Incorporating Behavioral Techniques into a Comprehensive Residential Program Model: The Community Energy Services Approach

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ABSTRACT

In the new climate of support for energy efficiency, achieving high performance and mass participation within programs is essential. This paper examines some of the challenges for developing high-performing programs within the residential sector, and one approach to addressing these challenges. This approach attempts to incorporate lessons learned from the field of behavioral science relating to behavior change and persuasion to maximize program effectiveness. The Community Energy Services program was launched in late 2009 in several cities in Minnesota to test out a comprehensive model for residential program delivery including these behavioral strategies, which are identified and described in the paper. The program design includes three types of measures in order to maximize savings per household at the minimum cost: 1) direct install of low-cost measures; 2) occupant behavior change; and 3) major retrofits. Program participants are guided through a series of easy, simple and progressively larger steps, each step building on the previous one, and assisted by a range of supporting services, such as financing. The program provider uses a community-based marketing strategy including partnering with local governments, neighborhood groups, and community organizations for participant recruitment in targeted areas. The program process includes workshops, in-home visits, follow-up services, contractor training and quality control, and bi-monthly feedback reports. Energy use data is gathered for the 12 months prior to entering the program, and continues for at least 12 months post. Early program results from the first 1,000 participants are examined, and attempts to incorporate a process of continuous program improvement in the process are briefly described.

Designing Residential Programs for Increased Performance

Many states, Minnesota included, have set aggressive new targets for energy efficiency. In this new climate of support, residential energy efficiency programs have the dual challenge of needing to achieve greater participation, as well as achieve higher savings per participant, in order to meet aggressive efficiency targets. This paper focuses on design elements of residential programs that attempt to get deeper savings through a variety of savings measures, including no cost, low cost, and major upgrades. Major upgrades, such as insulation and air sealing, typically will require some kind of home visit to assist with the diagnosis and design of these major upgrades. Traditional audit programs, oriented towards providing information to help guide consumer action, are insufficient for the task of increased performance, as it has long been recognized that providing information is, in itself, insufficient for inducing participant action (Coltrane et al. 1986; Karg 1987).

This paper's authors are part of a residential program team at the Center for Energy and Environment (CEE) that have studied behavior change literature for many years (in the case of some staff, over 20 years) with the goal of designing and implementing a comprehensive

residential program incorporating lessons learned from this literature in the field. CEE's thesis is that it is possible to design and implement a cost-effective and comprehensive residential program that can achieve significant energy savings through a comprehensive treatment of energy savings measures in individual homes, while reaching the massive market segment necessary to achieve the impact required of the new climate of support for energy efficiency. Key metrics of success will be the savings achieved per home in a broad range of measures, program cost, and overall market penetration. CEE program design staff spent several years designing such a program, called Community Energy Services, and have recently started implementing the program. The program design attempts to incorporate behavior change strategies to maximize program participation and effectiveness.

In the program design process, CEE identified the following challenges for residential program that are crucial to designing a successful program:

