A Review of Energy Reduction Competitions:

What Have We Learned?

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Abstract

Competition is found in all societies, and it is found in many areas of society: for example, biology and ecology, economics, business, politics, sports, education, and lotteries. Not surprisingly, competition has become an increasingly popular strategy to engage individuals in energy and resource conservation; however, there has not been an objective, independent review of existing competition programs focusing on the reduction of energy use. This report attempts to address this shortcoming.

This report reviews a representative selection of completed and ongoing energy reduction competitions and uses the lessons learned to provide best practice guidance on the design, implementation, and evaluation of future programs. We address four key research questions:

- How effective have been competitions at changing behavior and reducing energy?
- How long do energy savings persist after the end of the competition?
- Under what circumstances are competitions more or less effective?
- What are common best practices for the design, implementation and evaluation of energy and resource conservation competitions?

The primary target audiences for this report are electric and natural gas utilities seeking to broaden their portfolio of behavior-based interventions, as well as potential designers, implementers and evaluators of energy reduction competitions. Our intention is to improve the effectiveness of competitions and to suggest when competition may or may not be an effective strategy to save energy over the long term. Many of the lessons from this report should also be relevant to students, practitioners and policymakers seeking to engage individuals and groups in energy and resource conservation.

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Executive Summary

This report reviews a representative selection of completed and ongoing energy reduction competitions and uses the lessons learned to provide best practice guidance on the design, implementation, and evaluation of future programs. We address four key research questions:

- How effective have been competitions at changing behavior and reducing energy?
- How long do energy savings persist after the end of the competition?
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This report is based on a literature review, in-depth interviews with designers, implementers and evaluators of 20 competitions, case studies and analysis. Results and recommendations in this report are organized by project type including: university residence halls, inter-community competitions, inter-community home energy upgrade programs, intra-community competitions, inter-organization competitions, intra-organization competitions and a national building energy competition. This review is not a meta-analysis of projects, and it does not seek to provide quantitative estimates of results. The methods do allow for in-depth observations based on input from program implementers and evaluators across a range of competitions.

The primary target audiences for this report are electric and natural gas utilities seeking to broaden their portfolio of behavior-based interventions, as well as potential designers, implementers and evaluators of energy reduction competitions. Our intention is to improve the effectiveness of competitions and to suggest when competition may or may not be an effective strategy to save energy over the long term. Many of the lessons from this report should also be relevant to students, practitioners and policymakers seeking to engage individuals and groups in energy and resource conservation.

Savings

Based on our review of the competitions in this report, we believe that competitions have been effective at changing behavior and reducing energy use, although we don't know how long the energy savings or practices (habits) will persist. **Energy savings** have not been measured in all of the programs, but where they have, it has been mainly electricity savings. In general, electricity savings from these programs have been around 5% during the program period, a strong result for behavior-based strategies. Some programs, however, have realized substantially higher savings. The Sustainable Connections' Community Energy Challenge has achieved 21% average savings in each year of its competition. In the first year of the CoolCalifornia Challenge, 14% electricity savings were achieved over five months of the year-long program for the roughly 1,000 most active participants entering energy data. And in the Campus Conservation Nationals,

the top 10% of participating buildings achieve over 30% savings. So, there is a potential for deep energy savings to occur, but most savings for most of the competitions were below 10%.

For a few programs, **CO_2 savings** have been estimated, and some results have been substantial. For example, as the Campus Conservation Nationals has grown over time, CO_2 savings have also grown impressively: to over 3 million pounds by its fourth year. The Sustainable Connections' Community Energy Challenge has achieved almost 13 million pounds of CO_2 savings per year. And NEEA's Kilowatt Crackdown has resulted in 50 million pounds of CO_2 savings since 2007.

For a few programs, **financial savings** have been estimated, ranging from a few thousand dollars to millions of dollars. For example, EPA's ENERGY STAR Building Competition believes that it has saved $70 million in the last two years of its national program, the Kansas Take Charge Challenge saved over $2 million, and Cool Choices saved about $430,000.

It is important to note that the **measurement and evaluation** of these programs varied substantially. None of the programs used a Randomized Control Trial (RCT) where subjects are randomly assigned to treatment and control groups (Vine et al. 2014). Only a few programs conducted a quasi-experimental study, comparing energy impacts for participants and non-participants (CoolCalifornia Challenge and San Diego Energy Challenge). The majority of the programs that conducted evaluations simply compared energy use during the treatment period with energy use in a prior (pre-treatment) period (either monthly or annual energy use) – with no comparison group analysis. Sometimes, the estimated savings were weather normalized (e.g., Energy Smackdown and Community Energy Challenge), but often the savings were not weather normalized. Finally, several programs relied on energy models to calculate the savings, while others did not conduct any energy evaluations.

Unfortunately, many of these competitions were of short duration (weeks or months), and none of the programs conducted a formal evaluation of **persistence**. We were only able to find some anecdotal information: the Campus Conservation Nationals program noted that savings were sustained 2-3 weeks after competition, and the Energy Smackdown program noted that participants reported doing the same behaviors six months or later (but not measured).

Communication Channels

The competition programs used different channels to communicate with participants. All programs had websites, which were a central, or even primary means of communicating with participants. Almost all programs also used some form of e-mail communication with participants, in-person communication strategies, informational flyers or poster, events, newsletters and social media. While communication channels are instrumental in the competitions, the behavior change strategies appeared to be more critical in ensuring successful outcomes.

Behavior Change Strategies

The most common strategies were local messengers, comparative feedback, social diffusion, competition, imagery, financial incentives and rewards, descriptive norms, commitments and goal setting. Interestingly, competition was not central to all programs, and one program (Community Energy Challenge) ultimately decided not to incorporate competition as a program strategy. This highlights that what are labelled "competitions" are very diverse, community-based behavior change programs that utilize a range of behavior change tools to encourage adoption of low energy consumption.

General Lessons Learned

Because the competitions used different metrics and designs, mostly without any experimental design, it is difficult to identify the most effective competitions or even the best practices for the design and implementation of these competitions. But we can provide some insights on what worked well. We provide some general lessons learned below, while we also provide lessons learned about behavior change strategies and by program type in the main report.

Scalability
Competitions have the ability to massively scale up interventions. While we found that a more prescriptive program could be more scalable, participants will most likely not be as personally engaged as programs designed locally, thereby limiting their effectiveness, as noted immediately below.

Success depends on other factors, not competition alone
Competition is a program strategy but does not guarantee savings. When a highly successful competition was expanded to six other counties by another implementer, there was no incremental change in home retrofits or energy savings. This is because the cornerstone of the original program was customer service, which was not transferred to other communities by the different implementing organization; just creating a competition was not sufficient.

Cost-effectiveness
Competitions can be very cost-effective. While some competitions appeared to be cost effective, for most competitions (particularly, campus conservation competitions), it appears that cost effectiveness was not a primary concern when first launching their competition – the non-energy benefits (i.e., educational benefits) were more important.

Engage, Engage, Engage
Continuous engagement is critical. Most of the competitions focused on getting potential participants engaged and then continuing that engagement over the life of the competition. If the participants are not engaged, it is unlikely that they will continue with the competition and unlikely to follow-up on any commitments that they may have made.

Ability to achieve deep savings
Competitions can achieve significant savings, particularly when they stimulate building retrofits. The Rutland County (Vermont) NeighborWorks program enabled nearly 5% of homeowners to complete home retrofits, with an average of 30% energy savings. While most of the competitions did not achieve this type of deep savings as a whole, the potential is there.

Social Norms
Competitions relied on social norms, particularly through comparative feedback mechanisms (see below) and marketing materials. However, the effectiveness of competitions based upon appeals to pro-social preferences and social comparisons may be short-lived and may wane over time (hence, the need for evaluating the persistence of energy savings).

Self-efficacy
Programs that are able to scale up and achieve deep savings help people feel like they are making meaningful contributions to solving real world problems, increasing their self-efficacy. Individuals who believe that they are capable of accomplishing their goals are much more likely to achieve them. This belief in the ability to make a difference is thought to be critical to energy saving behavior. However, not all competitions may lead to increased self-efficacy.

Software
Competitions used a variety of software tools to engage participants. The most compelling software tools appeared to be leaderboards (rankings for participants, teams within communities and communities overall), goals (ability to track progress of communities of achieving goals), stories (the ability to share what actions participants take), commitments (the ability to share what actions participants have committed to taking) and incentives (small rewards seen as positive feedback for achieving accomplishments).

Measurement and Evaluation
The measurement and evaluation of competitions varied substantially – with many of them significantly deficient. None of the programs used a Randomized Control Trial (RCT), and only a few programs conducted a quasi-experimental study, comparing energy impacts for participants and non-participants (CoolCalifornia Challenge and San Diego Energy Challenge). The majority of the programs that conducted evaluations simply compared energy use during the treatment period with energy use in a prior (pre-treatment) period (either monthly or annual energy use). Sometimes, the estimated savings were weather normalized (e.g., Energy Smackdown and Community Energy Challenge), but often the savings were not weather normalized. Finally, several programs relied on energy models to calculate the savings, while others did not conduct any energy evaluations.

For competitions, evaluation is challenging. First, it is difficult to prevent the comparison group from learning about a program that is being marketed within communities or organizations. And second, for opt-in programs, RCTs are difficult to implement.

Installation of Energy Efficiency Measures

Given the short time span of most competitions, investments in energy-efficient equipment or whole home retrofits are challenging. It takes a long time between the point at which homeowners begin thinking about a home retrofit and the point at which work is completed. Competitions usually do not last long enough to capture these equipment-based savings. However, some competitions are successful in bringing about retrofits changes and, hopefully, significant long-term savings.

Persistence of Energy Savings

None of the programs conducted a formal evaluation of persistence of energy savings. We were only able to find some anecdotal information. Since many of these competitions were conducted over short periods of time, it is difficult to infer persistence from these results.

Persistence of Actions

While competitions that only focused on conservation measures typically did not measure persistence after completion of the program, some programs did examine the persistence of actions, often through adoption of new practices. These habits are a good metric of persistence, since they are hard to break. Furthermore, all behaviors do not persist at the same rate: for example, some one-time changes (such as changing the temperature of the water heater, or changing the television's brightness) have "built-in persistence" as it is unlikely that someone will undo that action.

Recommendations

Create Well Crafted Intervention Strategies

Competitions need to focus on key program strategies to be more effective. Most programs used as many behavior change strategies as possible. Projects that used fewer strategies were often just as effective. It is important to have well crafted intervention strategies that are appropriate to the target audience in order to create a program that is simple, informative and engaging. A program design that incorporates too many behavior change strategies might result in participant confusion. Thus, one must be selective and strategic in incorporating and funding behavior change strategies in competitions.

Change the Focus from Winning to Doing Well

There are winners and losers in competitions. Those at the bottom or middle of rankings may not feel that they have a chance to win, so they may not perform well. Worse, poor performers may lose some of their intrinsic motivation and self-efficacy, which are critical factors in changing behavior. Thus, care should be taken to increase the motivation of all participants, even those at the lower levels of participation. This may be accomplished by providing recognition for achieving goals rather than, or in addition to, outperforming peers. One possible solution is to provide awards or prizes commensurate with the level of participation.

For example, the CoolCalifornia City Challenge provides funding to cities based on how many points are earned by participating residents. This changes the focus from winning to doing well. One could also provide recognition, awards or prizes to “most improved” participants. In sum, recognition should be granted for all participants and communities achieving particular goals, not just outperforming peers.

Know Your Target Audience

Competitions are not for everyone. Competitions appear to be most effective when they are between groups of individuals who know each other personally or are natural rivals. Similarly, business competitions can be very effective, but it is important to construct competitions in ways that support all businesses and minimize potential negative impacts of businesses that do not do as well in competitions.

Simplify Engaging Software

Software should be simple and engaging. As noted earlier, the most compelling software tools appeared to include leaderboards (rankings for participants, teams within communities and communities overall), goals (ability to track progress of communities of achieving goals), stories (the ability to share what actions participants take), commitments (the ability to share what actions participants have committed to taking) and incentives (small rewards seen as positive feedback for achieving accomplishments). These software tools, to the extent they are implemented, should be clear, bug free, and easy to engage.

Be Careful in Scaling Up

After a successful pilot program, there is a tendency to scale up the program to a larger geographic area. However, you may lose more than what you gain if the personal engagement is not there for motivating people, making it difficult to change existing habits. It is possible, but local program managers and stakeholders will need to be engaged and motivated to promote the program.

Use Rewards But Be Careful

Rewards (recognition and prizes) do work: they have been shown to enhance intrinsic motivation (and thus long-term behavior change) when they are seen as positive feedback for accomplishments rather than a means of control. However, programs should be careful to not over-emphasize extrinsic rewards. Program implementers’ prizes to participants should be seen primarily as recognition and positive feedback for participants' personal accomplishments rather than the primary goal of participation.

Experiment!

Competitions do work. Unfortunately, we have a limited understanding of how well these competitions work. Instead of collecting more anecdotal information, program planners and designers need to be more strategic and systematic by using experimental design to find out what works and what does not work. Ideally, randomized control trials should be encouraged,

so that a rigorous evaluation can be done. Alternatively, competitions should be evaluated using quasi-experimental designs – comparing treatment populations with comparison groups.

Devote More Resources to Measurement and Evaluation

Competitions need to devote more resources to evaluation and measurement. There are several things that most of the case studies lacked in this regard that future implementers should address for ensuring more rigorous evaluations:

- Develop a program theory and logic model document prior to implementation to illustrate the hypothesized causal links between program activities and outcomes.
- Plan for a means to measure the linkages in the logic model as program performance metrics—whether or not energy change will be measured.
- Identify other behavior change and similar initiatives occurring at the same time of the intervention, to avoid confusion and address attribution issues.
- Develop evaluation plans that use a preponderance of evidence approach so that desired outcomes aside from lowering of energy use can be measured (e.g., AKA (awareness-knowledge-attitudes) type metrics, program touches, unique visitors to websites, etc.).
- Develop standardized measures across a range of key variables (to enable cross comparisons to be made across different studies).
- Provide a sufficient budget for evaluation activities to measure persistence of savings over time.

Ensure Persistence

More resources need to be devoted to ensuring the long-term effectiveness of behavior change strategies and competitions. Most competitions are relatively short lived. For long-term behavior change, a few possibilities arise: (1) continue the competitions over a longer period of time, (2) conduct a series of short-term competitions that build on the original competition, (3) conduct follow-up activities that build on the competitions; and (4) emphasize habit development and installation of energy efficiency measures in current and future competitions.

Conclusions

For competitions to be effective, it is imperative that resources are committed for the long term, so that a competition program can endure. By keeping a program stable in the community for several years, one is able to build critical relationships, trust and consistency in program delivery, leading to enhanced program credibility and program accomplishments. At the same time, resources need to be committed for the design and implementation of rigorous evaluations of competitions. As federal, regional, state and local governments and non-profits move towards aggressively pursuing energy savings, we expect that more energy reduction

competitions will be needed to provide these additional energy resources. We hope that this report can stimulate more thinking about competitions as well as more funding for the design, implementation and evaluation of energy reduction competitions.

1. Introduction

Competition is found in all societies, and it is found in many areas of society: for example, biology, ecology, economics and business, politics, sports, education, and lotteries. Not surprisingly, competition has become an increasingly popular strategy to engage individuals in energy and resource conservation; however, there has not been an objective, independent review of existing competition programs focusing on the reduction of energy use. This report attempts to address this shortcoming.

1.1. Research Study Motivation and Goals

This report reviews a representative selection of completed and ongoing energy reduction competitions and uses the lessons learned to provide best practice guidance on the design, implementation, and evaluation of future programs. We address four key research questions:

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The primary target audiences for this report are electric and natural gas utilities seeking to broaden their portfolio of behavior-based interventions, as well as potential designers, implementers and evaluators of energy reduction competitions. Our intention is to improve the effectiveness of competitions and to suggest when competition may or may not be an effective strategy to save energy over the long term. Many of the lessons from this report should also be relevant to students, practitioners and policymakers seeking to engage individuals and groups in energy and resource conservation.

1.2. Steering Committee Guidance

We formed a steering committee of industry professionals, academics and utilities to provide guidance on project goals, case study selection, refining interview questions, and review of the final draft report. The committee was convened by email, and individuals were contacted periodically for their input on specific aspects of the project. The members of this committee are listed in the Acknowledgements section.

1.3. Organization of Report

The rest of this report is organized in the following sections. Section 2 presents the context for this report by highlighting key aspects of energy reduction competitions, behavior change strategies, and the design of competitions. Section 3 focuses on this study's data collection and analysis methods. Section 4 presents the overall results of the competitions examined in this study, as well as results by type of program. Section 5 describes the lessons learned from this study – overall, as well as by type of program. Section 6 contains our recommendations going forward, and Section 7 presents our concluding remarks. The last section (Section 8) contains the references cited in this report. There are two appendices. Appendix A contains the detailed case studies, and Appendix B the survey instrument.

2. Report Context

This section presents the context for this report by highlighting key aspects of energy reduction competitions, behavior change strategies, and the design of competitions.

2.1. Energy Reduction Competitions

At their core, competitions provide a set of rules, mechanisms to track results, and public acknowledgement (recognition) to participants for their progress in achieving a specified objective. In energy reduction competitions,[1] the objectives may be reducing energy below a benchmark, earning points for taking energy conservation strategies (such as investing in an energy-efficient appliance or changing an air conditioner's thermostat setting), achieving the most energy upgrades, or other quantifiable activities that either directly or indirectly (e.g., via education) reduce energy use.

Competition may be thought of as both a type of program and an intervention strategy. Programs that refer to themselves as competitions typically organize resources, activities and evaluation metrics around the objectives of the competition, while in other behavior change programs, competition may be an intervention strategy of a larger program. Engagement is key: while there are typically winners and losers in competitions, most competitions try to publicly engage all participants and reward them with recognition and/or tangible incentives (e.g., prize money for a community project).

Competitions build on the growing evidence of the power of social influence in general, and peer pressure in particular, in promoting cooperative behavior (Mani et al. 2013). Competitions are typically conducted in a social, publicly visible setting where group dynamics are important and where goals are set, commitments are made, information and feedback are provided, and prompts are issued to keep participants informed and to make it easy for them to participate.

While reductions in energy use are typically the principal focus of competitions, another goal is to increase awareness, understanding and knowledge of the connection between behavior change and energy use, and often attempting to increase the competencies, capabilities and self-efficacy of individuals to create change.

In summary, competitions must be structured to achieve four related goals in order to stimulate change in thought and behavior that result in short and long-term reductions in energy use (Petersen et al. 2014):

1. Engage (catch attention and involve the target audience)
2. Educate (communicate information on what, why and how behavior should change)
3. Motivate (enhance desire to change behavior), and

[1] In this paper, we use the term "energy reduction" to encompass both energy conservation actions (focusing on behavior change) and energy efficiency actions (focusing on installing energy efficiency measures).

4. Empower (increase perception and reality of self-efficacy and suggest concrete and actionable behavior)

2.2. Behavior Change Strategies

Energy reduction competitions use a variety of behavior change strategies that build on key insights from behavioral sciences (McKenzie-Mohr 2013). Some of the most common strategies are described below:

Local Messengers

As noted in the energy efficiency literature, people respond best when approached by a peer that they can trust and comprehend (Fuller et al. 2010). Usually, the trusted messenger is someone who lives in the local community. As described in this report, local messengers have played critical roles in energy reduction competitions.

Comparative Feedback

Providing information about how a household's energy use compares to others, and how energy use changes over time as a result of actions taken, can influence behavior—the first type of feedback taps into social norms, and the second provides a stronger association between an action and its consequences (Fuller et al. 2010). Several studies have found that in-home energy monitors can induce occupants to reduce energy consumption, at least during a short pilot period (Darby 2006). In the last six years, utilities have funded home energy reports (HERs), comparing customers' energy consumption with, for example, their neighbors. Customers with higher than average energy use are motivated to reduce their energy use to more average levels of consumption, while the reports motivate lower than average users by providing positive feedback and setting a lower target to achieve. These reports have led to persistent energy savings of 1-2% across residential customer segments over time, with larger savings in higher use demographic groups (Ayres, Raseman, and Shih 2012). Due to their cost savings, these reports are spreading fast, particularly for high-energy consumers. HERs' success seems to rely on comparative feedback. However, we don't know whether it is the letter, the smiley face, the graphic, or the attention that drives the change. The various components of the reports have not been isolated to see what is causing the effect.

