	ML			20-25%	
	H/R	Reduced use of Stereo	ML			9-24%	
	H/R	Reduced use of Computer CPU	M			27-39%	
	H/R	Reduced use of Computer Monitor	M			36-48%	
	ST	Reduced use of stand-by settings	M	sr /sd			17.6%
Heating & Cooling	H/R	Turned off AC or reduced use	MH	sd	36-41%	52-58%	
	H/R	Turned down electric space heating	MH		53%	42-53%	
	ST	Reduced heating/cooling demand (thermostat)	H	sr /sd nd	5-7%	27-74%	
	ST	Reduced the number of hours heating is on	VL				
	ST	Reduce number of rooms heated/cooled	VL				17%*
	H/R	Pulled Window Shades	VL		2-7%		
Appliances	ST	Turned down refrigerator thermostat	L				9-24%
	H/R	Opened refrigerator less often	L				
	H/R	Reduced use of clothes washer	MH	sr / sd	36-66%		
	H/R	Used cold water wash in clothes washer	MH			41-56%	
	H/R	Reduced use of clothes dryer	M	sr / sd	33-66%	22-53%	
	H/R	Reduced temperature on dryer	L			12-16%	
	H/R	Reduced use of electric range	ML			18-28%	
	H/R	Reduced use of electric oven	M			12-43%	
	H/R	Reduced use of microwave oven	VL				
	H/R	Reduced use of dishwasher/only full loads	M	sr / nsd sd	36-42%	16-21%	
	H/R	Used cold/short cycle on dishwasher	M			28-37%	
Hot Water Heating	H/R	Reduced hot water demand	ML	sr / nsd		29%	
	ST	Turned down water heater	L				
	H/R	Reduced number or length of showers	MH	sr /sd	81%		

	ST	Turned down electric water heating	ML			18-40%	
Other Behaviors	H/R	Reduced use of Hot tub	M L			6-33%	
	ST	Turned off pool filter	VL		3-5%		
	H/R	Reduced use of ventilation fans	VL				
	H/R	Ironed in batches	VL				
	ST	Turned off pool pump	VL		9-10%		
	H/R	Reduced meat consumption	M L	sr /sd			
	H/R	Reduced food waste	M L	sr /sd			
	H/R	Transport mode shifting	L				

*This number represents the energy savings associated with two behaviors: reducing the number of hours that rooms were heated and (to a lesser degree) by reducing the room temperature.
Source: Adapted from Ehrhardt-Martinez et al. 2010

KEY for TABLE 3:

VH = very high, **H** = high, **MH** = med. High, **M** = medium, **ML** = medium low, **L** = low, **VL** = very low

sr/nsr = significant (or non-significant) change in a particular behavior over the intervention period,

sd/nsd = significant (or non-significant) difference between the experimental group and the control group

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