- ***High transaction costs relative to energy savings.*** Compared to the commercial or industrial sector, the magnitude of the available energy savings per customer is relatively small. Thus, residential programs that involve a home visit must achieve high efficiencies in program delivery to minimize transaction costs. Minimizing the number of visits to the home (and maximizing the energy savings per visit) is necessary to achieve program cost effectiveness. To maximize energy savings per customer each visit must focus on all fuel types present, as well as multiple modes of savings, including direct installation, major retrofits and behavioral change.
- ***Individual consumer behavior plays a large role in household energy consumption.*** It is well established that consumption in identical homes, even those designed to be energy-efficient, can easily differ by a factor of two or more depending on the behavior of the inhabitants (Darby 2006). Recent utility studies have established that addressing energy related behaviors can result in significant reductions in energy consumption (PA Consulting Group 2010).
- ***Information barriers.*** Just because it is rational for consumers to invest in all conservation opportunities with a payback of 10 years or less does not mean that consumers know what those opportunities are. While providing homeowners with information about what to do is necessary, care must be taken in how that information is presented. Research shows that presenting too many choices can actually increase the likelihood that someone won't choose at all (Schwartz 2004).
- ***Logistical barriers.*** Even if they know what actions to take, unless it is made incredibly easy for them, they may not take those actions due to logistical barriers. Programs must reduce confusion, provide easy steps to action, and deal with logistical barriers, such as assisting homeowners in finding contractors.
- ***Factors other than economics are primary in consumer decision-making***. Even if a measure can be demonstrated to be a positive economic investment to the consumer, other factors determine homeowner priorities. A new kitchen remodel can be more appealing to the day-to-day life of the homeowner as well as increasing resale value compared to insulation that is invisible to the next homebuyer. Programs should include persuasion based on non-economic factors, such as homeowner comfort and creating peer pressure to do the right thing.
- ***Financial barriers***. Homeowners often do not have access to capital to make needed improvements. It should be noted that in CEE's experience with financing over $100

million in energy improvements, this is perhaps the least important of the barriers listed here, but nonetheless important for program designers to address.

Unless a program is designed to overcome these challenges, achieving cost-effective energy savings in the residential sector will remain elusive.

The Community Energy Services Program Design

The program design of the Community Energy Services (CES) program builds upon CEE's prior experience with previous residential programs (Operation Insulation and Neighborhood Energy Workshops), and incorporates concepts from the field of behavioral science relating to behavior change and persuasion to maximize program effectiveness. The program is designed to achieve high levels of penetration and participation, motivate participants to action, achieve significant savings per household, and be delivered efficiently and cost-effectively. The program treats major retrofits in a style similar to that of Home Performance with Energy Star through the use of contractor training and certification, as well as the use of post inspection quality control and blower door tests. The recruitment strategy for the program is similar in some respects to "neighborhood sweep" programs that attempt to saturate a neighborhood typically focusing on low-cost/no-cost measures that can be completed in a single visit (SWEEP 2005).

Lessons from behavioral psychology are attempted to be incorporated into each aspect of the program. Several of the behavior change strategies used in the program are identified in the table below, and discussed further in the following section.

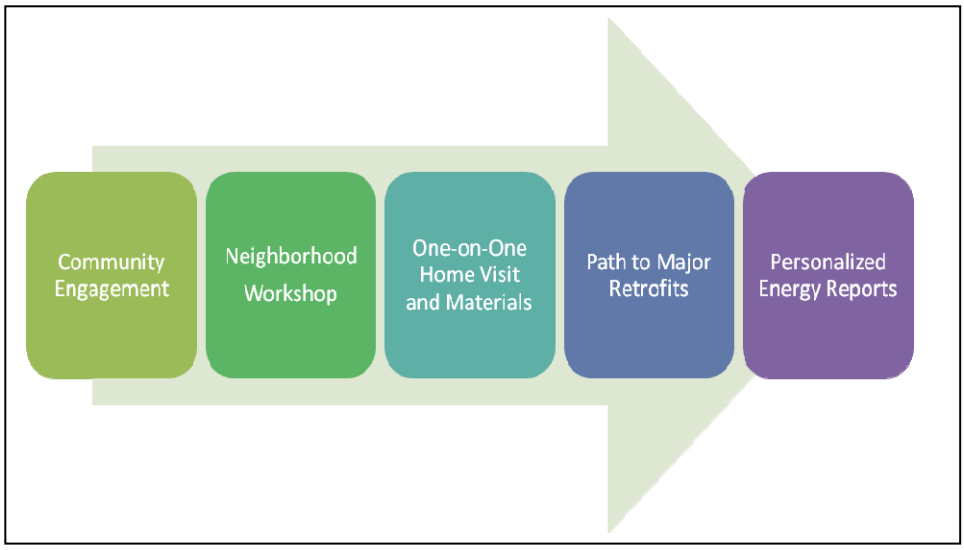
Table 1. Behavior Change Strategies Applied to CES Program Design