Comparative feedback is central to energy reduction competitions, which compare participants or groups of participants on energy use, energy reductions and/or progress completing educational tasks or other goals. Most competitions have leaderboards (tables) showing the rank of individual participants and teams. This type of feedback may be even more compelling than generalized neighbor comparisons used in HERs, since participants or groups of participants may be directly compared with their peers, making energy use and progress toward program goals publicly visible and in "real time." Also, the feedback may be positive or negative, and the frequency of feedback may vary (e.g., real time, daily, monthly, or annually).

Social Diffusion

In the context of this report, social diffusion refers to social network methods that people use for spreading information about energy reduction behavior and technologies. Competitions encourage participation in pro-social and pro-environmental behaviors by enhancing social interaction among participants. For example, enrollment in community-based competitions relies largely on word of mouth, and promotion of programs occurs through social networks such as groups of friends, colleagues, dorms, schools, churches, community-based organizations and other opportunities for peer-to-peer exchanges (e.g., through social media such as Facebook, Twitter, Instagram, etc.).

Imagery

Imagery uses figurative language to represent objects, actions and ideas (e.g., saving energy) in such a way that it appeals to our physical senses and emotions. Imagery makes use of particular words, and word imagery is associated with mental pictures. In competitions, imagery can be a powerful tool to help communicate programs to diverse geographic, demographic and psychographic population segments.

Rewards and Financial Incentives

Rewards and financial incentives have been widely used to influence behavior, and, in fact, individuals often point to incentives as the primary reason for engaging in the behavior (McKenzie-Mohr and Schultz 2014). Rewards include strategies where gifts or other tangible prizes are given in recognition of achievement or willingness to engage in a behavior and to encourage reciprocity on the part of the receiver (Ignelzi et al. 2013). Financial incentives include monetary strategies (such as rebates or discounted prices) to motivate end users and midstream or upstream market actors to engage in a behavior, or to change the supply of goods or services through midstream/upstream incentives (Ignelzi et al. 2013).

A common critique of competitions is that an overemphasis on extrinsic rewards and financial incentives can reduce intrinsic motivation for individuals to take the desired behaviors and decrease the likelihood that the behaviors will be sustained when the rewards are withdrawn at the end of the competition (Covington and Müeller 2001; Deci et al. 1999). Thus, if McKenzie-Mohr and Schultz (2014) are correct in asserting that competition as a behavior change strategy is more appropriate when intrinsic motivation is low (i.e., they are not motivated to reduce their energy use), then extrinsic rewards and financial incentives may not be appropriate for competitions.

On the other hand, according to Cognitive Evaluation Theory (Deci et al. 1999), rewards may also increase intrinsic motivation. The difference depends on the meaning given to the reward. If the meaning of the reward is primarily positive feedback for accomplishments, then intrinsic motivation to continue the behavior is increased. On the other hand, if rewards are seen as

controlling and an end-goal themselves, this may decrease intrinsic motivation for behaviors. Thus, the meaning of the reward should be primarily informational, rather than tangible.

Competition alone, in the absence of external rewards and financial incentives, is thought to increase intrinsic motivation by making the activities more challenging and enjoyable (Deci et al. 1999). For example, Petersen et al. (2007) found that the concept of competing for a reward may have been more motivational than the reward itself (which often went unclaimed).

It is also important to consider that competition may be only one of many behavior tools employed in programs labeling themselves as competitions. The combination of these strategies may enhance intrinsic motivation, while competition is used to make participation more meaningful and enjoyable for participants.

Social Norms

Individuals are greatly influenced by the behavior and expectations of peers (Cialdini 2003; Cialdini et al. 2006), and it is well documented that social comparisons can cause consumers to reduce energy use (Allcott 2011; Nolan et al. 2008; Schultz et al. 2007). Efforts to use such comparisons build upon Leon Festinger's (1954) social comparison theory, which posits that individuals validate the appropriateness of an action or thought through comparison to others. Norms are either descriptive, indicating how others, particularly peers, tend to behave, or injunctive, indicating social approval or disapproval of behavior. In regards to encouraging reductions in resource use, social norms have been shown to be significantly more motivating in stimulating energy conservation behavior than environmental, financial or societal benefits (Nolan et al. 2008). Competitions, as one form of social comparison, may also explicitly incorporate other types of comparative information (e.g., benchmarking tables showing ranks of competitors) to influence behavior.

Prompts

Forgetting is a common barrier to individuals engaging in sustainable behaviors, and prompts help to overcome forgetting. Prompts are visual or auditory memory aids that are used in close proximity to a targeted behavior: e.g., turning off the lights, or adjusting the thermostat. When used, prompts should target positive behaviors rather than encouraging the avoidance of negative behaviors (McKenzie-Mohr and Schultz 2014). As described in this report, many of the competitions made use of prompts.

Public Commitments

Self-perception is the most important factor in determining why commitments work: when people make a commitment to do something, they are altering the way that they perceive themselves (Burger 1999). People are more likely to follow through with an action if they have made a commitment to do it, especially a public commitment (McKenzie-Mohr 2011). Public pledges activate social norms because people want to live up to others' expectations and follow

through on their commitments (Fuller et al. 2010). A review of numerous commitment studies have found: (1) commitments are most likely to be effective when an individual is motivated to act but has not engaged in the action; (2) written commitments appear to be more effective than verbal commitments; and (3) public commitments appear more effective than private commitments (McKenzie-Mohr and Schultz 2014). As described in this report, campus conservation competitions often used this behavior change strategy, for example, where participants could see all the commitments that were made by residents on a particular dormitory floor.

Goal Setting

Goal setting, which entails having individuals or households set specific goals for reducing their energy consumption, has been demonstrated to be effective in achieving the set goals (Ashby 2010). Research shows that we are more likely to obtain our goals if we associate them with implementation intentions (or commitments – particularly, public commitments, as noted above) (McKenzie-Mohr and Schultz 2014).

Scarcity

Participants are more likely to participate in program strategies in which there is a limited supply of desirable resources offered. For example, households may be more likely to sign up for a free or low cost whole home energy audit if they know that only a few will be made available. Time is also an important resource. Knowing that there is a deadline to receive the incentive, earn points, or complete certain tasks, people are motivated to participate. As described in this report, several competitions used this strategy and noted that it was an important motivating factor.

Reciprocity

The reciprocity rule explains people's strong tendency to reciprocate favors or gifts with a favor or gift of equal or greater value, regardless of whether the initial favor was solicited or not (Ashby 2010). For example, a utility providing a gift or other reward *in advance* of a customer changing their behavior may be particularly effective in encouraging the desired action.

Gamification

While there is no agreed upon academic definition of games (and we are not referring to game theory), there does seem to be an emerging definition of gamification. Gamification refers to the incorporation of game design elements or strategies into real world applications. Competitions are often considered games, or a subset of games (Mazur-Stommen and Farley 2013)[2]. Competition itself is a game element, but there are also other important common

[2] In their typology of behavior programs, Mazur-Stommen and Farley (2013) include competitions, challenges, and lotteries under Games.

elements of games, such as completion of small tasks, passing through levels, reward and punishment, and rules that define how the game is played and what strategies may be most effective. While the purpose of playing games is typically enjoyment, gamified energy reduction competitions incorporate the core elements of games with the goal of achieving a pro-social or pro-environmental purpose. Gamified energy efficiency solutions have the following traits: clear goals and rules of play, a compelling storyline, short-term challenging but achievable tasks, and quick feedback (Grossberg et al. 2015).

Loss Aversion

People are more sensitive to losses than to gains, and hence more concerned with what they may lose from a decision (e.g., up front cost) than by what they may gain (e.g., future reductions in energy bills) (Stern 1986; Kahneman and Tversky 1981). As described in this report, many competitions emphasized how much money was lost due to energy waste, as well as highlighting how much energy was saved.

Energy Coach/ Advisor

An energy coach or adviser is often a member of the staff of the implementing organization and offers advice to a homeowner, renter, or building owner or tenant about audits, financing, contractors, energy efficiency measures, etc. The coach not only acts as a technical advisor but also helps and encourages individuals and organizations to implement their behavior change plan.

2.3. Design of Competitions

The design of energy reduction competitions is critical, especially if the target audience is not motivated to save energy. As noted above, the key to competitions is to engage the potential participants, often at the community level. Thus, the competitions are seen as a framework or organizing principle on which to build a program composed of effective behavior change strategies designed with the audience and desired outcomes in mind. As with conventional energy efficiency programs, there are many issues that affect the design of programs that need to be addressed (e.g., program implementation and evaluation budgets, cost effectiveness, etc.); below, we focus on a few issues that are particularly relevant for competitions.

Technology and Behavior

One of the key design issues that energy reduction competitions face is the amount of attention being paid to changing energy use behaviors versus changing existing energy technologies to more energy-efficient measures in the home and workplace. For competitions that last only a few months, the focus is typically on quickly changing behaviors, although some technological change and change in habits are expected. For longer competitions, there is more time for participants to invest in new energy-efficient equipment (lights, appliances, etc.). Of course,

there is often a mix of behavior and technology change in most competitions. But the implication of this mix occurs later when examining the persistence of actions and energy savings over time: we would expect greater savings with technology change than behavior change, unless there has been a change towards adopting energy-reducing habits.

Size of Competitions

One of the key questions for competitions is whether there is a limit on the absolute number of participants. For example, is there a maximum size for a social network, so that the larger the town, the lower the proportion of participating households? And in the case of college and university campus competitions, are competitions more effective when floors within dorms compete, compared to one dorm versus another? In sum, do competitions become more motivational the finer the scale of competition? These questions will vary by the type of competition being implemented: for example, a first-time competition to test out the different features of the competition, versus a competition that scales up towards a larger program targeting a wider geographic area or simply more households or buildings.

Scaling Up

For most of the competitions, the populations targeted have been small. This makes sense, since the competitions are relatively new, and there is an expectation that they will be scaled up over time. One of the key questions is how might these efforts scale – in particular, which efforts are most likely to be scaled easily and effectively? Since most competitions focus on local organizing and social cohesive groups, it may be difficult to scale up. Alternatively, more prescriptive (versus customized) competitions may be more scalable, but they may not be as effective since participants may not be as personally engaged as programs designed locally. Finally, if these competitions are not scaled up, are there equity issues, as noted below?

Equity

Is there an equity issue with competitions? As with other energy efficiency programs, we know that those who would benefit most from increased efficiency lack the money to invest in better equipment, the time to investigate what might work or even to work through how to make changes, and even suffer from being cognitively overcommitted to dealing with the regular problems that they face to think through or even pay attention to reducing their energy use. For example, consider the single low-income parent who could benefit a lot by lower energy bills, but between managing day care, work, household tasks, trying to get by within budget, etc., this person does not have the money, time or thinking to spare for participating in a competition. Can there be specific competitions that target these hard-to-reach groups, or will these households have to rely on other programs (such as, low income weatherization programs)?

Perverse Incentives

An unexpected consequence of competitions is that a focus on individual or group outcomes may reduce concern with the larger collective good and thus lead to diminished protection of the commons outside the domain of the competition or when the competition ends. There is considerable concern that monetizing what had been collective goods can lead to increased consumption, and this might happen with the use of energy reduction competitions as well (Asenio and Delmas 2015; Dietz 2015).

Another unexpected consequence of competitions is that they may spark conflict and, potentially, aggression, violence and sabotage as a result of intergroup conflict over limited resources (Sherif et al. 1961). While unlikely, we did ask program implementers about this possibility, and nobody encountered these negative aspects of competitions.

Nevertheless, it is important to design the competitions so that all players believe that the competitions are fair so that they will not cheat. In addition, it is important to encourage positive interpersonal peer pressure among participants, as well as to effectively monitor participants' actions (Mani et al. 2013).

3. Study's Data Collection and Analysis Methods

This study uses mixed methods to systematically review and characterize energy reduction competitions that met our criteria for selection. The primary methods include a literature review, selection of case studies, telephone interviews with program implementers and evaluators, development of case studies, and analysis of literature and interviews.

3.1. Literature Review

We reviewed the literature on energy reduction competitions, which we found to be incomplete. Individual programs were primarily documented in the grey literature (program websites, conferences, program evaluation reports, etc.), and only a few papers on these programs were published in the academic literature. A few studies included competitions in meta-analyses of behavior programs (e.g., Abrahamse et al. 2005 and Delmas et al. 2013), and a few recent studies have been published on competition on college and university campuses (Petersen et al. 2015; Brewer et al. 2013; and Johnson et al. 2012) and on gamification (Grossberg et al. 2015). There have been very few experimental treatments of pro-environmental behavior published in the literature (Osbaldiston and Schott 2012). Energy competitions are included in some behavior change programs, for which documentation exists on the design, implementation and evaluation of these programs. And in some cases, program implementers and evaluators provided us previously unpublished documentation of programs including evaluation results, program materials and other relevant information.

3.2. Case Study Selection

Due to study project length and the desire to conduct interviews with implementers and evaluators of projects, we were not able to conduct a comprehensive review of energy-reduction competitions. Therefore, we selected a representative selection of projects with strong potential to answer our research questions and provide best practice guidance. We used the following criteria to select projects: 1) a focus on energy, 2) measured results, 3) strong documentation, and 4) representation from a range of domains (households, businesses, schools, etc.). The research team proposed a list of potential cases to the Steering Committee. Steering Committee members suggested additional cases and rejected a few competitions in favor of others. We reviewed 25 projects, and include 20 in this report (see Appendix A).

Results and recommendations in this report are organized by project type, including: campus energy conservation competitions, inter- and intra-community competitions, inter-community home energy upgrade programs, inter- and intra-organizational competitions, and a national building energy competition. The 20 projects included in this report, organized by project type, are noted below.

Campus Energy Conservation Competitions

1 Campus Conservation Nationals
2 Kukui Cup

Inter-Community Residential Energy Conservation Competitions

3 CoolCalifornia Challenge
4 Energy Smackdown
5 Kansas Take Charge Challenge
6 Minnesota Energy Challenge
7 Western Mass Saves Challenge

Intra-Community Residential Energy Conservation Competitions

8 NYSERDA Competition-Based Pilot for Residential Consumers
9 San Diego Energy Challenge
10 Opower Social

Inter-Community Home Energy Upgrade Competitions

11 NeighborWorks H.E.A.T. Squad Competition
12 Vermont Home Energy Challenge
13 Sustainable Connections' Community Energy Challenge

Inter-Organization Energy Conservation Competitions

14 Boulder's 10 for Change Challenge
15 El Paso's Energy Savings Challenge
16 Chicago's Green Office Challenge
17 NEEA's Kilowatt Crackdown

Intra-Organization Energy Conservation Competitions

18 Cool Choices
19 Kilowatt Cup

National Building Energy Competition

20 EPA's ENERGY STAR National Building Competition

3.3. Interviews

We based the interview questions on a standard program logic model, used in program development. A logic model diagrams the sequences of causes (resources, activities and outputs) that are intended to produce the results (outcomes) sought by the program (Barnes and Jordan 2006). Logic models vary to some degree by discipline and practice, but standard models ask program designers to identify motivations, goals, important characteristics of the target audience, communication channels utilized, the specific strategies that were employed to meet objectives, the resources provided to meet objectives, outputs (e.g., number of

participants or number of audits), and outcomes (short-term [e.g., changes in awareness or knowledge of energy efficiency measures and behaviors], medium-term, and long-term [e.g., amount of energy saved or carbon emissions reduced]). The research team realized that many programs would not have developed a logic model, but hoped program implementers and evaluators would be able to either answer questions in interviews or provide access to appropriate documentation. The final list of interview questions is included in Appendix B.

Prior to conducting interviews, the research team prepared documentation (including a protocol for conducting the interviews) for submission to the University of California's Office of the Protection of Human Subjects (OPHS). The protocol required informed consent from interviewees. The protocol submission documented procedures for obtaining informed consent, recording and transcribing interviews, storing data, and presentation of results. The interview consent form is included in Appendix B. We transcribed the interviews, and we destroyed the audio files per OPHS protocol.

3.4. Case Studies

Case studies of each of the projects are included in Appendix A. The primary purpose of the case studies is to present relevant information from the interviews. Each case study is not meant to be reviewed as a stand-alone document, and the information in each case study varies depending on the availability of information for each project. Some projects are also more completely documented in other locations (e.g., the Tools of Change website[3]), so replication of this information was not generally provided in our report. Each case study was reviewed by program implementers and evaluators during the draft report review process.

3.5. Analysis

This report does not include any detailed statistical analysis of project results. The primary data are presented (in Tables 1-3 and Figures 1-2) as reported by each program implementer/evaluator or program report. It was not possible to do a meta-analysis[4] showing average project effects, due to different methods used by each project to demonstrate results (e.g., comparison to benchmark data, modeled results, pledged reductions, etc.). We do, however, present a range of reported results for projects, combined with qualitative information from interviews and reports to assess the success of each project and to gain insight on the effectiveness of different strategies used. We asked interviewees to provide professional opinions on the relative success of different intervention strategies and key lessons learned. We then provide qualitative analyses comparing the results from each project in order to draw broadly applicable lessons for future program developers.

[3] http://www.toolsofchange.com/en/home/

[4] A meta-analysis typically involves three major steps (Cooper 2010): (1) conduct an extensive literature search to find all of the relevant studies that meet the specified inclusion criteria; (2) evaluate and code the studies for types of treatment and calculate effect sizes; and (3) statistically analyze the coded features.

4. Results

4.1. Overall Results

This section presents an overview of our analysis of (1) program characteristics, (2) energy, CO_2 and financial savings achieved, (3) measurement & evaluation and persistence, (4) communication channels used, and (5) behavior strategies used by competition programs. The details of these programs are contained in the case studies in Appendix A.

Program Characteristics

As seen in Table 1, the competition programs that are reviewed in this study are relatively new (75% occurring since 2010), have variable program durations (ranging from a few weeks to several years), as well as a wide range of participants (ranging from 6 cities in the Kansas Take Charge Challenge and 12 libraries in El Paso's Energy Savings Challenge to 300,000 students and staff in the Campus Conservation Nationals and 5,800 buildings in EPA's ENERGY STAR Building Competition).

Table 1. Competition Program Characteristics

Program	Geographic Location	Timeline	Length of program	Participation
Campus Energy Conservation Competitions				
1: Campus Conservation Nationals	National	2010 - present	3 weeks / yr	Y1: 105,000 students Y2: 197,000 students Y3: 300,000 students & staff Y4: 265,000 students & staff
2: Kukui Cup	University of Hawaii	2012 - present	Y1: 1 year Y2: 6 mo Y3: 2 weeks	1/3 of dorm residents (~350 students)
Inter-Community Residential Energy Conservation Competitions				
3: The CoolCalifornia Challenge	California	2013 - present	Y1: 13 mo Y2: 6 mo	Y1: 2,667 households Y2: 3,850 households
4: Energy Smackdown	Massachusetts	2007 - 2010	Varied per year	Y2: 100 households
5: Kansas Take Charge Challenge	Kansas	2009 - 2012	Y1: 1 year Y2: 9 mo Y4: 6 mo	Y1: 6 cities Y2: 16 cities and >100,000 households
6: Minnesota Energy Challenge	Minnesota	2006 - present	Ongoing	30,693 participants to date
7: Western Mass. Saves Challenge	Western Massachusetts	2011	8 mo	2,000 households

Intra-Community Residential Energy Conservation Competitions				
8: NYSERDA Residential Energy Competition	Brooklyn, NY	2010	1 year	159 households
9: San Diego Energy Challenge	San Diego, CA	2012 - 2013	Y1: 9 mo	5,634 households
10: Opower Social - Facebook App	National	2012 - 2015	Ongoing	Tens of thousands
Inter-Community Home Energy Upgrade Competitions				
11: NeighborWorks Competition	Rutland County, VT	2010 - present	1 year/yr	350 retrofits
12: Vermont Home Energy Challenge	Vermont	2013	1 year	Not clear any participated because of new efforts
13: Sustainable Connections' Community Energy Challenge	Northwest Washington	2010 - present	1 year/yr	2,454 assessments
Inter-Organization Energy Conservation Competitions				
14: Boulder's 10 for Change Challenge	Boulder, CO	2009 - 2011	1 year/yr	Over 100 businesses
15: El Paso's Energy Savings Challenge	El Paso, TX	2012 - 2013	6 mo/yr	Y1: 12 libraries Y2: 34 fire stations
16: Chicago's Green Office Challenge	Chicago, IL	2013 - present	9 mo/yr	150 businesses
17: NEEA's Kilowatt Crackdown	Pacific Northwest	2007 - 2013	1 year/yr	300 offices
Intra-Organization Energy Conservation Competitions				
18: Cool Choices	Wisconsin	2010 - present	8 weeks/yr	14 entities (corporations, public agencies, faith communities) - over 4,000 players
19: Kilowatt Cup	Portland, OR	2012 - 2014	Y1: 2 weeks Y2: 1 month Y3: 1 month	One company
National Building Energy Competition				
20: EPA's ENERGY STAR Building Competition	National	2010 - present	I year/yr	2014: 5,800 buildings

Energy, CO_2 and Financial Savings

As seen in Table 2, **energy savings** have not been measured in all of the programs, but where they have, savings have been mainly from electricity. In general, electricity savings from these programs have been around 5% or less, a strong result for behavior-based strategies. Some programs, however, have realized substantially higher savings (e.g., up to 25% in the Kukui Cup, and 21% in the Community Energy Challenge). In the first year of the CoolCalifornia Challenge, 14% electricity savings were achieved over five months of the year-long program for roughly 1,000 most active participants entering energy data. The Sustainable Connections' Community Energy Challenge has achieved 21% average savings in each year of its competition. And in the Campus Conservation Nationals, the top 10% of participating buildings achieve over 30% savings. So, there is a potential for deep energy savings to occur, but most savings for most of the competitions were below 10%.

For a few programs, **CO_2 savings** have been estimated, and some results have been substantial. For example, as the Campus Conservation Nationals has grown over time, CO_2 savings have also grown impressively: to over 3 million pounds by its fourth year. The Sustainable Connections' Community Energy Challenge has achieved almost 13 million pounds of CO_2 savings per year. And NEEA's Kilowatt Crackdown has resulted in 50 million pounds of CO_2 savings since 2007.

For a few programs, **financial savings** have been estimated, ranging from a few thousand dollars to millions of dollars. For example, EPA's ENERGY STAR Building Competition believes that it has saved $70 million in the last two years of its national program, the Kansas Take Charge Challenge saved over $2 million, and Cool Choices saved about $430,000.

Table 2. Energy, CO_2 and Financial Savings From Competition Programs

Program	Electricity Savings	Natural Gas or Heating Oil Savings	CO_2 Savings	Financial Savings*
Campus Energy Conservation Competitions				
1: Campus Conservation Nationals	Y1: 4% * 3 weeks (0.23%/yr) 510,000 kWh Y2: 3.1% * 3 weeks (0.17%./yr) 1,021,000 kWh Top 10% of dorms achieved 28% and 33% saving in electricity and water respectively in 2010 and in 2012 Y3: 2.1 million kWh (3 week competition) Y4: 4.5% (3 week competition), with the top 10% of schools achieving campus-wide reductions of 11.3% or		Y1: 816,000 lbs Y2: 1,622,000 lbs Y3: 2.4 million lbs Y4: 3 million lbs	Y1: $50,000 Y2: $100,000 Y3: $158,000 Y4: $198,000

	greater. 2.2 million kWh			
2: Kukui Cup	~8% * 2 weeks 2300 kWh; Short-term reductions of up to 20-25%			
Inter-Community Residential Energy Conservation Competitions				
3: The CoolCalifornia Challenge	Y1: 14% * 5 mo		Y1: 500,000 lbs / 12 months	
4: Energy Smackdown	Y2: 14%	Y2: heating oil: 17%	Y2: 300,000 lbs	
5: Kansas Take Charge Challenge	Y2: 7M kWh. Top city reduced 5%		Y2: 22 million lbs	Y2: $2,341,025
6: Minnesota Energy Challenge	Unknown		247,832,782 lbs/yr in pledged reductions	$13,280,000/yr in pledged reductions
7: Western Mass. Saves Challenge	Top community reduced 2.3%			
Intra-Community Residential Energy Conservation Competitions				
8: NYSERDA Residential Energy Competition	4%			
9: San Diego Energy Challenge	6% summer, 2% winter = 1,059,000 kWh		1,059,000 kWh * 0.8 lbs/kWh (ARB) = 847,353 lbs / 9 mo	
10: Opower Social - Facebook App	Unknown			
Inter-Community Home Energy Upgrade Competitions				
11: NeighborWorks Competition	Unknown	360 gallons / yr	5,300 lbs/yr * 350 homes = 1,855,000 lbs/yr	$914/yr * 350 homes = $319,900/yr
12: Vermont Home Energy Challenge	Unknown		Unknown	Unknown
13: Sustainable Connections Community Energy Challenge	21% average savings (6,723,511 kWh saved to date)		12,859,560 lbs / yr	$472 average annual savings $591,426 in annual savings for all projects (residential and commercial)
Inter-Organization Energy Conservation Competitions				
14: Boulder's 10 for Change	Y2: 4% Y3: 8%		Unknown	Unknown

Challenge				
15: El Paso's Energy Savings Challenge	Y1: 262,000 kWh Y2: 100,000 kWh		Y1: 216,000 lbs Y2: 82,500 lbs	Y1: $21,000 Y2: $8,000
16: Chicago's Green Office Challenge	Not possible to measure savings for all buildings		Unknown	Unknown
17: NEEA's Kilowatt Crackdown	70 MWh saved to date (3-7%)		59 million lbs	
Intra-Organization Energy Conservation Competitions				
18: Cool Choices	400 kWh per active players 4-6% verified	1%	4.4 million lbs	$430,000
19: Kilowatt Cup	Y1: 719 kWh (14% of plugs) Y2: 3,100 kWh (20% of plugs and lights) Y3: 1,500 kWh (9% of plugs and lights)			
National Building Energy Competition				
20: EPA's ENERGY STAR Building Competition	4.3 billion kBtu (2010-2013) Y1: 14 competitors saved 44 million kBtu Y2: 245 competitors saved 240 million kBtus - winner was a parking garage (63%) Y3: 3,000+ competitors saved 3 billion kBtus (89 buildings reduced their energy use by 20% or more; winner was a school - 52%) Y4: 3,000+ competitors saved 1 billion kBtus (more than 50 buildings reduced their energy use by 20% or more; winner was a school - 46%)			

*Financial savings refers to any monetary savings that were reported in the program and do not necessarily refer to the avoided retail cost of energy.

Measurement & Evaluation and Persistence

It is important to note that the **measurement and evaluation** of these programs varied substantially. None of the programs used a Randomized Control Trial (RCT) where subjects are randomly assigned to treatment and control groups (Vine et al. 2014). As seen in Table 3, only a few programs conducted a quasi-experimental study, comparing energy impacts for participants and non-participants (CoolCalifornia Challenge and San Diego Energy Challenge). The majority of the programs that conducted evaluations simply compared energy use during the treatment period with energy use in a prior (pre-treatment) period (either monthly or annual energy use) – with no comparison group analysis. Sometimes, the estimated savings were weather normalized (e.g., Energy Smackdown and Community Energy Challenge), but often the savings were not weather normalized. Finally, several programs relied on energy models to calculate the savings, while others did not conduct any energy evaluations.

As noted earlier, one of the key research questions that we wanted to address was the amount of time that energy savings persisted. Unfortunately, many of these competitions were of short duration (weeks or months), and none of the programs conducted a formal evaluation of **persistence**. We were only able to find some anecdotal information: the Campus Conservation Nationals program noted that savings were sustained 2-3 weeks after competition, and the Energy Smackdown program noted that participants reported doing the same behaviors six months or later (but not measured).

Table 3. Measurement & Evaluation and Persistence

Program	Measurement and Evaluation	Persistence
Campus Energy Conservation Competitions		
1: Campus Conservation Nationals	Compared energy use to baseline period immediately prior to competition and reported energy savings as a percentage reduction from baseline	Savings were sustained 2-3 weeks after competition.
2: Kukui Cup	Compared energy use to previous year	Not measured
Inter-Community Residential Energy Conservation Competitions		
3: The CoolCalifornia Challenge	Compared energy to a delayed control group	Not measured
4: Energy Smackdown	Compared monthly energy use to one year before and weather normalized. Reported energy savings as a percentage reduction from past year.	Participants reported doing the same behaviors 6 months later, but this was not measured.
5: Kansas Take Charge Challenge	Metered data were collected, both pre- and post-installation, along with weather normalization.	Not measured
6: Minnesota Energy Challenge	Not measured or evaluated. Uses pledges and carbon calculator to estimate CO_2 savings.	Not measured
7: Western Mass. Saves Challenge	Compared energy use to previous year	Not measured
Intra-Community Residential Energy Conservation Competitions		
8: NYSERDA Residential Energy Competition	Compared energy use to previous year	Not measured
9: San Diego Energy Challenge	Compared energy use to previous year and used a comparison group	Not measured
10: Opower Social - Facebook App	Not measured or evaluated	Not measured
Inter-Community Home Energy Upgrade Competitions		
11: NeighborWorks Competition	Modeling using auditor's software	Not measured
12: Vermont Home Energy Challenge	None	Not measured

13: Sustainable Connections' Community Energy Challenge	Compared energy use to previous year with weather normalization	Not measured
Inter-Organization Energy Conservation Competitions		
14: Boulder's 10 for Change Challenge	Compared energy use to previous year	Not measured
15: El Paso's Energy Savings Challenge	Compared monthly energy use to month in previous year	Not measured
16: Chicago's Green Office Challenge	Compared energy use to previous year	Not measured
17: NEEA's Kilowatt Crackdown	Compared energy use to previous year	Not measured
Intra-Organization Energy Conservation Competitions		
18: Cool Choices	Calculated savings on average based on reported actions	Not measured
19: Kilowatt Cup	Compared actual energy use to modeled energy use of previous year	Not measured
National Building Energy Competition		
20: EPA's ENERGY STAR Building Competition	Compared actual energy use to modeled energy use of previous year	Not measured

Communication Channels

The competition programs used different channels to communicate with participants. In Figure 1, the color green indicates that the communication channel was an important and frequent form of communication, while yellow indicates infrequent use and grey indicates the communication channel was not used. All programs had websites, which were a central, or even primary means of communicating with participants. Almost all programs also used some form of e-mail communication with participants, in-person communication strategies, informational flyers or poster, events, newsletters and social media. While communication channels are instrumental in the competitions, the behavior change strategies appeared to be more critical in ensuring successful outcomes, as shown in Figure 2.

Program	Website	Emails	In-person	Flyers / Posters	Events	News-letters	Social media	Phone	Television program	Phone hotline	Energy Advisor	Mail	Building dash-board	Lawn signs
Campus Energy Conservation Competition														
1: Campus Conservation Nationals														
2: Kukui Cup														
Inter-Community Residential Energy														
3: The CoolCalifornia Challenge														
4: Energy Smackdown														
5: Kansas Take Charge Challenge														
6: Minnesota Energy Challenge														
7: Western Mass. Saves Challenge														
Intra-Community Residential Energy														
8: NYSERDA Residential Energy Competition														
9: San Diego Energy Challenge														
10: Opower Social - Facebook App														
Inter-Community Home Energy Upgrade														
11: NeighborWorks Competition														
12: Vermont Home Energy Challenge														
13: Community Energy Challenge														
Inter-Organization Energy Conservation Competition														
14: 10 for Change Challenge														
15: Energy Savings Challenge														
16: Green Office Challenge														
17: Kilowatt Crackdown														
Intra-Organization Energy Conservation Competition														
18: Cool Choices														
19: Kilowatt Cup														
National Building Energy Competition														
20: EPA's ENERGY STAR Building Competition														

Figure 1. Communication Channels by Program

Behavior Change Strategies

Program implementers were asked if their program used common behavior change strategies (see Section 2.2), including those listed in Figure 2 below, and if so, how they were used (see Appendix B for definitions used in the survey). Green indicates that the strategy was fully developed and an important part of the program; yellow indicates that either the strategy was not fully developed or was not an important program strategy, while grey indicates the strategy was not used. On average, programs used 12 of the 20 strategies (median was 13 and mode was 12).

The most common strategies were local messengers, comparative feedback, social diffusion, competition, imagery, financial incentives and rewards, descriptive norms, commitments and goal setting. Interestingly, competition was not central to all programs, and one program (Community Energy Challenge) ultimately decided not to incorporate competition as a program strategy. This highlights that what are labelled "competitions" are very diverse, community-based behavior change programs that utilize a range of behavior change tools to encourage adoption of low energy consumption. We provide some examples of behavior change strategies below, and in Section 5 (Lessons Learned), we return to our assessment of the behavior change strategies.

Local messengers – In the Campus Conservation Nationals and Kukui Cup, the local messengers were Research Assistants who were instrumental in implementing these programs. Local messengers were also the most important strategy for the Kansas Take Charge Challenge, and neighborhood groups played a very important role in NYSERDA's Competition-Based Pilot for Residential Consumers. In the NeighborWorks H.E.A.T. Squad Competition, local volunteers were critical, as noted by the program manager: *"… in one town, the five volunteers called every person in town, because between them, they knew everyone. …And where there were good champions, there were good results.*" As a final example, the Vermont Home Energy Challenge relied on local community groups as the local messengers who initiated messaging about their program.

Comparative feedback – In the Campus Conservation Nationals, instantaneous feedback occurred through a software platform with real time data on a building dashboard. In the CoolCalifornia Challenge, comparisons of households, teams and cities were published on an online scoreboard and in weekly emails.

Social diffusion – In the Campus Conservation Nationals and Kukui Cup, social diffusion happened locally through dorms and on Facebook, while in the CoolCalifornia Challenge and the Kansas Take Charge Challenge, social diffusion occurred through schools, churches, community groups and offices. In Opower Social, using Facebook was a key strategy. The Vermont Home Energy Challenge relied on town energy committees (groups of volunteers) to spread the word about their program, as noted by the program manager: "*Social diffusion was the pillar of the program … customers are your sales force*." Finally, the 10 for Change Challenge relied on

business associations, while in Cool Choices, teams that were formed for the competition spread the word about the competition.

Imagery – Many competitions used simple graphics on their website, emails, and newsletters. In the Kukui Cup, there was a graphic design for T-shirts, website and other communications, and in the Energy Smackdown, television showed not only images, but also stories in a very compelling way. Many competitions used graphs of energy use over the year, as well as photos of people, energy efficiency measures, prizes, etc. And in Opower Social, imagery was key via the use of website characters (e.g., smiley face) and badges conveying different achievements of energy savings that could be shared in Facebook.

Rewards – In the Campus Conservation Nationals, rewards varied by campus (e.g., pizza and ice cream parties, as well as trophies and plaques), and in the CoolCalifornia Challenge, awards and prize money were given to cities and some cities optionally gave away raffle prizes.

Prompts – In the CoolCalifornia Challenge, weekly reminders were sent to cities to enter data, and in the Kansas Take Charge Challenge, participants received weekly tasks and tip lists. In the San Diego Energy Challenge, alerts were sent to participants on "reduce your energy" days, and in the NeighborWorks H.E.A.T. Squad Competition, postcards were sent as prompts. The Community Energy Challenge relied on home energy reports and newsletters to homeowners as prompts, and the Energy Savings Challenge in El Paso posted energy reduction plans to walls in stations and libraries as a reminder. Finally, Cool Choices sent daily emails to participants on new actions available that day.

Commitment – In the Campus Conservation Nationals, individual participants could choose to make commitments on the online software, and the commitments were posted to the committing individual's Facebook profile. In the Kansas Take Charge Challenge, people pledged to switch five bulbs and then posted this information in the library, and in the Western Mass Saves Challenge, individuals created plans to reduce electricity, and the plans were posted on an online portal.

Goal Setting – In the CoolCalifornia Challenge, there was a carbon savings goal set for the entire program. In the Kansas Take Charge Challenge, businesses had a partipation goal. And in the NeighborWorks H.E.A.T. Squad Competition, the program had a goal of 15% energy reduction per home. The Vermont Home Energy Challenge set a goal of 3% of homes retrofitted in each community, and each building in the Kilowatt Crackdown had an energy reduction goal.

Scarcity – In the Kukui Cup, participants had a 24-hour time limit to complete certain tasks, and in the Energy Smackdown, there was limited time to get tasks done. In the Western Mass Saves Challenge, the rewards program was only available to the first 5,000 customers, and in the Vermont Home Energy Challenge, there was a limited time offer for discounted audits.

Reciprocity – In some competitions, reciprocity was not explicit, but assistance was offered free of charge for those attempting to save energy. In the Kukui Cup, some students wanted to

please Research Assistants. And in the Kilowatt Cup, some team captains gave their teams treats, and donations to charities on behalf of the company would occur only if the game's goal was met.

Gamification – In Opower Social, badges were earned for monthly reductions and cumulative savings, group competitions were held, challenges were sponsored by groups, and comparisons were reported and easily seen on leaderboards. In the Green Office Challenge in Chicago, participants earned points for taking specific activities affecting energy use, and in Cool Choices, players earned points for completing actions at home and at work.

Loss Aversion – In many competitions, loss aversion was framed in terms of what participants would gain (in terms of the amount of energy saved) or money lost by not acting. In the Kansas Take Charge Challenge, a basketball was presented at some events to show how much energy was being wasted. In the San Diego Energy Challenge, participants would lose points for saving energy if they did not use them. And the Kilowatt Crackdown emphasized opportunity loss and the cost of not staying competitive to building owners, managers and operators of office buildings: money would be lost due to higher operating costs, or loss of tenants.

Energy Coach/Advisor – In the Energy Smackdown, energy coaches played a critical role in communicating the program, and in the NeighborWorks H.E.A.T. Squad Competition, after an audit was performed, an impartial advisor offered advice to homeowners. The Energy Savings Challenge in El Paso relied on the City's Sustainability Office staff to act as an energy coach. And in the Kilowatt Crackdown, each participating building received an energy coach and a technical advisor. The coach acted as a guide throughout the competition, assisting the participating building with data gathering, benchmarking, coordination, and the development of an action plan.

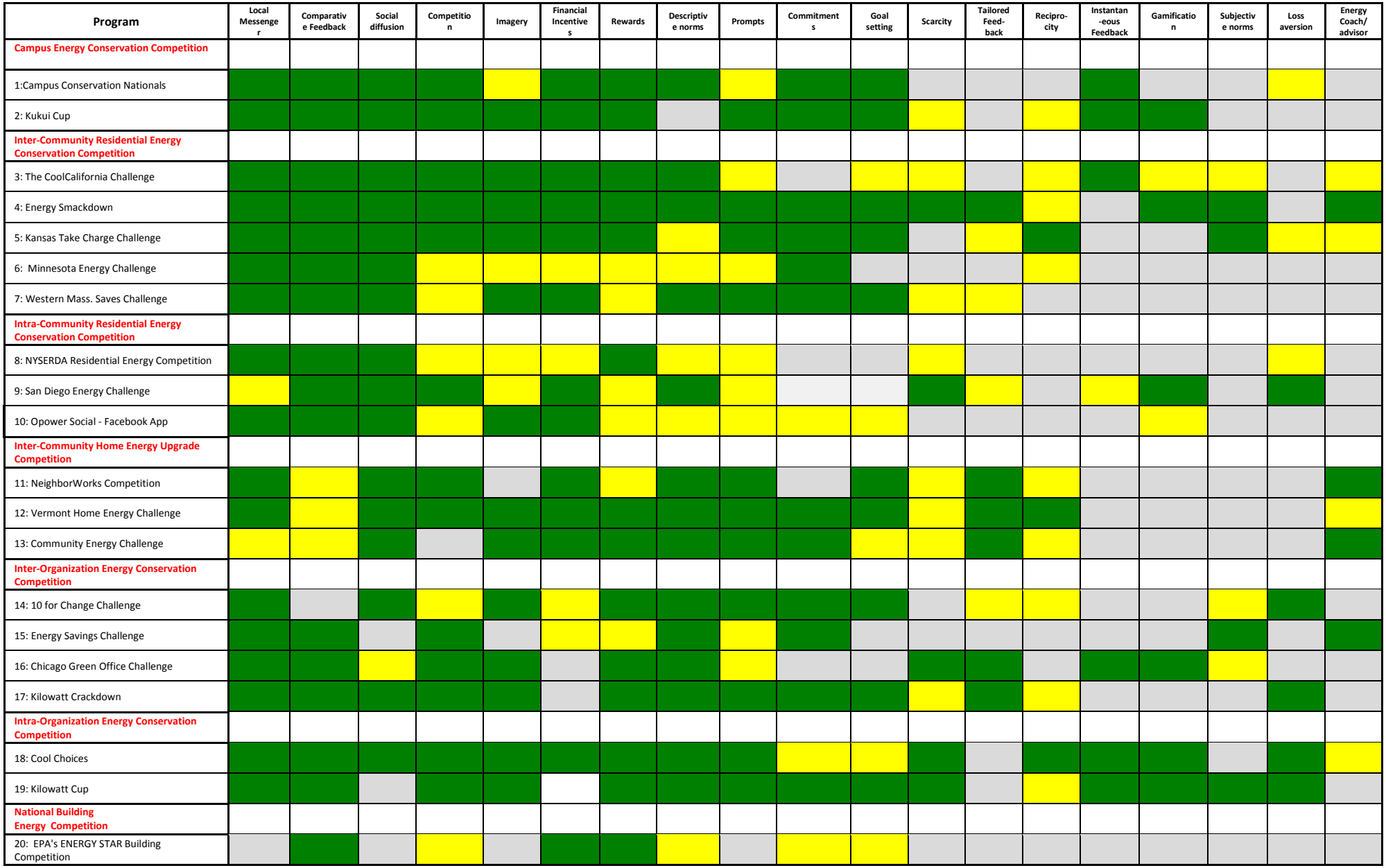

Figure 2. Behavior Change Strategies Used by Programs

4.2. Results by Program Type

4.2.1. Campus Energy Conservation Competitions

To date, the majority of energy conservation competitions have taken place on college and university campuses. The campus environment offers a unique opportunity for competition: typically, the residents are young, relatively homogeneous, and likely to be interested in the competition and related behavior interventions – and most importantly, when a school or dormitory decides to participate in a competition, everyone participates (unless they decide to opt out). Energy awareness, and energy conservation in the long term, is a primary objective of these competitions. College students are at a formative age. Hence, the energy reductions during brief competition periods may be dwarfed by longer-term impacts, such as the long-term impact on normative behavior, lifestyles, careers and culture. Therefore, making them aware during these competitions may have long-term impacts in reducing energy use (Attari et al. 2010; Dietz 2014). The popularity of competitions as a means of engaging students on sustainability and the ability to unite universities in a common basic program design speaks to the inherent scalability of competitions.