Behavior	Strategies	Explanation
Agreeing to Participate	CBSM (Community-based Social Marketing)	Face-to-face recruitment by community members is the most effective means to achieve a commitment to participate that is likely to lead to later action.
Showing Up at Workshop	Cues, Commitments	Participants are asked to commit to attend a workshop, and receive reminder calls in the 48 hours prior to the workshop
Signing up for Home Visit	Peer Pressure, Making Conservation Actions Visible, Humor	Being in the presence of community members who are signing up for a home visit makes other's actions visible thereby creating a social norm of taking conservation actions.
Major Upgrades	Foot in the Door, Cues	Participants are provided with low cost/no cost measures to perform prior to their home visit, providing a "foot in the door" for taking a more significant action following the home visit. Cues come from follow up calls from the Resource Coordinator.
Making Behavioral Changes	Cues, Feedback	Ongoing feedback about energy consumption provides a cue and motivation to conserve.

The program design follows a five-step process, as shown in Figure 1. This process is designed to offer a "one-stop shop" comprehensive and integrated package of easy-to-use energy efficiency services to achieve progressively higher energy savings across three basic categories of energy saving measures: 1) low-cost retrofits; 2) no-cost behavioral changes; and 3) major

retrofits. The program utilizes proactive recruitment strategies that both increase participation and attempt to leverage the power of community action to increase program results.

Figure 1: Community Energy Services Program Process



Step One: Leveraging Community Resources to Recruit Participants

Recruitment efforts focus on recruiting people to attend a workshop (Step 2), which is the entry point for the program. The recruitment process is a combination of marketing and community organizing with an emphasis on community buy-in. CEE works only in a limited number of communities (usually neighborhoods) at one time, working to saturate participation within those neighborhoods. The program leverages the participation of local government as well as neighborhood and community organization partners as much as possible, as they are often best equipped to lead a community-marketing campaign. In some cases, this partnership leads to a formalized Memorandum of Understanding between CEE and the local neighborhood group as to roles and expectations. Some neighborhood organizations have contributed funding to reduce the participant co-pay for residents in their neighborhood, supplemental funding for low-interest loans or marketing.

Partnering with community partners provides several benefits to increase participation. Neighborhood groups know what the particular barriers to participation may be in their community, including high rental rates and immigrant communities. Their knowledge of the community allows CEE to tailor the outreach message for each individual community instead of relying on a cookie-cutter approach. For example, the Longfellow neighborhood of Minneapolis traditionally has a high rate of participation in environmental programs, so the messaging in that neighborhood focused much more on their history of high participation and environmental pride as a neighborhood. The north side neighborhood of Logan Park is much smaller with a lower earning demographic, so messaging in that neighborhood focuses on lowering utility bills.

As with our experience with the Neighborhood Energy Workshops and Operation Insulation, face-to-face outreach has proven the most effective at recruiting participants. CEE and the local partners identify volunteers to assist in recruiting participants and host a meeting for these volunteers to train them in recruitment techniques. This training includes details about

Community Energy Services, materials provided and outreach kits with a script and materials. A very effective way to involve these volunteers is to have block leaders door-knock the neighbors on their block and ask them on the spot to participate (Burn 1991; Grasmick et al. 1991). The neighborhoods with the highest rate of volunteers door knocking have also had the largest turn out at the community workshops.

Block leaders and community volunteers also ask for a commitment on the spot for attendance at the community workshop, particularly a commitment to attend a certain workshop. Cues are provided in the form of reminder calls and emails two days before workshops to reduce no-shows.

Specific community marketing tactics used vary by community, but include the following:

- Utilization of block leaders and other community leaders to recruit their neighbors;
- Presentations at community events like board meetings and environmental fairs;
- Door knocking with up-front asks for commitment;
- Postcard mailings;
- Door hangers; and
- Neighborhood and community newsletters.

Participants are asked to sign waivers to give CEE permission to receive their utility bill data, ideally before the workshop, so that specialized reports can be developed for the homeowner.

Step Two: Enhancing Participant Actions through Community Workshops

In order to sign up for the rest of the Community Energy Services program, homeowners are required to attend a community workshop. Workshops are held in every neighborhood once or twice a season. The workshop is an opportunity to use effective social marketing tools to invite homeowners to participate in the program as well as present a different way of communicating about energy efficiency and conservation. Homeowners typically have feelings of confusion around the technical aspects and a sense of boredom with the topic of energy efficiency and conservation. People are most comfortable doing an action that they see their neighbors and peers doing, but energy efficiency and conservation are often not visible as community actions. The workshop helps address these barriers by providing a fun and entertaining atmosphere, helping everyone get on the same page around low-cost and no-cost actions, and providing a sense of peer pressure to participate in the program.

The workshop presenter has specifically tailored the workshop to be different from typical energy efficiency and conservation presentations, including working with a local improv comedy professional to help make the presentation more entertaining. Various studies in the education field have shown that using humor in the classroom helps reduce anxiety around sensitive subjects and encourages learning (Bryant et. al 1980). CES benefits from the same principles by using humor to approach home energy use.

Rather than focusing on messages around climate change or “do this because it’s a good thing to do,” the presentation repeats the message that energy efficiency is easy, keeps people comfortable and saves money. The presentation includes stories of other Minnesotans taking action to reduce their energy use and personal anecdotes with a bare minimum of slides with a

paragraph of text on them. The presentation also presents energy efficiency actions as a spectrum and lets people know that everyone is going to take different actions. Some people may feel guilty about not having already taken action to reduce their energy use, so it's important to help people relax and not feel defensive.

At the beginning of the forty five-minute workshop, the focus is on no-cost, low-cost actions such as installing compact fluorescent light bulbs, turning down the thermostat and washing clothes in cold water. These actions are divided into "good habits" and "good equipment," with the emphasis that both categories are equally important when it comes to staying comfortable and saving money. Next the presentation shows how these actions fit into a larger picture of "good investments" like attic insulation, air sealing and major mechanical upgrades. In this way, participants are gently introduced to incrementally larger upgrades in a way that shows these actions as part of a natural progression. Very little time is spent on building science or technical information, and the style of the workshop encourages audience participation and call-and-response.

At the end of the presentation, it is then assumed that everyone will register for the program instead of presenting registration as an option. Attendees can pick a date and time for their home visit and submit their co-pay ($20 in 2008 and 2009, now switching to $30 in 2010) and receive some basic materials to take home and install. The nominal co-pay is a proven tool used to gain buy-in and commitment. The workshop is free and open to any members of the participating neighborhood, and the success rate of signing up attendees for home visits is currently over 95%. This high conversion rate is certainly due in part to the prior commitment gained by the block leaders. Once participants have registered and scheduled a home visit, homeowners receive four compact fluorescent light bulbs, two packets of gasket seals and a pack of outlet safety plugs. They are told to install these before their home visit, which lets them take action immediately after the workshop. While the savings from these installations is minor compared to what will come in the home visit, this strategy takes advantage of the "foot in the door" technique which shows that people who make small commitments are more likely to then commit to larger actions in the future (Freedman et al. 1966). In this case, installing the compact fluorescents and outlet measures helps essentially "prime" the homeowner to be more open to the installations during the home visit and major retrofits like insulation and air sealing.