Campus Conservation Nationals (CCN) annually engages over 200,000 students on more than 100 U.S. college and university campuses in 3-week competitions, saving an estimated 2 million kWh of electricity and 500,000 gallons of water since 2010.[5] The participating colleges and universities come from all over the U.S. Through the first two years (2010 and 2012), CCN focused on residence halls; starting in 2013, CCN has encouraged campuses to include non-residential halls – but the vast majority of competitions has been among residence halls. This is an opt-out program: students don't choose to participate, since the choice to participate in the competition is decided at the institutional level.

CCN is an excellent example of the power of competitions to scale up electricity reductions with minimal investment. The current national program is almost entirely web-based, providing the rules, training materials, online software tools (Lucid's BuildingOS, Building Dashboard, and Building Blocks) to track electricity use data and share competition results, and recognition to winning schools. The technology company Lucid hosts the content and works with fellow program partners U.S. Green Building Council, National Wildlife Federation and the Alliance to Save Energy to market the program and provide support to competition organizers at participating schools. This partnership allows each organization to benefit from involvement with the program while providing support. Oberlin College was involved in the initial design of the program and has also conducted evaluations of this competition (Petersen et al. 2015).

[5] See: http://www.competetoreduce.org/

Each school designs and runs its own internal competition between buildings on campus. Optionally, each school also competes against other schools with whom they have agreed to form a "group competition." In CCN 2014, 50 schools (46% of the schools that participated in CCN 2014) participated in 13 different school versus school competitions. Full electricity use data are either manually entered or automatically uploaded to BuildingOS, Lucid's online operating system for buildings, which calculates and displays savings and competition standings. This framework allows CCN to scale to a large number of campuses with minimal investment; however, the program also has little influence over the success of individual campus competitions. While the program provides excellent training materials, success largely depends on the ability of local programs to implement best practices and run successful behavior change campaigns. CCN offers advice to campuses on how to approach fundraising, but each campus is responsible for securing funds to host their events. Many schools have had success running their competitions on very small (less than $500) budgets. Some campuses receive small stipends for college student interns to run the programs locally. As an example, the Pacific Gas & Electric Company supports the Alliance to Save Energy's PowerSave Campus program, which funds paid student interns at 16 university campuses in California to generate energy savings (among other objectives). In general, most programs do not have trained staff to run programs.

One of the keys to participation is the initial buy-in from campus officials. Once a campus has decided to run a competition, the individuals living or working in participating buildings have little choice but to participate in the program since their building will be evaluated with or without their participation. Average savings in these programs are estimated at 3-4% in electricity consumption in participating buildings over the three-week competition period, while the top 10% achieve over 30% savings.

The goals of CCN are fourfold: (1) engage, (2) educate, (3) motivate and (4) empower students to make environmentally sustainable choices. Students are engaged if they sign up and participate in saving energy. The educational activities vary widely from campus to campus and have not been studied in detail. Standardized educational materials and tools are not provided by CCN. In the evaluation of the CCN, students reported high levels of motivation (80%) to reduce their energy consumption during the competition period; however, students reported being significantly less empowered to reduce energy (57%). According to the program evaluator, in order to be truly successful, programs should increase the educational aspects and self-efficacy, or the belief in the participants' ability to make a meaningful contribution to environmental sustainability.

Recognizing that education and increased student energy awareness are the real benefits of campus energy competitions, the **Kukui Cup** at the University of Hawaii emerged with the intention to provide substantial learning opportunities for students. In their competition (separate from CCN), students earn points for learning and participating in an online game, not just for energy reductions. Students earn points for watching online videos, taking quizzes, taking pledges and doing small activities. The software is complemented by events, field trips and other activities that motivate students, and enhance their education and enjoyment of the program. Thus, while there is competition among floors, and short-term reductions of electricity

(estimated at 8%), the main impact is the educational benefits and motivating them to pursue a sustainable lifestyle and career. This approach is very consistent with the lessons from the CCN, that education and self-efficacy (presented to students as “empowered” to change their behavior) will lead to more lasting savings at this critical stage of development for young adults.

4.2.2. Inter-Community Residential Energy Conservation Competitions

Recent years have seen the emergence of inter-city energy reduction competitions, often sponsored by statewide agencies, utilities or non-profit organizations. Programs are typically between a few cities but also may include statewide programs with a large number of participating communities. Community-based competitions typically rely on local messengers and social diffusion to get the message out and to motivate participants to engage in programs. Community residents work together to compete against other communities, emphasizing in-group collaboration and out-group competition. These types of programs often include rankings and/or direct competition between individuals or groups of individuals within communities. Experts tend to agree that the most effective competition is among people who know each other, combined with recognition at larger scales (e.g., city or state).

There is some evidence that medium-sized cities achieve more savings than very large or small cities. For example, medium-sized cities, such as Davis, Chula Vista and Tracy in California, enrolled more participants and outperformed the large cities of Sacramento and San Jose in the CoolCalifornia Challenge, and medium-sized cities also outperformed small cities in the Kansas Take Charge Challenge. Small communities tend to have stronger identity and place-based attachment by residents. Participants in small and medium-sized cities are likely to hear about programs multiple times through multiple communication channels compared to large cities where messages are more diffuse. Even though small communities tend to have stronger identity and place-based attachment, this may not influence involvement in energy competitions and, at the same time, very small cities typically do not have staff dedicated to sustainability efforts. The success of medium-sized cities may be related to their retaining strong place-based identity while having sufficient city staff and strong community-based organizations to implement local programs. However, the size of cities appears to be much less important in securing enrollments than having sufficient resources to run programs at local levels.

The **CoolCalifornia Challenge** is a California-based inter-city competition that engages residents to track and reduce GHG emissions in household energy and transportation. The program engaged 2,700 participants in 8 cities in 2013, saving an estimated 14% in electricity consumption over the five months measured using a delayed control group[6] for the 1,000 most active participants. During the second year, when 10 cities competed for $100,000 in prize money, the program saved 60% more CO_2 in half the time (6 months versus 12 months) and budget ($200,000 versus $400,000). Local engaged program managers and volunteers are critical to running successful community-based programs. The California Air Resources Board awards the city with the most points the “Coolest California City,” with the two runners up each named “Cool California City.”

The **Energy Smackdown** was an inter-city household-based competition – this time, among three cities in Massachusetts to reduce environmental footprints from household energy, travel, waste, and meat consumption. Showcasing their actions through a reality show, households

[6] Households that sign up at a later date become a rolling control group for households that sign up earlier.

were able to achieve significant savings – for example, the winning household reduced its electricity use by 73% and its heating use by 66%; and second and third place winners also reduced their energy use – 37% and 28% electricity reductions and 51% and 44% heating use reductions, respectively. The Program Director noted that the behavior strategies chosen are less important than designing the motivational strategies extremely well to motivate people with busy lives: "*If you are going to do a program like this, you should remember that people are busy. I like to think of the ideal program as something like an iPhone for its ease of use. It takes a whole lot of thinking and creativity to come up with a program that is fun and easy to use. If you put that type of thought and creativity into developing your program, then people who are mostly thinking about their kids and all their daily concerns can get engaged because it is easy and even a little fun."*

The **Kansas Take Charge Challenge** involved 6 cities in the pilot year and expanded to 16 different cities in four regions during the second year, saving an estimated $2 million in energy costs. In the third year, the program focused on businesses instead of households and, as noted by the program implementer, was less successful in building natural rivalries with competitive spirit. Local messengers – such as schools and churches – played a critical role in building a sense of community, and in the second year of the program, the top city was able to reduce its energy usage by 5%. Some key lessons include: (1) use positive messaging about the benefits of energy efficiency, (2) build relationships with influential champions within communities and across the state, (3) get buy-in from cities during the design phase and work with them to build the community and help communities set goals, and (4) select the cities based on natural rivalries. They also found that a more prescriptive program could be more scalable, but that participants will not be as personally engaged as programs designed locally.

The **Minnesota Energy Challenge** primarily relied on a website where Minnesota residents could learn how to stay comfortable and save money in their homes. Members could also join teams for their city, business, congregation, school, neighborhood and other community organizations and use the Energy Challenge to track their group savings. This was not intended to be a competition, but groups competed against each other, and it was mainly seen as an educational tool. According to the program implementer, the in-person follow through is key: "*Originally, we thought we would build this site, and it would be a great resource and people would use it, and what we learned very quickly is that it was a great website and a great resource and people wanted you to come and tell them how to use it."* The website is a very low investment strategy to generate interest and personal contact, thus an opportunity for education and further engagement. However, it is difficult to evaluate the effectiveness of a website that allows groups to enter results and compete against themselves.

The **Western Mass Saves Challenge** was a community competition among four small towns to reduce electricity use. The program offered participants access to an online portal with personalized energy-saving advice and rewards for reducing energy, as well as home energy reports to selected households. While none of the towns reached the goal of a 3% reduction, they all had demonstrated electricity savings. The "winner" achieved a 2.3% reduction and received a 1 kW photovoltaic system. Similar to some of the other programs, most of the people

who earned rewards did not claim them. A critical lesson for inter-city challenge is that basing competition on overall percentage reduction gives an unfair advantage to smaller communities: the winning town had 1/10 the population of the largest town.

4.2.3. Intra-Community Residential Energy Conservation Competitions

Intra-community competitions refer to those competitions that occur within a community – typically, households competing among one another – in contrast to one community competing against another community. These programs were difficult to implement and evaluate, and they were very resource intensive. Inter-city competitions that combined intra-city competition appeared to be more effective at motivating residents. It also appears that an opt-out program may be more effective than an opt-in program from a resource management perspective (as demonstrated in the San Diego Energy Challenge and Opower Social).

NYSERDA's Competition-Based Pilot for Residential Customers was a small pilot among households in three socially engaged neighborhoods in Brooklyn – but in this case, households were not competing with each other but were chosen to see how much energy they could save as a group with the help of the local utility, community groups and organizations. The program implementer stressed that local messaging and prompts were important for local engagement, yet this focus on local organizing and social cohesion makes it more difficult to scale up programs.

The **San Diego Energy Challenge** targeted utility customers within the same service territory, and in the first year, the Challenge focused on households who were required to join with a middle school to compete for a prize for their school (in the second year, households competed against each other). The first year program was an opt-in schools program, while the second year was an opt-out information strategy program. The program did achieve 6% electricity savings in the summer in the first year, but the program designers felt it was too resource-intensive to engage all the schools. The utility switched to an opt-out strategy in the second phase of the project, with all utility customers receiving information and, as an option, the ability to opt-in to a website that offered tailored information and rewards.[7]

The **Opower Social** used a social network (Facebook) to engage people, especially having them "compete" among their "friends." This was not strictly a competition, but more like a peer comparison. While appealing conceptually, they were unable to achieve participation levels that were self-sustaining (i.e., an average of over one referral for one new participant), even with very aggressive national media attention and the efforts of large utilities, Opower and Facebook.

[7] The savings are not known in the second phase of the project.

4.2.4. Inter-Community Home Energy Upgrade Competitions

In these programs, communities focused on improving the energy efficiency of the existing building stock. Utilities often seek to achieve lasting energy savings through whole home upgrades, but uptake in programs is typically slow due to high upfront costs, poor financial returns on investment and very burdensome transaction costs (e.g., time, hassle, and complexity). The programs reviewed in this section have attempted to increase program uptake through community-based social marketing (CBSM) strategies, including competition. CBSM strategies are useful to market such programs, but, ultimately, as noted by the interviewees, success depends on the availability of highly trained, trusted energy advisors, simplification of the process for homeowners and clear communication of non-energy benefits (e.g., comfort) to homeowners.

The **NeighborWorks H.E.A.T. Squad program** was launched in 2010 with $4.5 million of American Recovery and Reinvestment Act (ARRA) funding and a goal of upgrading 1,000 homes in Rutland County, Vermont.[8] About 50% of Vermont housing stock was built before World War II, with drafty envelopes in a cold climate. Whole home upgrades are typically complicated, expensive and difficult. Thus, primary goals of the program were to make energy upgrades simple, understandable and affordable. The program accomplishes these goals by lowering the cost of energy audits and providing a "one-stop-shop" of information, guidance and financing. The NeighborWorks team "holds the hands" of homeowners through the entire process, providing impartial advice and facilitating all steps of the process. A competition component allocated $25,000 in prize money to the top three communities (out of 27) with the highest percentage of homes completing upgrades (Home Performance with Energy Star) and highest average energy savings. In addition, for each completed upgrade, the town received $50 during the competition. When a similar program was expanded throughout the state by another organization (Efficiency Vermont), there was no additional uptake in audit completions. The deep level of customer service in the NeighborWorks program appears to have made the difference.

The **Vermont Home Energy Challenge** was a competition among 79 small Vermont towns and communities to raise awareness of energy efficiency and increase the completion of upgrades (Home Performance with Energy Star). In this competition, the community in each of six districts with the highest percentage of homes with upgrades was declared the winner and was awarded a $10,000 monetary prize. Social diffusion (customers telling other customers about the program) and face-to-face interaction were the most effective strategies. The program offered "turnkey solutions" including home energy visits, door-to-door outreach, home energy savings workshops, home energy parties, phone-a-thons, energy saving kits, events and contractor partnerships. Despite sizable investment in the program, it did not increase the number of audits that would have been expected without the program. This may have been due to the lack of a local trusted advisor who could have helped to assist the customer. The time between initial contact with homeowners and completion of projects was also typically many

[8] For more information, see: http://heatsquad.org/

months and was not conducive to short-term competition. The chance of winning a $10,000 community prize did not appear to have been particularly motivating.

Sustainable Connections' Community Energy Challenge focused their efforts on providing comprehensive customer support including outreach, low cost energy assessments, a third party energy advisor, vetting of contractors, quality assurance, and access to incentives and financing. Providing information on a customized basis and through a one-stop shop were keys in converting audits to actual upgrades (57% conversion rate in homes and 28% conversion rate in businesses). While the program designers originally envisioned competition would be an important part of the program, they found businesses were resistant to being ranked against each other. They also recognized that the core of the program would be providing comprehensive customer support to homeowners; competition just wasn't a major focus. While this program is not a competition, we have left it in this report because it is a good example of a program that was originally conceived as a competition (and it is still called an Energy Challenge), but was later changed. Program implementers realized that the success of home energy upgrades depends on simplifying the process for homeowners; competition really was not a good fit. The program estimates over $5 of private investment for every $1 of public investment, and roughly 50% of public investment comes back through increased taxes (business tax, sales tax, etc.).

4.2.5. Inter-Organization Energy Conservation Competitions

In this type of competition, businesses or organizations within the same community or region compete against one another in saving energy.[9]

Boulder's 10 for Change Challenge encouraged businesses to commit to reduce energy use by 10% a year, and awards were provided based on a variety of metrics (e.g., most electricity reduced, most natural gas reduced, most innovative in reducing energy, most innovative in educating businesses to save energy, etc.). The most effective strategy for this competition was person-to-person contact, and in 2011, an average of 8% energy savings was achieved for all participating businesses (a little less than their 10% reduction goal). The 10% reduction goal was important as a target; however, the program recognized that businesses are very different, and it is difficult to have fair comparisons, particularly for businesses that are growing and changing. The total budget for the program was small (between $40,000-$60,000/yr, mostly in redirected staff time), but overall energy savings for participating businesses reached 8% in 2011, reflecting the City's success in establishing long-term relationships with the business community and actively and extensively engaging them to save energy.

El Paso's Energy Savings Challenge is clearly an example of a cost-effective program, albeit at a small scale. During the first six months, participating City libraries saved $21,000 in energy costs, while the total program cost less than $7,000 (including staff time), all in reallocated staff time with no additional new hires. The program focused on fire stations in the second year, and the fire stations collectively saved $8,000. Overall, 82% of the fire stations reduced their energy usage from the previous year. The fire fighters noted that they saved this much mostly by turning off unnecessary lights and by shutting off air conditioning units when no one was using that space. Some fire stations also thought of very creative ways to save energy, including propping open doors to see which lights were left on, taking out light bulbs in vending machines, and cooking outdoors on warm days. In one month, Fire Station 29 reduced their energy use by 30%, and the Captain of the station said the main change his team made was just turning off the lights. Prior to beginning the competition, each building was required to create an energy reduction plan indicating what changes they would commit to throughout the competition, and then each fire station displayed their plan in a highly visible place. Each month, the winning library or fire station with the highest percentage of energy reduction was awarded a lunch party and/or recognition through a newsletter. At the end of the six months, the overall winning library or fire station was awarded with a celebration and a $500 gift that they could use towards their library or fire station. While the libraries saved more energy overall, the program implementer felt that the program worked better among departments that had strong natural rivalries, such as with the fire fighters: "A*ll you need to say is that, 'Fire Station 6 is winning' and that is all the motivation they need. They really don't need lunches.*

[9] Although competition between schools could be mentioned here, we included them in Section 3.2.1, Campus Energy Conservation Competitions.

They don't need anything else. Just that." The winning library saved 19% in electricity use, and the winning fire station saved 21% in electricity consumption.

Chicago's Green Office Challenge engages tenants in offices to compete together to earn points and recognition for making their offices more "green" by managing energy, water, procurement and transportation. Larger amounts of points are earned for taking more difficult actions. Awards (but not prizes) are given to teams for earning the most points collectively, and certificates are provided to everyone. The most effective strategy was providing normative information and peer pressure via leaderboards (showing rankings of teams) and featured stories in social media. About 150 offices in 30 buildings have been actively engaged with over 1,000 individuals completing activities. The program implementer noted that people have different motivations for participating: "*I think it was definitely clear that individuals were not one type of gamer. They could be multiple types or a combination. At times, they are motivated by competition, and at other times, they were motivated more by socializing."*

The **Northwest Energy Efficiency Alliance's (NEEA) Kilowatt Crackdown** was a competition between office buildings in cities across the Pacific Northwest that ran from 2007 through 2013. The program buildings were benchmarked using EPA Portfolio Manager software, and an energy advisor (coach) and technical advisor (engineer) worked with building managers to identify, document and implement operational and capital improvements in coordination with utilities. The property team also met with program staff to support their follow through on commitments, which resulted in 3-7% energy savings in post-program years. At the end of the yearlong program, awards were given to those buildings that saved the most energy. The energy advisor model was the core strategy for increasing active participation; however, this also came at considerable expense. As noted by the interviewee, the key to successful implementation was effectively managing time and resources spent with individual buildings. It was also important to partner with trusted organizations to recruit participants, in this case the Building Owners and Managers Association (BOMA), which provided support and credibility to building owners making energy efficiency improvements. The program has become a replicable model for BOMA chapters and municipalities around the nation to effectively challenge commercial real estate markets through friendly peer competition, education and support.

4.2.6. Intra-organization Energy Conservation Competitions

In this type of competition, teams of employees in one company or organization are competing against one another in saving energy.

Cool Choices is a Wisconsin nonprofit that inspires actions that reduce GHG emissions. Cool Choices partners with companies and public entities (including schools) to make environmentally sustainable actions the norm via innovative game-based programming. Teams of employees compete with one another through an online game where players earn points for completing actions at home and at work. Organized as an online card game, participants are encouraged to adopt additional practices each day. More points are awarded for more difficult activities and for activities that are carbon intensive. The game format gives participants a clear and simple path to follow to earn points, increases transparency of activities taken and builds a supportive social environment in which participation is encouraged. Between 30% and 70% of employees of businesses typically participate in the game; public agency participation has been slightly lower. There is a range of motivations for employees to participate in games (e.g., protecting the environment, saving money at work, winning, and socializing). Most of Cool Choices partners have strong corporate sustainability commitments; these employers work with Cool Choices to engage employees around sustainability and to promote team building. The most effective strategy is the social aspect of the game, with team members encouraging each other to earn points. Participation is considered more important than winning when giving out awards, which are often recognition-style prizes (e.g., temporary possession of a trophy). At the same time, competition is an important motivating factor. According to Cool Choices' Executive Director: "*People say to us 'we are really not competitive.' It is really not true. Everywhere we go, we see people really liking the opportunity to have a little competition in what they do*." Cool Choices estimates impacts based on player actions during the game, and Cool Choices has worked with independent evaluators to verify electric savings, which averaged 4% at the participating household level and 6.6% at participating fire stations in another game.

The **Kilowatt Cup** is a competition between employees at a national energy efficiency consulting firm, PECI[10], headquartered in Portland, Oregon. PECI employees compete with one another in a commercial office setting, with floors competing against each other. By using a variety of behavioral intervention strategies, the 2012 competition achieved a 14% reduction in plug load energy use and 4% reduction in total company wide consumption during the two-week competition period; in the following year, they achieved a 20% reduction in plug load and lighting electricity use during the competition and 7% reduction in total company wide consumption. The most effective strategy was peer messaging and finding new ways to automate savings (e.g., new lighting control settings).

[10] In October 2014, CLEAResult acquired PECI's assets.

4.2.7. National Building Energy Competition

Recently, the federal government has become more interested in competitions for stimulating innovation and reducing energy and GHG emissions.

The **U.S. Environmental Protection Agency's (EPA) ENERGY STAR National Building Competition** targets commercial buildings and encourages them to reduce their energy use. The buildings with the greatest percentage-based reductions in energy or water use receive EPA recognition, and the competition has grown from 14 buildings in year 1 to over 5,800 buildings in year 5. The most effective strategy is the use of benchmarking and standardization tools (e.g., ENERGY STAR Portfolio Manager), so that all of the information is transparent, including baseline energy use.

5. Lessons Learned

Four research questions guided this study:

- How effective have been competitions at changing behavior and reducing energy?
- How long does energy savings persist after the end of the competition?
- Under what circumstances are competitions more or less effective?
- What are common best practices for the design, implementation and evaluation of energy and resource conservation competitions?

Based on our review of the competitions in this report, we believe that competitions have been effective at changing behavior and reducing energy use, although we don't know how long the energy savings or practices (habits) will persist (see Section 4). Because the competitions used different metrics and designs, mostly without any experimental design, it is difficult to identify the most effective competitions or even the best practices for the design and implementation of these competitions. But we can provide some insights on what worked well.

5.1. General Lesson Learned

Scalability

Competitions have the ability to massively scale up interventions. In 2013, Campus Conservation Nationals (CCN) engaged 240,000 students in 1,400 buildings at 119 college and universities with little more than a website, free online data tracking and engagement software, and training materials. Each campus organizes its own internal competition between buildings (and optionally competes against other schools in their region) and enters electricity data into online software that automatically calculates savings and competition standings. Elements of the CCN are also being scaled up to K-12 schools regionally. As another example, Sustainable Connections' Community Energy Challenge scaled up to four counties. While we found that a more prescriptive program could be more scalable, participants will most likely not be as personally engaged as programs designed locally, thereby limiting their effectiveness, as noted immediately below.

Success depends on other factors, not competition alone

Competition is a program strategy but does not guarantee savings. When the highly successful Vermont NeighborWorks competition was expanded to six other counties by another implementer (Efficiency Vermont), there was no incremental change in home retrofits or energy savings. This is because the cornerstone of the NeighborWorks program is customer service, which was not transferred to other communities by the different implementing organization; just creating a competition was not sufficient.

Cost-effectiveness

Competitions can be very cost-effective. With only a tiny reallocation of city staff time, the City of El Paso's Energy Savings Challenge saved about $30,000 savings in energy with its fire station and library challenges. And Sustainable Connections's Community Energy Challenge estimated over $5 of private investment for every $1 of public investment, and roughly 50% of public investment came back through increased taxes (business tax, sales tax, etc. For most competitions (particularly, campus conservation competitions), it appears that cost effectiveness was not a primary concern when first launching their competitions – the non-energy benefits (i.e., educational benefits) were more important.

Engage, Engage, Engage

Continuous engagement is critical. Most of the competitions focused on getting potential participants engaged and then continuing that engagement over the life of the competition. If the participants are not engaged, it is unlikely that they will continue with the competition and unlikely to follow-up on any commitments that they may have made. The CoolCalifornia Challenge noted that local engaged program managers and volunteers were crucial to running successful community-based programs. Similarly, Cool Choices partnered with companies with strong corporate sustainability commitments in order to engage employees around sustainability and to promote team building.

Ability to achieve deep savings

Competitions can achieve significant savings per retrofit. The Rutland County (Vermont) NeighborWorks program enabled nearly 5% of homeowners to complete home retrofits, with an average of 30% energy savings. While most of the competitions did not achieve this type of deep savings as a whole, the potential is there, as noted in the examples provided in Section 4.1.

Social Norms

Competitions relied on social norms, particularly through comparative feedback mechanisms (see below) and marketing materials. The Western Mass Saves Challenge used marketing materials that said "Join 6,000 of your neighbors who have already signed up." And the Vermont Home Energy Challenge also used marketing materials with "the faces of energy efficiency" – pictures of people and how much they saved. However, the effectiveness of competitions based upon appeals to pro-social preferences and social comparisons may be short-lived and may wane over time (Ferraro and Price 2011). Hence, the need for evaluating the persistence of energy savings.

Self-efficacy

Programs that are able to scale up and achieve deep savings help people feel like they are making meaningful contributions to solving real world problems, increasing their self-efficacy. Individuals who believe that they are capable of accomplishing their goals are much more likely to achieve them. This belief in the ability to make a difference is thought to be critical to energy saving behavior. However, not all competitions may lead to increased self-efficacy. For example, in the Campus Conservation Nationals (CCN), students reported significantly more

motivation than empowerment (or self-efficacy, i.e., the ability to influence electricity usage): 80% reported that the competition "motivated me to use less electricity," while 57% reported that they "felt empowered by the competition." As noted in the CCN case study: *"Feedback is simply enabling. It doesn't ensure any outcomes. If the people experiencing information feedback don't understand what is going on, then it's pretty difficult for them to make intelligent decisions. But the fact that they know what is going on doesn't mean that they will make intelligent decisions; it's a necessary but insufficient condition. … We tend to assume that feedback is going to enhance self-efficacy. But there is a distinct danger that it can actually have exactly the reverse effect: students can discover how limited their influence is over things."*

Software

Competitions used a variety of software tools to engage participants. The most compelling software tools appeared to be leaderboards (rankings for participants, teams within communities and communities overall), goals (ability to track progress of communities of achieving goals), stories (the ability to share what actions participants take), commitments (the ability to share what actions participants have committed to taking) and incentives (small rewards seen as positive feedback for achieving accomplishments).

Measurement and Evaluation

The measurement and evaluation of competitions varied substantially – with many of them significantly deficient. None of the programs used a Randomized Control Trial (RCT), and only two programs conducted a quasi-experimental study, comparing energy impacts for participants and non-participants (CoolCalifornia Challenge and San Diego Energy Challenge). The majority of the programs that conducted evaluations simply compared energy use during the treatment period with energy use in a prior (pre-treatment) period (either monthly or annual energy use). Sometimes, the estimated savings were weather normalized (e.g., Energy Smackdown and Community Energy Challenge), but often the savings were not weather normalized. Finally, several programs relied on energy models to calculate the savings, while others did not conduct any energy evaluations.

For competitions, evaluation is challenging. First, it is difficult to prevent the comparison group from learning about a program that is being marketed citywide. And second, for opt-in programs, RCTs are difficult to implement (but see Vine et al. [2014] for alternate evaluation methods).

Installation of Energy Efficiency Measures

Given the short time span of most competitions, investments in energy-efficient equipment or whole home retrofits is challenging. It takes a long time between the point at which homeowners begin thinking about a home retrofit and the point at which work is completed. Competitions usually do not last long enough to capture these equipment-based savings. However, some competitions are successful in bringing about retrofits changes and, hopefully, significant long-term savings. For example, the Kansas Take Charge Challenge completed 152 whole house efficiency projects, switched over 309,000 incandescent bulbs to CFLs, and installed over 4,000 programmable thermostats.

Persistence of Energy Savings

None of the programs conducted a formal evaluation of persistence of energy savings. We were only able to find some anecdotal information: the Campus Conservation Nationals program noted that savings were sustained 2-3 weeks after competition, and the Energy Smackdown noted that participants reported doing the same behaviors six months or later (but not measured). Since many of these competitions were conducted over short periods of time, it is difficult to infer persistence from these results.

Persistence of Actions

While competitions that only focused on conservation measures typically did not measure persistence after completion of the program, some programs did examine the persistence of actions, often through adoption of new practices. For example, the winning fire department in El Paso changed the habit of leaving air conditioning on at night, and learned to open doors in hallways at night to light the hallways from lit rooms. And the implementers of the Kilowatt Cup learned how to institutionalize the behavior changes made during the competitions (e.g., implementing changes to lighting controls, adding timers to coffee makers and copiers, and installing power management software on computers). These habits are a good metric of persistence, since they are hard to break (Becker and Murphy 1988). Finally, all behaviors do not persist at the same rate: for example, some one-time changes (such as changing the temperature of the water heater, or changing the television's brightness) have "built-in persistence" as it is unlikely that someone will undo that action.

5.2. Lesson Learned About Behavior Change Strategies

Competitions varied in their use of behavior change strategies, since people react differently to the different strategies. Most programs used as many behavior change strategies as possible. Projects that used fewer strategies were often just as effective. When queried, the most effective strategies appeared to be the following (in no order of priority): comparative feedback (including normative information in leaderboards and media), incentives and rewards, education, game mechanics (e.g., competition, levels, rules, strategy and points), local messengers, social networking and person-to-person contact, loss aversion, social diffusion, energy plans, and energy advisors/coaches. Not surprisingly, a few programs could not identify the most effective strategy, since many strategies were often used. Below, we briefly highlight some of the lessons learned for the behavior change strategies used in these competitions.

Local messengers – Local messengers were instrumental in many programs, and, in particular, this was assessed to be the most important strategy for the Kansas Take Charge Challenge and the NeighborWorks H.E.A.T. Squad Competition.

Comparative feedback – Comparative feedback was central to most energy reduction competitions, which compared participants or groups of participants on energy use, energy reductions and/or progress completing educational tasks or other goals. Many competitions

used leaderboards (tables) showing the rank of individual participants and teams, so that participants or groups of participants could be directly compared with their peers, making energy use and progress toward program goals publicly visible and in "real time." As noted by several interviewees, however, it is important to point out that comparative feedback is simply enabling and does not ensure any outcomes (see Section 5.1 – self-efficacy).

Social diffusion – Social diffusion and networks were used in many competitions; in particular, Opower Social, using Facebook was a key strategy, and for the Vermont Home Energy Challenge, social diffusion was the "pillar of the program."

Imagery – Many competitions used simple graphics on their website, emails, and newsletters. Also, many competitions used graphs of energy use over the year, as well as photos (of people, energy efficiency measures, prizes, etc.). In particular, for Opower Social, imagery was key via the use of website characters (e.g., smiley face) and badges conveying different achievements of energy savings that could be shared in Facebook.

Rewards – Rewards (e.g., gift cards, pizza and ice cream parties, trophies and plaques, and raffle prizes) and financial incentives encouraged participants to complete the competitions, and for some programs, the incentives were a main reason why people took part in the energy reduction competitions. On the other hand, some programs felt that these rewards were not particularly effective, as in the case of Campus Conservation Nationals: the concept of competing for a reward may have been more motivational than the reward itself (which often went unclaimed).

Prompts – Prompts were used in many competitions – some were daily, others weekly, and others of longer duration (monthly or quarterly). For example, Cool Choices sent daily emails to participants on new actions available that day.

Commitment – In the Campus Conservation Nationals, individual participants could choose to make commitments on the online software, and the commitments were posted to the committing individual's Facebook profile. In the Kansas Take Charge Challenge, people pledged to switch 5 bulbs and then posted this information in the library, and in the Western Mass Saves Challenge, individuals created plans to reduce electricity, and the plans were posted on an online portal.

Goal Setting – In the CoolCalifornia Challenge, there was a carbon savings goal set for the entire program, in the Kansas Take Charge Challenge, businesses had a partipation goal, and in the NeighborWorks H.E.A.T. Squad Competition, the program had a goal of 15% energy reduction per home. The Vermont Home Energy Challenge set a goal of 3% of homes retrofitted in each community, and each building in the Kilowatt Crackdown had an energy reduction goal.

Scarcity – In the Kukui Cup, participants had a 24-hour time limit to complete certain tasks, and in the Energy Smackdown, there was limited time to get tasks done. In the Western Mass Saves

Challenge, the rewards program was only available to the first 5,000 customers, and in the Vermont Home Energy Challenge, there was a limited time offer for discounted audits.

Reciprocity – In some competitions, reciprocity was not explicit, but assistance was offered free of charge for those attempting to save energy. In the Kukui Cup, some students wanted to please Research Assistants. In the Kilowatt Cup, some team captains gave their teams treats, and donations to charities on behalf of the company would occur only if the game's goal was met.

Gamification – In Opower Social, badges were earned for monthly reductions and cumulative savings, group competitions were held, challenges were sponsored by groups, and comparisons could be easily seen on leaderboards. In the Green Office Challenge in Chicago, participants earned points for taking specific activities affecting energy use. Cool Choices is marketed as a game, with participants earning points for taking new actions each day.

Loss Aversion – In many competitions, loss aversion was framed in terms of what participants would gain (in terms of the amount of energy saved) or money lost by not acting. In the Kansas Take Charge Challenge, a basketball was presented at some events to show how much energy was being wasted. And in the San Diego Energy Challenge, participants would lose points for saving energy if they did not use them. The Kilowatt Crackdown emphasized opportunity loss and the cost of not staying competitive to building owners, managers and operators of office buildings: money would be lost due to higher operating costs, or loss of tenants.

Energy coach/advisor – Although only a few competitions used an energy coach, the ones that did felt that they were critical to the success of their program. As noted by the program manager for the Kilowatt Crackdown: "*The core part of the program is the provision of a coach and a technical advisor. That has been the very core strategy that has been successful. We have heard how valuable the program services have been to people. We have seen an ongoing repeat in participation…there have been many buildings that have participated multiple years."*

5.3. Lessons Learned by Program Type

Campus Competitions

Local campus programs are only as effective as the motivation and training of the people implementing these programs. Since the primary purpose of these competitions is educational (rather than saving energy), it is critical to provide high quality educational components in this type of competition. And it is through education, that long-lasting changes can occur, as noted in the Kukui Cup: "*… we have students change their major to one that was more sustainability related, we had students take different courses based upon the Kukui Cup challenge, and we saw evidence of students changing their attitudes about what careers they might want."*

These programs are high cost if one only considers short-term energy savings and if interns/staff are being paid. However, they can be low cost if volunteers are unpaid and if longer-term benefits are valued. For example, some university programs reward student volunteers with service annotations on their transcripts rather than dollars. Thus, there needs to be a balance between keeping costs low and ensuring a viable, long-term program.

Competitions can reduce energy use, but they do not guarantee savings. As noted by Petersen et al. (2007), competitions are motivating, even to a wide demographic, but they do not necessarily increase self-efficacy. In fact, feedback may be disempowering, if students realize that they have little control over the total energy use in their buildings (see also Asenio and Delmas 2015).

Inter-Community Competitions

The key to success of any inter-community competition is increasing capacity and motivating local program managers and stakeholders. These competitions have shown that it is critically important to build relationships with influential champions within communities across the program territory. Successful programs have worked with cities to build support for the program within communities in setting goals at the design stage. These programs have also emphasized positive messaging about the benefits of energy efficiency, and, in some cases, there were able to select the cities based on natural rivalries.

Competitions may achieve scale at low cost compared to other program types by being less resource intensive. For example, some competitions simply provide the rules, a way of tracking energy savings and recognition, and no financial incentives, while relying extensively on volunteerism to drive participation. But there would be no personal engagement with these prescriptive type programs, limiting their ability to help develop habits and promote the installation of energy efficiency measures.

Several of the competitions showed that recognition should be granted for all communities achieving particular goals, not just outperforming peers. Rewards (recognition and prizes) have been shown to enhance intrinsic motivation (and thus long-term behavior change) when they are seen as positive feedback for accomplishments rather than a means of control (Deci et al. 1999).

Intra-Community Competitions

Intra-community competitions have shown that competition is often more effective if competitors are natural rivals. For this reason, intra-community competition may be more motivating for sub-groups within communities than competition between cities, which may have little relationship with each other. Campus programs are primarily competitions between residence halls on individual campuses. Some schools have even implemented competitions between floors within residence halls, making performance in the competition more meaningful. A seemingly ideal way to accomplish this in cities would be for households to be

affiliated with elementary, middle or high schools within the community. However, as was learned by the San Diego Energy Challenge, this approach requires considerable on-the-ground effort to coordinate with individual schools in order to be successful. A well-developed toolkit similar to the one used in the Campus Conservation Nationals would be a good model for other competitions, making it easy for schools, businesses or other entities within communities to participate.

Inter-organization Competitions

Business competitions can be very effective but it is important to construct competitions in ways that support all businesses and minimize potential negative impacts of businesses that do not do as well in competitions. There is also a need to ensure that competitions are fair, considering the diversity and constantly changing nature of business. Thus, there is a need for multiple metrics and multiple winners (rather than one winner for the greatest reduction in energy use). Providing businesses with the proper tools and resources for comparing energy use across businesses (and making it transparent) will facilitate competitions among businesses. Given the diversity of businesses, it may be best to segment the market and focus the competition on specific business markets. These programs should also be simple and easy to use and should be designed to last for multiple years, so that business can expect recognition over time. Normative information works in these competitions, so leaderboards showing the ranks of businesses need to be emphasized. Businesses should have the option of not making their information or rankings public.

Intra-organization Competitions

Employees in businesses are often accustomed to competing. The greatest benefit of intra-organization competitions for employers is often boosting employee morale and improving the team-focused culture of the company. Employees in the same office have special bonds or relationships, and can form teams easily (since they are used to that) and can be influenced by social norms. Games can play an important role in the competition, since they make “work” more fun. However, getting employees to do something meaningful in terms of saving significant amounts of energy use in commercial buildings is challenging; providing the right amount of feedback on results may facilitate more energy efficiency actions.

National Buildings Competition

National competitions work well and motivate the building sector to participate in the competitions. However, there is only one national competition of this type, so it is not scalable. However, other types of competition could be introduced: e.g., most energy innovative building, “greenest” building, etc. Also, providing tools and resources for benchmarking and analysis are key to all competitions at all scales.

6. Recommendations

Create Well Crafted Intervention Strategies

Competitions need to focus on key program strategies to be more effective. Most programs used as many behavior change strategies as possible. Projects that used fewer strategies were often just as effective. It is important to have well crafted intervention strategies that are appropriate to the target audience in order to create a program that is simple, informative and engaging. A program design that incorporates too many behavior change strategies might result in participant confusion. Thus, one must be selective and strategic in incorporating and funding behavior change strategies in competitions.