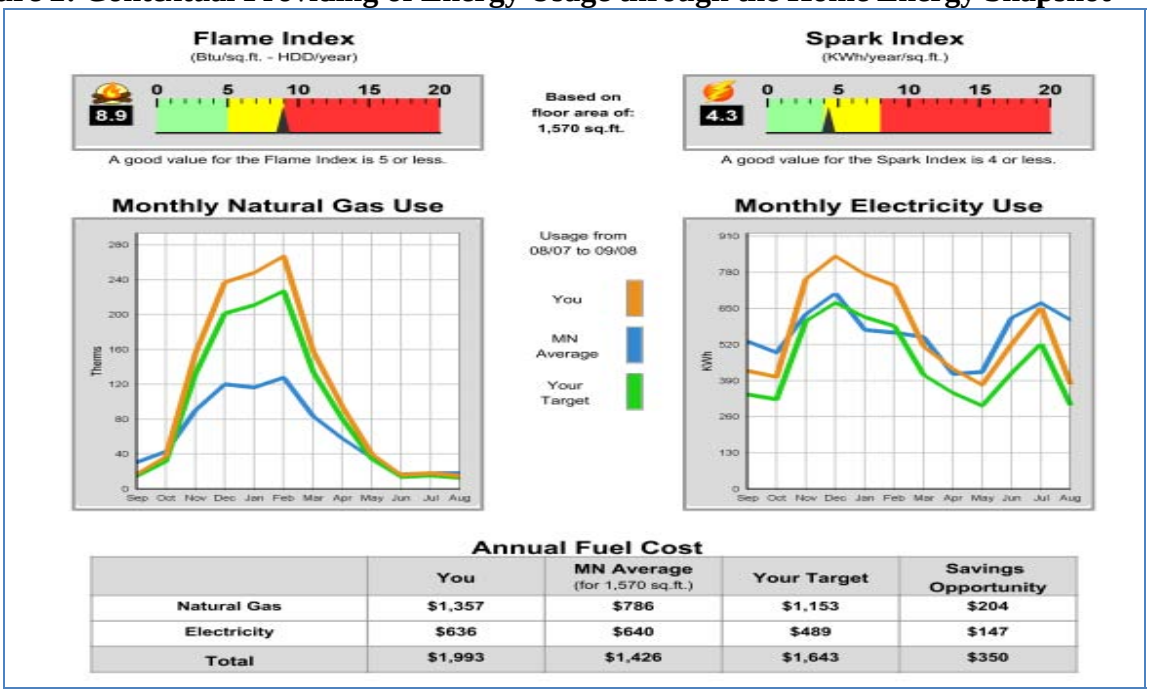
Step 3: Home Visit and Materials

A two-person team conducts the Home Visit, an "energy counselor" and an "energy technician." The counselor is the primary point of contact for the homeowner, and starts the home visit off by reviewing a "Home Energy Snapshot" which details the homeowner's past 12 months of natural gas and electricity usage. The Energy Snapshot gives the homeowner feedback on their energy usage by allowing them to compare their historical use to that of the Minnesota average usage based on their house size as well as what they could achieve in their house if energy efficiency measures were implemented. They are also provided with home energy use index ratings for their natural gas and electricity usages (a "spark index" and "flame index"; see Figure 2) with which provides further context, and defines their usage with a new vernacular (like miles-per-gallon for cars). The energy counselor will congratulate the homeowner if they are doing well or provide them with suggestions if they have high usage. The goal is to provide feedback on behaviors as well as create a social context for their usage. The counselor then conducts a walk-through of the home with the homeowner.

At the same time, the energy technician conducts a blower door test, performs furnace and hot water heater safety check, including a worst case combustion and spillage tests, and checks insulation levels in the attic and walls. A prioritized list of recommendations is then developed, limited to no more than three major recommendations. A report with this information is then be provided to and discussed with the homeowner.

If air sealing and/or insulation is recommended, the homeowner is left with a list of qualified contractors that have agreed to meet program quality standards. If ventilation or combustion safety issues are identified, the homeowner is instructed to deal with these before any major upgrades are to be implemented.