Change the Focus from Winning to Doing Well

There are winners and losers in competitions. Those at the bottom or middle of rankings may not feel that they have a chance to win, so they may not perform well. Worse, poor performers may lose some of their intrinsic motivation and self-efficacy, which are critical factors in changing behavior. Thus, care should be taken to increase the motivation of all participants, even those at the lower levels of participation. This may be accomplished by providing recognition for achieving goals rather than, or in addition to, outperforming peers. One possible solution is to provide awards or prizes commensurate with the level of participation. For example, the CoolCalifornia City Challenge provides funding to cities based on how many points are earned by participating residents. This changes the focus from winning to doing well. One could also provide recognition, awards or prizes to “most improved” participants. In sum, recognition should be granted for all participants and communities achieving particular goals, not just outperforming peers.

Know Your Target Audience

Competitions are not for everyone. Competitions appear to be most effective when they are between groups of individuals who know each other personally or are natural rivals. Similarly, business competitions can be very effective, but it is important to construct competitions in ways that support all businesses and minimize potential negative impacts of businesses that do not do as well in competitions.

Simplify Engaging Software

Software should be simple and engaging. As noted earlier, the most compelling software tools appeared to include leaderboards (rankings for participants, teams within communities and communities overall), goals (ability to track progress of communities of achieving goals), stories (the ability to share what actions participants take), commitments (the ability to share what actions participants have committed to taking) and incentives (small rewards seen as positive feedback for achieving accomplishments). These software tools, to the extent they are implemented, should be clear, bug free, and easy to engage.

Be Careful in Scaling Up

After a successful pilot program, there is a tendency to scale up the program to a larger geographic area. However, you may lose more than what you gain if the personal engagement is not there for motivating people, making it difficult to change existing habits. It is possible, but local program managers and stakeholders will need to be engaged and motivated to promote the program.

Use Rewards But Be Careful

Rewards (recognition and prizes) do work: they have been shown to enhance intrinsic motivation (and thus long-term behavior change) when they are seen as positive feedback for accomplishments rather than a means of control. However, programs should be careful to not over-emphasize extrinsic rewards. Program implementers' prizes to participants should be seen primarily as recognition and positive feedback for participants' personal accomplishments rather than the primary goal of participation.

Experiment!

Competitions do work. Unfortunately, we have a limited understanding of how well these competitions work. Instead of collecting more anecdotal information, program planners and designers need to be more strategic and systematic by using experimental design to find out what works and what does not work. Ideally, randomized controlled trials should be encouraged, so that a rigorous evaluation can be done. Alternatively, competitions should be evaluated using quasi-experimental designs – comparing treatment populations with comparison groups.

Devote More Resources to Measurement and Evaluation

Competitions need to devote more resources to evaluation and measurement. There are several things that most of the case studies lacked in this regard that future implementers should address for ensuring more rigorous evaluations:

- Develop a program theory and logic model document prior to implementation to illustrate the hypothesized causal links between program activities and outcomes.
- Plan for a means to measure the linkages in the logic model as program performance metrics—whether or not energy change will be measured.
- Identify other behavior change and similar initiatives occurring at the same time of the intervention, to avoid confusion and address attribution issues.
- Develop evaluation plans that use a preponderance of evidence approach so that desired outcomes aside from lowering of energy use can be measured (e.g., AKA (awareness-knowledge-attitudes) type metrics, program touches, unique visitors to websites, etc.).
- Develop standardized measures across a range of key variables (to enable cross comparisons to be made across different studies).

- Provide a sufficient budget for evaluation activities to measure persistence of savings over time.

Ensure Persistence

More resources need to be devoted to ensuring the long-term effectiveness of behavior change strategies and competitions. Most competitions are relatively short lived. For long-term behavior change, a few possibilities arise: (1) continue the competitions over a longer period of time, (2) conduct a series of short-term competitions that build on the original competition, (3) conduct follow-up activities that build on the competitions; and (4) emphasize habit development and installation of energy efficiency measures in current and future competitions.

7. Concluding Remarks

For competitions to be effective, it is imperative that resources are committed for the long term, so that a competition program can endure. By keeping a program stable in the community for several years, one is able to build critical relationships, trust and consistency in program delivery, leading to enhanced program credibility and program accomplishments. At the same time, resources need to be committed for the design and implementation of rigorous evaluations of competitions. As federal, regional, state and local governments and non-profits move towards aggressively pursuing energy savings, we expect that more energy reduction competitions will be needed to provide these additional energy resources. We hope that this report can stimulate more thinking about competitions as well as more funding for the design, implementation and evaluation of energy reduction competitions.

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Appendix A. Case Studies

Case Study 1: Campus Conservation Nationals

Type: Campus Energy Conservation Competition

Description

Campus Conservation Nationals (CCN) is a nationwide electricity and water reduction competition between college and university campus buildings with recognition and the chance to win a prize for the top performing campuses.[11] Participating campuses choose whether they will participate in the electricity competition, the water competition, or both. The first national competition was held in November 2010, with subsequent competitions in the spring semesters of 2012 through the present.

The program's primary function is as an organizing framework with each campus organizing its own three-week building vs. building competition. Schools also have the opportunity to self-organize a "group competition" against one or more other schools. With the exception of the 2010 competition, participating schools are not ranked against each other outside of the group competitions (due to the difficulty of finding a single three-week time period that works for 100+ schools). Rather, the top 10 best-performing schools are recognized and a histogram is provided on the program website to allow schools to benchmark how their performance compared to other participating schools.

Schools are required to report consumption data to BuildingOS, an online software platform made by Lucid that is provided for free to schools that do not already have it, at least once a week. Schools also receive their own Building Dashboard website. Building Dashboard is a public, occupant-facing tool that displays competition standings as well as consumption data, both of which are automatically pulled from BuildingOS. Each local competition employs different strategies to engage and motivate residents.

Electricity and water savings are calculated as a percentage reduction compared to average usage during a preselected baseline period, which is typically a two-week period immediately prior to the competition. During the first two years of the competition, during which time it was limited to only residence halls, electricity reductions averaged 3-4% for all participating residence halls during the first two years, with 25-30% savings for the top ten percent of dorms. The program engaged 105,000 students in 2010, 197,000 students in 2012, 300,000 students and staff in 2013, and 265,000 students in 2014. A paper by Petersen et al. (2015) provides a detailed assessment of the first two competitions, including an analysis of performance and of post-competition participant surveys.

[11] For more information, see: http://www.competetoreduce.org/

Organizers

- Alliance to Save Energy
- National Wildlife Federation
- U.S. Green Building Council
- Lucid Designs
- Oberlin College

Goals and Motivations

- Promote campus energy competitions for engaging, education, motivating and empowering resource conservation on campuses
- Educate and train young adults in energy conservation and help students think about and engage with sustainability in new ways during important formative years. This may lead to spillover benefits such as career formation, civic engagement, voting, etc.

Target Population

- College students in dorms are the principal audience. Dorms are the environment where students have the most control and self-efficacy. In recent years, the competition has also targeted non-residential buildings (e.g., offices and service buildings)
- About 70% of respondents who filled out the evaluation survey were women[12].
- About 50% of survey respondents were politically liberal, while 20-25% of survey respondents were conservative.

The Competition Prize

- Among participating schools, the top 10 electricity reducers and top 5 water reducers are recognized on the program website, receive certificates of recognition and are entered in a raffle to win 1 year of free access to: Lucid's BuildingOS software platform with real-time data for 2 buildings; BuildingOS' occupant and engagement solution, Building Dashboard; and necessary metering hardware (electricity winner only).
- Individual campuses provide their own prizes to winning residence halls. Common prizes are trophies/plaques and pizza and ice-cream parties.

Theories of change

- Social norms
- Public commitments

Communication Channels

- Institutional buy-in – for example, signatures of support from representatives of facilities, residential life, sustainability, and administration (required to participate).

[12] A financial incentive was provided to complete the survey – and this may be entirely unrelated to the competition itself. The desire and incentive to participate in the survey may not be related to the desire and incentive to participate in the competition. So, while more women than men completed the survey, this does not mean that more women than men participated in the competition.

- Email updates – the program organizers send emails to campus competition organizers with resources, updates, and advice every 1-2 weeks before and during their competitions.
- Campuses do all the direct communication with residents, and this varies greatly from campus to campus. Most schools use posters and flyers, Lucid's Building Dashboard website, social networking websites, emails, a kickoff event, events during the competition and advertisement on official campus websites.

Activities

- Campus signs up and agrees to enter weekly (or more frequent) electricity data from meters into BuildingOS (if their electricity meters are not connected to BuildingOS).
- In the first year (2010), all campuses competed during the same time period, but that became logistically too difficult. Now campuses run their programs any time during the program's 3-month "competition season" (February through April).
- Campus competitions last 3 weeks.
- Campuses can manually read data and enter it online or Lucid's BuildingOS software, which automatically collects time series data from campus meters.
- Each campus designs its own competition, often with additional educational components. CCN provides materials, framework, and software tools.

Behavioral Strategies Employed

Strategy	Description
Commitments	Institution makes commitment to enter electricity data. Individual participants can choose to make commitments on the online software (Building Dashboard). Commitments are posted to the committing individual's Facebook profile unless they opt out of this option.
Goal setting	2010 through 2013: Overall conservation goal for all schools participating. 2010 through present: Program resources encourage goal setting and provide advice for doing so (Step 4 of CCN's Competition Planning Guide).
Prompts	None, but may be organized individually at some schools. This is encouraged in CCN's Marketing & Behavior Change Guide.
Social diffusion	This happens locally through dorms and on Facebook
Comparative Feedback	Comparison between dorms. Schools can optionally choose to compete with other schools. There is no comparison between individual participants.
Instantaneous Feedback	In schools with dashboards (optional)
Tailored Feedback	None
Descriptive norms	Done locally, by providing comparative feedback.
Subjective norms	No messaging directly to participants. This may be done

	locally. This is encouraged in CCN's Marketing & Behavior Change Guide
Scarcity	No messaging directly to participants. This may be done locally.
Loss aversion	Energy framed in terms of savings on the website
Reciprocity	No messaging directly to participants. This may be done locally.
Local Messengers	Some schools involve Research Assistants, others have "ecoreps," others just have students with more responsibilities. This is encouraged in CCN's Competition Planning Guide - "Create a Building Captain Plan". Also, in many ways the campus organizers themselves are local messengers.
Imagery	Some (not described).
Rewards and incentives	Some prizes and recognition are provided for top-performing schools at the national level (see above), but the primary incentive is just doing well and bragging rights. Rewards vary by campus. For example, ice cream parties tend to be motivational, but usually winning and recognition are the primary motivation.
Competition	Nationally, the top 10 schools that achieve the greatest percentage reduction in their electricity use in comparison to their preselected baseline periods (and the top 5 schools for water) are named and recognized. At individual schools, participating buildings are ranked by percent reduction in electricity/water use in comparison to the preselected baseline period. Schools have their own local criteria for determining and recognizing levels of achievement.
Energy Coach / trusted advisor	No

Most effective strategy

- Opt-out – students don't choose to participate. It is decided at an institutional level.
- Comparison between buildings on campus is more motivational than how well a school does compared to other schools. Schools that can compare floors within dorms are even more motivated – the finer the scale, the more motivational.
- Comparative feedback sends normative information about their performance.

Scalability

- Lucid is pursuing a similar concept at K-12 schools, though at regional (approximately state) instead of national scale. Requires institutional buy-in, similar to university competitions.

Resources Available

- No data are available on the resources required to run the competitions at individual campuses. Each program funds itself, mostly with volunteer time from students and staff.
- The sponsoring organizations (Lucid, Alliance to Save Energy, National Wildlife Federation and the U.S. Green Building Council) contribute in-kind resources to help market and implement the program.

Outputs

- 105,000 students in 2010, 197,000 students in 2012, 300,000 students in 2013 and 265,000 students in 2014
- 550 students made 4,300 commitments to resource conservation on the website during the 2010 competition.
- Involvement at schools from sustainability offices, housing staff, facilities staff, faculty and students inside and outside of residence halls.

Outcomes

- 2010: 4% reduction in electricity (510,000 kWh, $50,000 and 816,000 lbs CO_2) in the 471 dorms that participated.
- 2012: 3.1% reduction in electricity (1,021,000 kWh, $100,000, 1,622,000 lbs CO_2) in 1084 dorms.
- Top 10% of dorms achieved 28% and 33% saving in electricity and water respectively in 2010 and in 2012.
- 2013: 2.1 million kWh ($158,000 and 2.4 million lbs CO_2)
- 2014: 4.5% reduction in electricity (2.2 million kWh, $198,000, 3 million lbs CO_2), with the top 10% of schools achieving campus-wide reductions of 11.3% or greater.

Persistence

- Based on evaluations of 2010 and 2012 competitions:
    - Savings were sustained 2-3 weeks after the 2012 competition (the only competition assessed with a comprehensive post-competition evaluation).
    - In surveys, students consistently say that they will continue their new behaviors and practices in the future.
    - 92% of students reported some level interest in the standing between dorms, and 34% expressed being very interested. Students reported being somewhat less interested in standings between schools (81% were interested and only 18% were very interested). Students also expressed interest in a graph showing changing patterns of resource use in dorms (91% interested and 22% very interested).

Measurement and Evaluation

- Removed outliers (any dorm reporting reduction or increase of > 50%).
- Compared energy use to baseline period immediately prior to competition and reported energy savings as a percentage reduction from baseline.

Program Evaluation Findings

- Based on evaluations of 2010 and 2012 competitions:
    - Students reported significantly more motivation than empowerment (or self-efficacy, i.e., the ability to influence electricity usage): 80% reported that the competition "motivated me to use less electricity," while 57% reported that they "felt empowered by the competition."
    - Students were more motivated to protect future generations than by their own well-being or the financial well-being of their school.
    - The most popular energy saving behavior was turning out lights (66%). Other reported actions included using power strips and using the stairs. Many students reported that during the competition they engaged in additional conservation behaviors such as recycling and bicycling that clearly had no effect on competition standing.

Challenges and recommended improvements

- Do a better job of educating and empowering students

Key Lessons

- Local organizing is critical for effective competitions. The competition is just a framework and an enabling technology that can make possible the success of a well-organized local program.
- This model proves that you can get large savings from behavior change programs.
- Competitions "preach beyond the choir" by engaging people who would not otherwise join an environmental campaign.
- Feedback can be empowering, but it can also be disempowering by lowering individuals perception that actions that they take can make a difference, e.g., lowering their self-efficacy.
- Competitions do a good job at raising motivation, but not necessarily a good job at increasing self-efficacy. More attention should be placed on the educational components of programs.

Quotes from Program Evaluators

> *A technology or program is only as useful as the local organizational efforts created around it… Whether that program is successful or not is wholly contingent on what or how good an organizational effort is put in locally.*
>
> *Feedback is simply enabling. It doesn't ensure any outcomes. If the people experiencing information feedback don't understand what is going on, then it's pretty difficult for them to make intelligent decisions. But the fact that they know what is going on doesn't mean that they will make intelligent decisions; it's a necessary but insufficient condition.*

We tend to assume that feedback is going to enhance self-efficacy. But there is a distinct danger that it can actually have exactly the reverse effect; students can discover how limited their influence is over things.

Those students who were least engaged in the environment tended to change the most in response to competitions, and those students who were most engaged in the environment tended to respond least to the competition.

We're very excited because the competitions we feel ended up preaching beyond the choir.

People are much more motivated to behavior change by emotional rather than logical response, and so we've made an effort to create imagery that stimulates their emotional response.

We need to do a better job within these programs of helping people to understand what it is they can actually do to make change, to make effective change…You know a lot of kids get all worked up about whether their cell phones are plugged in or not, and I don't think that's making a heck of a lot of difference in terms of their performance in the competitions, and yet they do think it's important.

Case Study 2: Kukui Cup
Type: Campus Energy Conservation Competition

Description

Since 2012, the Kukui Cup at the University of Hawaii has held a competition for students, dorm floors and dorms to provide learning opportunities to reduce energy use. In contrast to most other campus competitions, which focus on reducing electricity, natural gas and/or water as the primary objective, the Kukui Cup is a game that gives points to individual participants, dorms and dorm floors for taking a variety of educational activities.[13] Rather than base rankings on energy reductions compared to a baseline, similar to most other campus energy competitions (Johnson et al. 2012), participants earn points for doing a variety of educational activities, including answering questions after watching videos, participating in events, taking and following through on pledges, engaging with others socially and playing online games.

The Kukui Cup organizers recognize that the real value in campus competitions is increasing the awareness, motivation and self-efficacy of students to lead more sustainable lives, including influencing their careers, majors and civic participation. While it is difficult to measure these more intangible outcomes, the program is specifically designed to maximize the educational benefits to students, while engaging them in a fun game that engages students in activities, both online and in their dorms.

Organizers

- University of Hawaii

Goals and Motivations

- To enable more persistent savings with greater educational benefits than other campus energy competitions.

Target Population

- College students in dorms (they needed a place to install the smart meters in similar energy infrastructure).

The Competition Prize

- $10,000

Theories of change

- Existing campus competitions
- Feedback mechanisms
- Intrinsic and extrinsic motivations: could competitions lead to more meaningful change if they incorporated more Community Based Social Marketing (CBSM) elements?

[13] For more information, see: http://kukuicup.org/

Communication Channels

- Interaction on the website
- Facebook page
- Participant communication with smartphones
- Email

Activities

- Online system
    - Educational game
    - Watching videos and answering questions
- Attending workshops in dorms
- Energy audits in dorms
- Weekend excursions / field trips
- Mini-competitions between floors

Behavioral Strategies Employed

Strategy	Description
Commitments	Public commitments – Inside the game, you can see all the people on your floor and which commitments they've made
Goal setting	Energy goal game – points if they reduce 10% below a baseline of previous 2 weeks
Prompts	Yes, send reminders 3 days after start
Social diffusion	Dorm floors, social media
Comparative Feedback	How well individuals, dorms and floors are doing (points)
Instantaneous Feedback	Smart meter data
Tailored Feedback	No
Descriptive norms	No
Subjective norms	No
Scarcity	Limited time – have 24-hr time limit to complete certain tasks.
Loss aversion	No
Reciprocity	Possibly by some Research Assistants (RAs) in dorms – helping students and students wanting to please the RAs.
Local Messengers	RAs act as local messengers implementing the program.
Imagery	Yes, there was a graphic design for T-shirts, website and other communications. They try to use little text.
Rewards and incentives	Prizes, badges, party each week for winners
Competition	Yes
Energy Coach / trusted advisor	No

Most effective strategy

- It is a combination of strategies: feedback, incentives, education, game mechanics…"all of them were useful"

Resources Available

- $400,000 NSF grant (supporting graduate students, programmers, etc.)
- Some utility funding
- 40 resident assistants
- Facilities managers

Outputs

- Y1 (2012) 1 year – about 350 students (1/3 of dorm residents)
- Y2 (2013) 6 months– about 350 students (1/3 of dorm residents)
- Y3 (2014) 2 weeks– about 350 students (1/3 of dorm residents)
- Audits

Outcomes

- Y3: 2300 kWh over 2 weeks (Sablan, Pena and Johnson 2014). = 177/d * 13 days = ~8%
- Students who participated in Kukui Cup had higher energy literacy than students who didn't.
- Spillover – students who didn't participate showed some signs of increasing energy literacy as well.
- Short-term reductions of up to 20-25%

Persistence

- Not measured
- Program implementers believe that the true benefit is in education, and this will result in long lasting savings.

Scalability

- In its current form, the program requires administrators to review answers to questions. This is a limit to scalability, but questions could be modified to be more scalable.
- The team developed an application programming interface (API) that allows third parties to develop their own custom applications.

Measurement and Evaluation

- Energy compared to previous year; however, the implementers are very critical of the use of this method (Johnson et al. 2012).

Program Evaluation Findings

- None available.

Challenges and recommended improvements

- Important to measure the qualitative aspects of the programs. This is where the real benefits are, not kWh saved for a short duration. Most other programs are focused on the energy savings, not the educational aspects.

Key Lessons

- Educational benefits may be more meaningful than short-termed kWh savings. Students make important life decisions about careers and lifestyles that have long-term benefits. If the goal of competitions is education, then this should be measured in the program.
- Prizes should not be a central focus. If they are too large, they take the focus away from the actual energy behaviors being targeted.
- Important to figure out roles and responsibilities. The more ownership that can be passed on to local level, the better for scalability, but local champions need training and support, resources and sophisticated tools.

Quotes from Program Managers

So for example, we have students change their major to one that was more sustainability related, we had students take different courses based upon the Kukui Cup challenge, we saw evidence of students changing their attitudes about what careers they might want and you know voting behaviors and so forth.

The first year, we were quite insecure whether or not anybody would partake in the challenge. So we put a lot of energy into getting pretty cool prizes, so we had a recycled guitar signed by Jack Johnson as one of the prizes and that kind of stuff. And in later years, at least at this point when we advise people on the design of the Kukui Cups, we tend to say don't go too crazy with the prizes because that will probably motivate a lot of people to just do game playing as opposed to thinking about it from the perspective of actual energy behaviors and something that they might want to sustainably change. You know then otherwise they'll just be playing the game. They'll reduce their consumption to win the guitar then as soon as the guitar is awarded they will just go back to what they were doing before because they interpreted the challenge as a game rather than as something more kind of profound.

The students loved it. There weren't much negatives… we had people from other dorms sending us emails complaining about that fact that we weren't running it in their dorms as well.

Case Study 3: CoolCalifornia Challenge

Type: Inter-Community Residential Energy Conservation Competition

Description

The CoolCalifornia Challenge (also called the CoolCalifornia City Challenge) is a statewide competition between participating California cities to engage residents to track and reduce greenhouse gas emissions from household energy and transportation, and to create more vibrant and sustainable communities.[14] Participants earn points for having lower emissions than similar households (calculated by the software) and three to five times more points for lowering consumption. Households also earn points for taking small actions, like uploading photos, inviting friends and sharing photos or stories. At the end of the competition, the city with the most points is crowned the "Coolest California City," and the two runners up are each crowned "Cool California City" at an awards ceremony at the California Air Resources Board (ARB).

The program is administered by the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley (UCB) and the ARB. The first year of the competition was in 2013. The second competition in 2014 had major support from California's "Energy Upgrade California™" program[15] and offered $100,000 in seed and prize money to cities based on the performance of participants in each community. The funds support sustainability efforts in each community.

Organizers

- UC Berkeley: Design, implement and evaluate the program[16]
- ARB: Funding and co-design of pilot program, and co-management and evaluation of 2014 program
- Energy Upgrade California™ (2014)

Goals and Motivations

- Many California cities have adopted climate action plans that call for engagement of residents in steps to reduce greenhouse gas emissions.
- Wanted at least 200 survey responses
- No specific GHG reduction goal
- Wanted measureable GHG reduction reductions

Target Population

- The organizers identified two primary targets, based on a statewide energy efficiency segmentation study (Opinion Dynamics 2009): "Leading Achievers" are upper income, highly educated, politically liberal households that have already adopted a number of

[14] For more information, see: https://coolclimate.berkeley.edu/challenge/index.php?type=login
[15] See: http://www.energyupgradeca.org/en/
[16] Chris Jones, one of the authors of this report, was part of the UC Berkeley team that worked on this program.

energy-efficient practices and for whom energy and climate change resonate strongly with their values, while "Striving Believers" also tend to be well educated and politically liberal, but are younger, lower income and have taken fewer steps to reduce energy consumption. Together, these two groups comprise about 50% of California's population.

The Competition Prize

- 2012-2013: The City with the most participants in each of the first three months is awarded $10,000 in seed money and becomes a "finalist." The City with the most points at the end of the competition is crowned "Coolest California City," and runners up are each crowned "Cool California City." No prize money is awarded to winners.
- 2014: $50,000 distributed to cities based on number of new participants after 2 months. $50,000 distributed to cities based on the number of points earned by participants in each city at the end of the competition timeframe. The City with the most points at the end of the competition is crowned "Coolest California City" and runners up are each crowned "Cool California City." No prize money awarded to winners.

Theories of change

- Competitions
- Comparative feedback (household to household, city to city)

Communication Channels

- Email (biweekly newsletters in 2012-2013, weekly emails plus a weekly scorecard sent by email in 2014), sign-up events organized by cities, workshops for city program managers.

Activities

- Cities sign up participants
- Participants log monthly electricity and natural gas data, as well as vehicle miles in the online software
- Participants optionally join or create teams
- Software ranks households, teams and cities
- Participants receive email communications
- Some cities had local events. For example, Sacramento's "Cut Your Cubes" event showcased a metric ton-sized cube in front of the state capitol. A follow-up event was a scavenger hunt in which participants needed to sign up for the Challenge and then walked or biked around the city tracking down clues to sustainable practices and businesses in the community (e.g., electric vehicles, delivery bicycles, and solar panels owned by businesses).
- Cities optionally use seed money to offer raffle prizes or prizes for high achievers
- Participants optionally share stories on social media

Behavioral Strategies Employed

Strategy	Description
Commitments	No
Goal setting	Program-wide goal of 500,000 lbs reduced in 2012-2013.
Prompts	Weekly reminders to enter data.
Social diffusion	Facebook. Team formation (schools, churches, offices, etc.).
Comparative Feedback	Comparison of households, teams and cities on online scoreboard and in weekly emails.
Instantaneous Feedback	Participants receive points when they upload data.
Tailored Feedback	No
Descriptive norms	Sometimes used in newsletters.
Subjective norms	Not explicitly. This may happen locally. It is sometimes present in newsletters.
Scarcity	No, although limited time to sign up and enter data.
Loss aversion	Energy framed in terms of savings on the website.
Reciprocity	Some cities gave away small gifts when people sign up.
Local Messengers	Cities are responsible for much of the messaging to participants.
Imagery	Yes. Biweekly newsletters used imagery, but there was no specific theory guiding production of images.
Rewards and incentives	Some cities optionally gave away raffle prizes based on points earned by households. Each point counts as a raffle ticket. Awards for cities serve as recognition. In 2013, the Challenge gave away $100,000 in prize money based on number of new participants and points earned by cities. In 2012, the Challenge gave away about $50,000 in seed and prize money.
Competition	City with the most points crowned “Coolest California City.” Cities with second and third highest points crowned “Cool California City.”
Energy Coach / trusted advisor	No
Modeling	Hero of the week. Users uploaded photos and stories.

Most effective strategy

- Use of local messengers
- Comparative feedback (scoreboard with rankings of households, teams, cities)

Scalability

- The project could easily scale more deeply into communities, e.g., competitions between schools within communities, and to more contexts “Coolest California School,” “Coolest California Business,” etc.

Resources Available

- $300,000 grant from Air Resources Board to U.C. Berkeley (2012-2013); $150,000 sponsorship from Energy Upgrade California in 2014.

Outputs

- 2,677 participants in 2012-2013. 3,850 participants in 2014

Outcomes

- 14% reduction in electricity calculated in 2012-2013 (based on a comparison of participants to a delayed control group)

Persistence

- Not estimated

Measurement and Evaluation

- Variability in Adoption method: households that sign up at a later date become a rolling control group for households that sign up earlier. Energy use is normalized by City.

Program Evaluation Findings

- In 2010, over 70% of respondents rated the program as either Excellent or Good, while 20% rated the program as Fair and 7% rated the program as Poor or Fail. Program implementers expect considerably higher ratings for the 2014 program.

Challenges and recommended improvements

- Software must be extremely easy to use and engaging.
- Cities that were not "finalists" essentially dropped out. These cities expressed disappointment. This was mostly corrected in the second round in which cities were awarded prize money based on the number of points…all cities receive something the better the city performed.
- Do a better job at creating meaningful competitions between teams within and between communities.
- Make sharing stories easier. People love to share what they are doing.

Key Lessons

- Key to success is not motivating participants, but motivating local program managers. Cities with the most active local support team performed the best.
- Participants loved comparative feedback.
- People love to share their stories. Make this easier.
- Make the program shorter: from 1 year in Round 1 to 6 months in Round 2.

Quotes from Program Managers

One-on-one personal interactions are obviously very effective at motivating people to adopt behaviors or becoming more energy efficient and reduce their carbon footprint…it is difficult to figure out how you would provide adequate resources to really engage every household in California on that level.

I would say that this type of a program does require substantial resource and staff investment, but as far as actually engaging the population of California in voluntary efforts to reduce their carbon footprints this concept has a lot of potential. I think the same would be true for other programs that tried to engage on particular aspects of carbon footprints like their transportation or water or just energy use.

Cities felt like they had a lot of outreach potential, but they didn't feel like they had enough resources to get the impact they would have liked. At the same time…there is a lot of demand at the household level for this type of program, so I think finding ways to streamline and implement this program would have a good payback.

Case Study 4: Energy Smackdown

Type: Inter-Community Residential Energy Conservation Competition

Description

The Energy Smackdown was a competition between households and communities in Massachusetts to reduce environmental footprints from household energy, travel, waste and meat consumption.[17] The first year (2007) of piloting tested the approach with three households over five months. The second year (2009) of piloting engaged 120 households in three communities through all four seasons. The third season (2010) involved 5,000 households in five communities. The program used elements of gaming to create an immersive experience for participants to take specific actions to reduce their environmental footprint and to participate in fun community-wide events and activities. The program was documented in a reality TV show, with videos showing what activities people are taking and explaining the process in their own words.

Organizers

- Brain Shift Foundation

Goals and Motivations

- Drive demand for energy efficiency services through a motivational program that involves game play.
- Maximize the reduction in electricity and natural gas; and maximize the impact in the community by having deep and wide savings.

Target Population

- Looking for a broad cross-section of households, not just the converted. Wanted many people on the teams to not be the "green types."

The Competition Prize

- Mostly bragging rights, some merchandise rewards from program sponsors

Theories of change

- Kurt Lewin's theory of change[18]
- Community-Based Social Marketing (see Doug McKenzie-Mohr 2011)
- Interactive computer games (rewards, points, etc.)

Communication Channels

- Reality TV program. Ran separately in each community. Ran several times. Was also on

[17] For more information, see: http://www.energysmackdown.com/ and also http://www.toolsofchange.com/en/case-studies/detail/643

[18] See: http://www.change-management-coach.com/kurt_lewin.html

the Internet.
- Email. Some team leaders created their own web pages.
- Phone trees

Activities

- Reality TV program.
- Governing council in each of three towns. The council would recruit participants.
- Increase the level of emotional engagement through events and a reality TV series to increase the level of engagement.
- Participants earned points by percent reduction in 5 areas: electricity, natural gas, meat consumption, recycling, and travel.
- Rewards: points and prizes to accelerate engagement.

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes. Kickoff meeting, they all read pledge.
Goal setting	Group goals were important. They had to be simple and have creative component to it.
Prompts	Yes. There were a lot of tasks, e.g., Locavore Banquet recipes were due on Monday, so they would need reminders. Or, for example, "The Smith Family achieved this result, can anyone beat it?" Prompting them to submit their data.
Social diffusion	Yes. The program had high visibility in communities thanks to challenge events and reality TV.
Comparative Feedback	Yes. It was a competition between teams. Points are compared between teams. Overall savings, reduction in each of 5 categories (electricity, natural gas, travel, recycling, meat). Developed spreadsheet of results from all participants and shared.
Instantaneous Feedback	No
Tailored Feedback	Energy audit by home energy professional
Descriptive norms	Yes. Showcasing what others are doing through reality show. Show producers were purposeful about developing compelling stories.
Subjective norms	Yes. Participants expressed why they were taking the actions.
Scarcity	Limited time to get tasks done.
Loss aversion	No
Reciprocity	In order to be on the team, they had to complete a free energy audit.
Local Messengers	Yes. Communication came from team leaders and energy coaches

Imagery	Yes. Very important. Television showed not just images, but stories in a very compelling way.
Rewards and incentives	Prizes from local sponsors (bicycles, dinners, t-shirts, etc.) as well as recognition at events, newspaper, and via Reality TV.
Competition	Yes
Energy Coach / trusted advisor	Yes

Most effective strategy

- Messaging
- Measurement and verification was important
- Social networking (peer-to-peer)
- Recognition

Cost-effective

- A lot of money went to film editing, and video production.
- Applied for funding for $1.2 million to expand to five cities for two years.

Scalability

- A similar concept might work elsewhere

Resources Available

- $200,000. Utilities and foundations.
- Towns provided meeting places and brought refreshments.
- Support from public access TV. Recording in studios. Borrowed equipment.
- Team members volunteered a lot of time. Consultant did measurement and verification on voluntary basis.
- National Grid and NSTAR contributed financially and paid for brochures.
- Massachusetts Department of Energy and Resources contributed time by coming to events.
- Kendal Foundation provided funding.

Outputs

- 100 participating households in three communities
- Tracked newspaper articles, and TV

Outcomes (Phase 2)

- 14% average annual reduction of electricity (winning household 73%, 2nd place: 37%; 3rd place: 28%)
- 17% average annual reduction in heating fuel (winning household: 66%, 2nd place: 51%, 3rd place: 44%)
- Average annual CO_2 reduction: 20% or 3,000 lbs per person.

- Participants made the following improvements:
    - 77% reduced hot water temperatures
    - 69% replaced incandescent light bulbs with CFLs
    - 54% air sealed or insulated homes
    - 46% installed low-flow aerators
    - 38% purchased green power
    - 38% replaced at least one major appliance with an energy efficient (Energy Star) model.

Persistence

- Participants reported doing the same behaviors 6 months later, but this was not measured.

Measurement and Evaluation

- Measured monthly for all 5 areas. Electricity and natural gas were reported from the local utility companies. Yearly baseline. Yearly air travel. Monthly energy use. And they calculated percent change. Energy use was adjusted by heating and cooling degree days. Utilities as well as a consultant reviewed the data.

Program Evaluation Findings

- An internet survey was used to obtain anecdotal feedback (from memory). In general, participants loved the program. They loved the challenge events. They thought the measurement and verification was a pain. Measurement and verification needs to be streamlined.

Challenges and recommended improvements

- Funding was the major barrier to continuing the program. The pilot program operated successfully on a fairly small budget.

Key Lessons

- Any of the motivational strategies could work. It is just a matter of really doing them well so that they work.

Quotes from Program Managers

In my experience, any one of those (behavior change strategies) you can make a lot of headway with. You can make it work for you if you really engage the people in it.

The idea was to have the participants become lost in the moment. I would describe that as, for example, when kids play a computer game, they can become so immersed, it is hard to get their attention. So we were looking to have these adults become so engaged in the game play that they forgot that they were saving energy. And we were quite successful doing that.

The surprises were the energy and creativity of people exhibited. We had a light bulb challenge where people had to change as many light bulbs as they could in one day. But they had to follow the rules. For example, they had to start at 7 am and finish at 7 pm; they had to finish one box of bulbs before they could come back and get another. The Arlington team was able to win the challenge by planning everything out ahead of time. Who was going to go where and get what. At 7 am, boom, they were off! They basically taught us how to do it. It is where there is great promise, I believe, tapping into people's creativity. The film about it was very funny.

We basically used messaging directly from the individuals to the audience.

People already get a lot of free stuff out there. In my experience, recognition was way more powerful as a motivator.

It is mostly not about energy. It is more about community and giving people an excuse to feel good and be with their neighbors. That is what I discovered.

If you are going to do a program like this, you should remember that people are busy. I like to think of the ideal program as something like an iPhone for its ease of use. It takes a whole lot of thinking and creativity to come up with a program that is fun and easy to use. If you put that type of thought and creativity into developing your program, then people who are mostly thinking about their kids and all their daily concerns can get engaged because it is easy and even a little fun.

Case Study 5: Kansas Take Charge Challenge
Type: Inter-Community Residential Energy Conservation Competition

Description

The Kansas Take Charge Challenge is a statewide energy savings contest, created by the Climate + Energy Project, and funded by the Kansas Corporation Commission (KCC), involving more than 275,000 Kansans from 16 different communities.[19] One winner in each region received $100,000 grant for an efficiency or renewable energy project. Participating communities also received up to $25,000 in energy efficiency block grant funds to host the challenge.

Residents and small businesses competed to see who could save the most energy. The competition was measured and judged based on three criteria:

1. Whole-house energy efficiency -- Efficiency Kansas energy audits and completed projects
2. Lighting changes -- switching to energy-efficient light bulbs; small business retrofits; programmable thermostats
3. Community involvement -- public education and outreach.

The program started in 2009. The first program was a year, and the second program lasted nine months. The most recent program (2012) lasted six months. The first year program was used to promote existing underutilized programs, like weatherization. At that point, they had a huge backlog of people waiting for weatherization.

Organizers

- Climate and Energy Project: co-designed and implemented the program.
- 1st year. Kansas Housing Resources Corporation: Weatherization assistance project.
- 2nd year. State of Kansas: Efficiency Kansas. On-bill financing program for whole house retrofits. Utilized the Challenge to promote that program.

Goals and Motivations

- Bring recognition to the value of energy efficiency. There was very little state-level policy on energy efficiency, and utilities were not heavily involved in energy efficiency in Kansas. When people thought of energy efficiency, it was usually in the context of giving something up. The organizers wanted to change the public perception of energy efficiency so that it was valued.
- Increase awareness of energy efficiency in the public and private sectors.
- Demonstrate that you can engage small and large communities, a variety of utility types (municipal, cooperatives and investor-owned utilities). Worked in geographically diverse areas.

[19] For more information, see: http://www.takechargechallenge.com/kansas2011/challenge.shtml

Target Population

- Did not target a specific group. They wanted to involve the entire community of residential customers.
- In the third year, they attempted a challenge with just businesses.
- Mayors, city managers and other high profile people were engaged.
- More lower income people in the first year because they were promoting low-income programs, such as weatherization.
- Efficiency Kansas also required investment, so the target population also included higher income households.

The Competition Prize

- Two prizes were awarded. One for most kWh reduced, the other for greatest percentage reduction.

Theories of change

- Did not have an overarching theory of change.
- They were aware of Opower programs that relied on comparative feedback.

Communication Channels

- Initially, community-based flyers, newspaper, earned media, public service announcements, grocery bag inserts, CFL promotion from local hardware stores, community events, a float at the Christmas parade and a booth to pick up a free CFL. Outreach depended on local community organizers. This was rural Kansas in 2009, so there was not a lot of widespread internet use.
- Second year: added email.
- Latest Challenge: businesses received weekly task lists, website.

Activities

- Work with a leadership team in each community. The city, county, school district, and non-profits, etc., were all a part of the leadership team.
- Town hall meetings, so the public could get involved.
- Focus each quarter on a particular technology - e.g., lighting. Record and announce results. Weatherization. Signing up for utility programs. Reported successes and then rolled out a new initiative during the program.

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes, in first and second year participants. People pledged to switch 5 bubs and then posted this information in the library.
Goal setting	Yes. Second year they had goal setting for participation within leadership teams. Businesses had a “number of participants” goal.

Prompts	First year: magnets with 5 actions (wash in cold water, install a CFL, etc.). Second year: tip sheet of simple things people can do to win. Third year: weekly tasks and tip lists.
Social diffusion	Yes. Schools – leadership teams did skits. Energy bandit with Captain Powerstrip. Students had workshop to search for energy bandits at school. Winner had pizza party. Community groups. Churches were involved.
Comparative Feedback	Website on community rankings.
Instantaneous Feedback	No
Tailored Feedback	Some. For homes that got audits.
Descriptive norms	Some. Peer pressure was important.
Subjective norms	No
Scarcity	No
Loss aversion	Somewhat. Mostly framed in terms of what they would gain. They did use a basketball at some events to show how big of a hole wasting energy was.
Reciprocity	Giving away CFLs
Local Messengers	This was the most important strategy
Imagery	Images were used at all events. Took pictures of participants and uploaded to website. Leadership teams earned points by uploading photos.
Rewards and incentives	First year. $10,000 to winning cities. Recognition luncheon for each city. Second year: kicked off Challenge at Governor's mansion. Announced winner at event. Third year: certificates for participation. Window claim/ label that they had participated. Prizes and recognition for businesses. No prizes for individuals in residential competition – all community prizes. Third year: businesses and communities were recognized.
Competition	Natural rivalries.
Energy Coach / trusted advisor	No
Framing	Saving money. Make home more comfortable. Winning. Sports analogies. Community pride. Second year: natural rivalries.

Most effective strategy

- Competition was most effective in first and second year. Natural rivalries tend to be effective in certain areas.
- In Business challenge, the rivalry and competition was not a motivator.