Figure 2: Contextual Providing of Energy Usage through the Home Energy Snapshot



	You	MN Average (for 1,570 sq.ft.)	Your Target	Savings Opportunity
Natural Gas	$1,357	$786	$1,153	$204
Electricity	$636	$640	$489	$147
Total	$1,993	$1,426	$1,643	$350

Source: CEE

Step 4: Path to Major Retrofits

Based on the findings of the Home Visit, houses that have received recommendations for major upgrade work (defined as by-pass sealing, attic and wall insulation, furnace/boiler or hot water heater replacement) are followed up with a phone call from a Resource Coordinator who encourages the homeowner to take the next step, if not already in progress. Homeowners are encouraged by offering assistance with applying for a variety of state, city and neighborhood financing programs and utility rebates. The Resource Coordinator is available to answer questions of program participants and help guide them through the process. When applicable, the homeowner is referred to a staff loan officer to assist in obtaining the appropriate loans and/or rebates.

As part of CEE's quality control program, CEE conducts quality-control inspections on a random sample of homeowner installations. The inspections include blower door and infrared scans, as well as visual inspection of the work done.

Step 5: Personalized Energy Reports

All participants are enrolled in a feedback program to encourage behavior change that reduces energy usage. This involves the preparation of personalized home energy reports, similar to the Home Energy Snapshot, that are delivered on a bi-monthly basis via email or mail. In this way context is provided for the homeowner's energy bill. Studies have shown that feedback can be an effective and low-cost way to reduce homeowner's energy bills by up to 13 percent, with this type of indirect feedback approach closer to the 2 percent range (Darby, 2006).

Initial Results and Continued Program Development

In the first 6 months of program operation (through March, 2010), the program has conducted 23 workshops and completed 1,000 Home Visits (as previously mentioned, over 95% of workshop attendees signed up for Home Visits). Based on engineering estimates and achieved rates of installation, the low-cost materials installed have saved about 3.5 Dth of natural gas and just over 600 kWh of electricity per year for the average participant (approximately $90/year of savings). The impacts of behavioral changes are expected to be approximately the same order of magnitude, but are as of yet unknown. Behavior change savings will be attempted to be captured thorough comprehensive utility bill data analysis once an appropriate sample size and time period is available (at the end of 2011).

Benchmarking Success at Converting Participants to Major Upgrades

The program goal for major upgrades is to get 25% of total participants to complete upgrades (a "conversion rate" of 25%). As initial estimates suggest that at least half of all participants are recommended major upgrades at the Home Visit, a 25% overall conversion rate will involve getting approximately half all participants that need upgrades to complete them. Initial, limited data (based on homeowners who have contacted CEE for loans to complete upgrades) suggest that the program has achieved at least a 13% conversion rate for major upgrades. However, the lead time for participants to complete these upgrades can be up to 12 months or perhaps more, and the program has not yet cross-referenced rebate applications and other data to assess which participants have in fact completed upgrades, so this figure cannot be regarded as accurate; it is still too early to assess the conversion rate efficacy of this program.

Maximizing the rate at which participants commit to high-cost/high-impact improvements is, however, an important metric of success, since significant and long-lasting energy savings can be achieved through these upgrades compared to the low-cost and behavioral measures. Several HPwES programs estimate that their conversion rate of visits to completed jobs range from 40% to 60% (ESource 2010). This high conversion rate, coupled with energy savings in the range of 20% to 30% for high-usage, cold-climate participants that commit to major insulation and air sealing work (Quaid et al. 1988; Belzer et al. 2007) enables high-cost home performance programs to achieve cost effectiveness. However the recruitment strategies and program designs of HPwES programs are very different from that of CES. In many of these HPwES programs customer participation is largely self-initiated by highly motivated homeowners. Presumably participants of these programs know or suspect that they can benefit from major insulation and air sealing work. CES' recruitment strategy does not select strongly

for people who already want to do major insulation and air sealing work, and thus these HPwES programs are not necessarily a good benchmark for the CES program design.

Continuous Improvement of Program Results and Future Directions

Based on CEE's past experience with implementing programs, it is expected that it will take at least another year for the program to start to hit full stride, and even longer for the program concept to reach its full potential. In the same way that homeowner behavior has an impact on the adoption and implementation energy efficiency actions and measures, the effectiveness of the program itself is dependent on the people implementing the program and the methods and tools they employ. Developing a new program requires ongoing learning and continuous improvement.

Based on the influence and guidance of John Tooley of Advanced Energy (2009), the lean manufacturing management approach developed by Toyota (Liker 2004) was adopted. This framework has the following features:

- Focus on systems thinking;
- Systematic use of analytic tools, such as Value Stream Mapping, to continuously improve the process;
- Development of standardized work and training methods for rapid, effective and high-quality workforce deployment;
- Utilization of methods to incorporate suggestions and improvements gained by "front-line" workers to make process improvements; and
- Use of quantitative data and clear program metrics to improve processes.

Although typically used to improve a manufacturing process, we believe the lean manufacturing framework is uniquely suited to improve residential energy efficiency program delivery because of its systematic tools to addresses the complexity of the many individual components that must be coordinated in an effective residential energy efficiency program (e.g., recruitment, workshop, home visit, contractor work, quality control, financing, homeowner follow-up). At a systems level, this is not dissimilar to a complex manufacturing process. Thus project staff have received lean manufacturing-related training, including: Training Within Industry, Job Instruction and Job Methods, the A3 Problem Solving Approach, and Lean Office Tools.

In addition, "kaizen" project teams were set up to map value streams of both current and future states of various facets of the program (kaizen, literally "good change," is Japanese for continuous improvement). From these maps, continuous improvement projects were identified. Creating metrics allowed the teams to agree on project goals, accept accountability and determine areas of improvement.

It is hoped that these lean tools will help create a common vision and language for the project team, improve communication, and push the team to higher levels of effectiveness. The interdisciplinary teams help to break down some of the walls that naturally exist in the silo-ing of project stages and tasks. An important concept was accepting that the program is a work in progress that should adapt and evolve as we gain experience. Continuous improvement requires a staff and a program that are open to change and learning. A systems approach to program

delivery is just as important as a systems approach to how a house works and how a homeowner uses energy, and this type of approach has potential to improve program results over time.

Several areas of improvement are currently being pursued. The first is the addition of a building energy label for the homes that go through the program, which is planned to be added by the end of 2010. The program will utilize the SIMPLE model, developed by Michael Blasnik, and incorporate the model results to produce a building energy label for each home. This model has been shown to have excellent predictive value for predicting a homes energy usage, but only requires a minimum amount of time to collect the required inputs (Energy Trust of Oregon 2009). The label itself will be designed to guide people to doing upgrades that will lead them to a higher score. The intent is that the label can help serve as a sales tool to help motivate homeowners to do more upgrades.

Another area of improvement CEE is exploring is in working with contractors. In the summer of 2010, CEE will experiment with giving homeowners direct bids for completing the work, based on pre-agreed upon prices with contractors. Homeowners need only agree to have the job done, and the job will be scheduled by a qualified contractor. This would cut out the step for the homeowner of having to get a bid (or multiple bids), which is another potential drop-off point for participants. Although challenges exist with this approach, it has the potential to improve conversion rates for the program. The approach is similar to a program run by CEE in the 1980s called Operation Insulation, which achieved over a 55% conversion rate, or a conversion of 73% of households who were recommended insulation (Quaid 1988).

Conclusion

CEE's Community Energy Services was developed as a new model of residential energy efficiency, incorporating new answers to the constant challenges of addressing the residential market. The program attempts to incorporate lessons from the field of behavioral science relating to behavior change and persuasion to maximize program effectiveness. Early results indicate are promising, particularly with regard to recruiting program participants, although it is still too early to tell if the program will successfully achieve high conversion rates in getting participants to undertake major upgrades, such as insulation and air sealing. Future program directions, including developing a building labeling system and providing direct bids to homeowners, could further improve program performance.

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