Scalability

- The program can very much be scaled to other cities and other locations

Resources Available

- Year 1 (6 cities in 2010). Foundation funding. Shoestring budget. 2 half-time staff for 15 months. Provided two $10,000 prizes to winning communities. Prizes had to be used for energy efficiency or renewable energy that would benefit community. One city used it to provide solar panels on a visitor center. Another city upgraded homes to higher efficiency heating systems, particularly for low income, elderly residents. Each community spent about $6,000 for events. The cost of the program was $60,000, plus one person (FTE equivalent) for 1.5 years.
- Year 2 (16 cities in 2011). $1.2 million American Recovery and Reinvestment Act (ARRA) grant: this included $400,000 in prize money. They gave $100,000 prize to each of four regional communities. They hired 5 part-time regional coordinators, and they had a fairly robust marketing budget.
- Software: partnered with Phillips lighting. They created the website that tracked bulb switches.

Outputs (2010 – 6 cities)

- Switched over 50,000 bulbs to CFLs and distributed hundreds of weatherization kits and energy-saving power strips.
- Installed over 1,000 programmable thermostats and more than 200 energy-efficient appliances in homes.
- Donated 2,600 hours of volunteer time to host 65 community events promoting energy efficiency and conservation which were attended by over 11,000 people.

Outputs (2011 – 16 cities)

- During the first year, the top city reduced its residential energy use by 5%.
- 7 million kWh of electricity were reduced, and residents took additional measures that would save another 6 million kWh.
- 50,000 CFLs were distributed. Installed over 1,000 programmable thermostats.
- Donated over 2,600 hours of volunteer time. Hosted 65 events in 6 communities. The program exceeded their wildest expectations.
- In nine months, these communities held over 1,000 events and programs involving over 404,000 Kansans.

Outcomes (2011 -16 cities)

- 110.2 billion BTUs of gas and electricity were saved, with an annual savings valued at $2,341,025; 22 million pounds of CO_2 were not released into the atmosphere.
- 1,141 energy audits were conducted.
- 152 “Whole House” efficiency projects were completed.
- 309,154 incandescent bulbs were switched to energy efficiency CFLs.
- 4,022 programmable thermostats were installed.

- University Region: 576 audits were conducted, 90 whole house retrofits were completed, 71,265 bulbs were switched, 3,266 programmable thermostats were installed, and 261 events were conducted, reaching 57,954 residents.
- Northeast Region: 144 audits were conducted, 1 whole house retrofit was completed, 58,204 bulbs were switched, 1,066 programmable thermostats were installed, and 142 events were conducted, reaching 65,010 residents.
- Southeast Region: 337 audits were conducted, 28 whole house retrofits were completed, 120,050 bulbs were switched, 576 programmable thermostats were installed, and 374 events were conducted, reaching 177,762 residents.
- Northwest Region: 84 audits were conducted, 33 whole house retrofits were completed, 59,635 bulbs were switched, 114 programmable thermostats were installed, and 132 events were conducted, reaching 104,248 residents.

Persistence

- Not estimated

Measurement and Evaluation

- In year one: control group for each community. Metered data were collected, both pre- and post-installation, along with weather normalization.
- In year two: three criteria were used for determining winner of the competition: 1) whole house (got points for getting an audit and points for completed projects), 2) specific projects: lighting, programmable thermostats, etc., and 3) community involvement – public education and outreach. You needed to win two out of three categories to be the winner.

Program Evaluation Findings

- No formal evaluation was conducted.
- Initially, the program developers didn't know what to expect. They hoped to generate media attention.
- The six original cities "blew it out of the water."

Challenges and recommended improvements

- Business challenge: they thought this would work well. The Chamber of Commerce would be a good partner. There wasn't the same type of leadership team commitment as there was when you have kids in schools, etc. They needed the community base to engage people.
- They created and redesigned the website, so cities could purchase a toolkit to use the website and guides, consulting time, etc. for future rounds of the competition.
- They are adding water and recycling actions. Also, some cities are interested in air quality – so they may focus on electric lawn mowers, etc.

Key Lessons

- Switch messaging to be more positive about energy efficiency.

- Build relationships with influential champions across the state.
- Get buy-in from cities and work with them to build the community and help communities set goals. It is important to meet with the cities prior to launch of program for design.
- A more prescriptive program can be motivating, and more scalable, but participants will not be as personally engaged.
- Select the cities based on natural rivalries.

Quotes from Program Managers

One of the things we learned is that while the competition aspect helped to motivate people, kind of just regionally, because the communities were so far away from each other, there was no natural rivalries. In year two, those 16 cities were actually 4 regions and a winner for each region. In the University region, we had the Kansas State versus University of Kansas and really played up the sports rivalry. Three other regions: West, Central and South East. Those regions competed again.

The leadership team might be staked out on this main street at a sidewalk sale, and trying to talk to people about energy efficiency and they would say, do you want to save money, do you want to help the environment and people would keep walking, but as soon as they would say, do you want to beat (name of city), the people would stop and listen to their spiel. So that was part of the messaging that worked, more specifically in some areas than others.

Now the website is substantial with actions they can take. Our hope is how we can use the product as a fee for service.

The thing I would say was missing in Round 2 of the Challenge… In Round 1, it was a really small prize, but people were really motivated. I attribute that to the fact that we spent a lot of time with the leadership team and town halls and really engaging with people and getting their ideas and support and their buy in. In the second round, the leadership team was really motivated to win because they were going to win $100,000. We didn't have the luxury to spend as much time…In the first Challenge, we spent 4 different meetings with the leadership teams and with the town hall. We got maybe 1 or 2 meetings in the second round. And so we had great participation but it wasn't as robust and people weren't quite as personally engaged. So much was prescribed by us about what actions they would take versus the autonomy they had in the first round of "here's how we want to implement this strategy from a community standpoint." I think there is real value with that engagement with community members to build that sense of community and build that common goal.

Case Study 6: Minnesota Energy Challenge

Type: Inter-Community Residential Energy Conservation Competition

Description

The Minnesota Energy Challenge uses a fun and easy website where Minnesota residents can learn how to stay comfortable and save money in their homes[20]. Launched in 2006 by the local nonprofit Center for Energy and Environment (CEE) based in Minneapolis, the Energy Challenge provides in-depth guides to energy efficiency and conservation actions, as well as practical information about savings and cost. Members can also join teams for their city, business, congregation, school, neighborhood and other community organizations and use the Energy Challenge to track their group savings.

Organizers

- Center for Energy and Environment

Goals and Motivations

- Goal was to launch a website to help Minnesotans reduce their energy consumption through daily habits
- Create a website as a way for people to pledge to take action
- Highest goal would be to get 10% of Minnesotans to participate in the challenge

Target Population

- They were interested in attracting people who are not just the early adopters. People who hadn't thought it about it much, but didn't have negative reaction.
- Schools became a central target audience –Turn Out Lights Behind You (TOLBY) mascot was used.
- The website doesn't ask for demographic information.

The Competition Prize

- No physical prize beyond money saved from enacting conservation behaviors

Theories of change

- Modeled on challenges with churches

Communication Channels

- Website
- Community groups
- Table at state fair
- Quarterly newsletters: with theme, e.g., summer travel

[20] For more information, see: http://www.mnenergychallenge.org/

Activities

- A fun and easy place (website) where Minnesotans can go to receive practical information to reduce their energy and to join teams
- It wasn't intended to be a competition, but groups competed against each other on their own
- Users can either enter their usage or just use the state average
- Outreach: CEE is in neighborhoods and communities to do energy financing. They also conduct workshops.

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes. Website: making public commitment
Goal setting	No
Prompts	Partial. Quarterly newsletters serve as reminder. Participants can print pledges.
Social diffusion	Teams: schools, churches, businesses, neighborhoods, etc.
Comparative Feedback	Yes. Compare usage to average usage. Compare your team CO_2 savings with average savings.
Instantaneous Feedback	No
Tailored Feedback	No
Descriptive norms	Partial. The website shows every year Minnesotans will save $13 million if they follow their pledges.
Subjective norms	No
Scarcity	No
Loss aversion	No. Saving money and energy framed as positive
Reciprocity	Partial. They provide everything for free, including TOLBY
Local Messengers	Yes. Through teams
Imagery	Yes. "We use very few words"
Rewards and incentives	Partial. Have had recognition in the past. Feature people in blog.
Competition	Partial. Used somewhat in communication to neighborhoods. Neighboring neighborhoods would run their own competitions. Two congregations ran their own competition to sign people up.
Energy Coach / trusted advisor	No

Most effective strategy

- "The realization that every bit counts… Your small contribution adds up."

Cost-effective or not

- Education is really the objective. Difficult to measure impact.
- Tabling can be either effective or not.

Scalability

- A similar concept might be scalable.

Resources Available

- All internally funded, within CEE.

Outputs (2006 – present)

- 30,693 participants
- Education provided to schools and community groups

Outcomes

- $13,280,276/year in pledged reductions

Persistence

- Not measured

Measurement and Evaluation

- Pledged actions: Each pledged action equates to amount of savings.

Program Evaluation Findings

- Program evaluation not conducted.
- The program meets their expectations.

Challenges and recommended improvements

- If we start to tell people how much money they save, it is not a big number.
- Partners would help get people engaged.

Key Lessons

- It's going to take a lot more follow up than you think… People really want to take the challenge, they didn't feel comfortable with the content to be the voice for it… We really had to be there to be the one who spoke of it.
- Figure out who your audience will be. If you want to engage beyond the early adopters, it is important to get buy in from them, not just the early adopters who want to go after deeper savings and will take the project in a different direction.
- Focused now on education, connections, being in the community. Originally focused on number of pledges. "It is a resource and an extension of what we do."

Quotes from Program Managers

> *Originally we thought we would build this site, and it would be a great resource and people would use it. And what we learned very quickly is that it was a great website and a great resource and people wanted you to come and tell them how to use it…There was*

maybe an energy committee at a congregation and they would call us. They didn't' feel comfortable giving the message. They wanted you to come and give the message. They wanted it to happen. But the Energy Challenge didn't fit the answer of people are just going to run with it. People are going to run with it if you are there to help them run with it.

We really designed the challenge to say wherever you are right now there is something little you can do…The idea behind it was once you get people thinking about it, even if it is just small steps that they take, that they would tend to make a larger investment….just thinking of themselves as more energy conscious.

For us, the whole things about change and making energy efficiency the norm is starting to work with kids and getting the kids to make the change on their own and then encouraging their families to do the same.

For us, it was really about not having to take too many steps…to make it easy for people to make the change.

The key lesson is it's going to take a lot more follow up than you think. You're going to have to hold somebody's hand. People really want to take the challenge, but they didn't feel comfortable with the content to be the voice for it. So, we were able to really engage people and to get people interested and get people to bring it to places, but we really had to be there to be the one who spoke of it. They want you to go there and explain to people why to do it.

How do we help to shape utility programs? Audit was a scary word for people…that is why we changed the word to home visit. We want to meet people where they are…where is this person at right now and what is the most likely things they will do?

We did workshops where we had homeowners take materials home with them and install them before we visited… So that when we came into their home, they have already turned the gear of we're energy conscious and we make energy efficiency decisions…. So that when we went in their home and said you need insulation, the mindset was already geared toward changing their perception of themselves.

Case Study 7: Western Mass Saves Challenge

Type: Inter-Community Residential Energy Conservation Competition

Description

In 2011, the Western Mass Saves Challenge offered utility customers access to an online portal with personalized energy-saving advice and rewards for reducing energy, as well as home energy reports to selected households.[21] In an effort to test community-based mechanism to drive more participation to the website, the Western Massachusetts Electric Company (WMECo) contracted the non-profit SmartPower to run a challenge between four small towns to reduce electricity consumption. Towns were given a target of community-wide electricity savings of 3%. Towns reaching the goal were to be awarded a 1 kW photovoltaic system on a public building. Towns were ranked throughout the 8-month competition on a project website. At the end of the program, none of the towns had reached the 3% target, however, all had demonstrated electricity savings. The town of Sunderland achieved the most reductions (over 2% community-wide) and was awarded a 1 kW photovoltaic system.

Organizers

- Western Massachusetts Electric Company (WMECo)
- SmartPower administered the marketing aspects of the program
- Efficiency 2.0 provided software to track and manage electricity
- Recyclebank provided rewards for points earned through program.

Goals and Motivations

- Test community-based strategy to increase adoption of utility website

Target Population

- Small communities in western Massachusetts that would have strong sense of community pride.

The Competition Prize

- Any town that achieved a 3% community-wide electricity reduction would receive a 1 kW solar photovoltaic system on a community building. Individuals were also eligible for individual rewards based on points earned by saving electricity. Individuals were ranked on a scoreboard showing all participants in each community.

Theories of change

- Comparative feedback

[21] For more information, see: http://nuwnotes1.nu.com/apps/wmeco/webcontent.nsf/0/60E2FD4B2C901670852579E50048C89E?opendocument

Communication Channels

- Website
- Email
- Local news media

Activities

- Outreach to community members
- Encouraged customers to sign up for online platform
- Provided tips to individual participants to reduce their energy
- Awards ceremony

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes. Individuals created plans to reduce electricity in online portal
Goal setting	Yes. Community goal of 3% community-wide reduction. No individual goals
Prompts	Yes. Emails generated from online software
Social diffusion	Yes. Social media and also within communities
Comparative Feedback	Yes. Comparison of individuals and communities on website
Instantaneous Feedback	No
Tailored Feedback	Partial. The online portal customized tips based on their electricity usage. It was not a fully tailored in-home energy audit, but an online software tool.
Descriptive norms	Yes. Marketing materials said "Join 6,000 of your neighbors who have already signed up."
Subjective norms	No
Scarcity	Yes. Rewards program available to first 5,000 customers for entire Western Mass Saves program
Loss aversion	No
Reciprocity	No
Local Messengers	Partial. Much of the messaging was created by the program, but there was also local messaging
Imagery	Yes.
Rewards and incentives	Yes. Heavy emphasis on rewards to individuals and community.
Competition	Somewhat. The communities were ranked, but any community reaching the target would win the prize. Recognition was given to all communities based on their total savings.
Energy Coach / trusted advisor	No

Most effective strategy

- Comparative feedback
- Tailored tips on software platform

Scalability

- SmartPower has run similar community-based challenges in other communities, mostly in the Northeast.

Resources Available

- No data are available

Outputs

- None

Outcomes

- Ludlow (21,103 pop.), 441 customers reached 0.1% savings
- Amherst (37,819 pop.), 673 participants achieved 0.55% savings
- Easthampton (16,053 pop.), 566 participants achieved 0.89% savings
- Sunderland (3,684 pop.) achieved 2.31% savings

Persistence

- Not measured

Measurement and Evaluation

- Compared energy use to previous year's energy use.

Program Evaluation Findings

- None provided

Challenges and recommended improvements

- An evaluation of the entire Western Mass Saves' programs conducted by an evaluation firm found that participants rarely claimed rewards. There were also fairly low adoption rates.

Key Lessons

- Rewards don't seem to be very effective. Very few people who earn rewards claimed them (Opinion Dynamics and Navigant Consulting 2012).
- Basing competition on percentage reduction for all community residents, whether or not they opted in, gave an unfair advantage to the smallest community (Sunderland) which is roughly 1/10 the size of the largest community in the challenge (Amherst).
- Opt-out programs, such as home energy reports, provide greater overall savings than opt-in programs (Opinion Dynamics and Navigant Consulting 2012)

Quotes from Program Managers

No interview was conducted for this case study. The program is no longer active, and the program implementer thought the program had been reviewed sufficiently in other studies.

Case Study 8: NYSERDA Competition-Based Pilot for Residential Consumers
Intra-Community Residential Energy Conservation Competition

Description

This was a small pilot conducted by the New York State Energy Research and Development Authority (NYSERDA) between households in three socially engaged neighborhoods in Brooklyn.[22] The primary goal was to understand the administrative costs of running such a program and to learn from the experience. The starting date was February 9, 2010, and the program ran for one year, with each new month starting on the 9th. Monthly updates went out once usage was tabulated. Everyone was combined into one group. Two rankings were created: absolute energy use and percent reduction from previous year. Each individual participant competed to be the best in either or both categories (absolute and percent reduction savings).

Organizers

- NYSERDA: designed and implemented the program
- Con Edison: provided data

Goals and Motivations

- Try to understand the level of administration that would be required to run a residential-based energy reduction competition.
- There was not a specific target.

Target Population

- Chosen because they would likely be receptive. These are eco-conscious neighborhoods.

The Competition Prize

- No prize, since there was no competition per se.

Theories of change

- Literature on competitions

Communication Channels

- Monthly emails showing ranks
- Community organizations

Activities

- Opt-in strategy. Notifying them via community organizations
- Sign up – which gave them access to only electricity utility data.
- Sent out monthly email blast that was customized to each household showing ranking. Email included seasonally appropriate tip sheet. City council member was highlighted.

[22] For more information, see: http://web.stanford.edu/group/peec/cgi-bin/docs/events/2011/becc/presentations/1%20NYSERDAs%20competition.pdf

- Nominal prizes: Second phase was a 12-month competition. iPad was a prize.
- Gave out CFLs, powerstrips, etc.
- Lending library: lent powerstrips, etc.

Behavioral Strategies Employed

Strategy	Description
Commitments	No
Goal setting	No
Prompts	Partial. Just the monthly email.
Social diffusion	Community groups and neighborhoods. Used the congressman, Brad Landers.
Comparative Feedback	They could see their rank. They could not see individuals. Sometimes they could see the top performer.
Instantaneous Feedback	No
Tailored Feedback	No
Descriptive norms	Possibly in some of the messaging.
Modeling	There were examples of top users. Congressman was a participant and his usage was made available.
Subjective norms	No
Scarcity	Partial. Deadline for joining
Loss aversion	Partial – it may have been used in certain communications.
Reciprocity	No
Local Messengers	Yes. Important to have neighborhood organizations.
Imagery	Partial. Graphs of performance over the year. Photos of items.
Rewards and incentives	Small prizes: iPad for winner. Interim small prizes, at the end of each quarter. Negligible impact. Winner publicized quarterly and at the end.
Competition	Yes
Energy Coach / trusted advisor	No
Positive or negative feedback	No

Most effective strategy

- Not clear

Scalability

- This could possibly be scaled to a school or church environment, within compact groups.

Resources Available

- One full-time intern. Two NYSERDA project managers dedicated 5% of time. No funding available.

- Some prizes were donated: $1,000.

Outputs

- 159 households
- Monthly emails, survey, event at the end

Outcomes

- Program implementers did observe energy savings: 4% electricity reduction (comparison of present electricity use to past year's electricity use).

Persistence

- Not measured

Measurement and Evaluation

- Compared energy use to energy use of previous year.

Program Evaluation Findings

- The only goal was to see how much effort would be required, so that goal was achieved.
- There was no formal evaluation.

Challenges and recommended improvements

- Difficulty in aggregating date on a monthly basis, since people have different billing dates.
- What to do with outliers in the dataset?

Key Lessons

- They have a better understanding of the time commitment required.
- They found it challenging to collect billing data and make it consistent. There were different meter reading dates. Some utilities estimated meter readings, if they can't read them.
- It is resource intensive to figure out what messaging works.
- Social cohesion is helpful, but this may make it more difficult to scale.

Quotes from Program Managers

> *If we pursued this for future rounds, we would focus more on framing, social norming, and messaging around feedback they are receiving.*
>
> *It was important to have the community groups send out reminders to members…. Having those reminders come from those groups as well as the monthly emails, I think that kept people pretty engaged.*

Case Study 9: San Diego Energy Challenge
Intra-Community Residential Energy Conservation Competition

Description

The San Diego Energy Challenge (Manage-Act-Save) encouraged San Diego Gas and Electric (SDG&E) customers to be more aware of their energy use and to conserve energy at home every day, but especially on peak days, when demand for energy is higher than usual.[23] Beginning in July 2012, SDG&E customers within the San Diego Unified School District boundaries were able to enroll in the San Diego Energy Challenge. These customers were recruited through various channels including email, direct mail, and through outreach events at local San Diego middle schools. Customer Engagement for the San Diego Energy Challenge Phase I demonstration was implemented in two parts:

1. A ***community segment*** (July 2012 – November 2012) in which customers could save energy in their households to win prizes for themselves and a local San Diego middle school of their choice; and

2. An ***individual segment*** (December 2012 – April 2013) in which customers received Weekly Energy Summary emails and could compete against their friends and neighbors for prizes just for themselves.

Customers who enrolled in the *community segment* of the competition were provided with:

- Access to an *Engagement Platform* with monthly, weekly, and hourly energy use data
- Opportunities to win prizes for a local middle school of their choice
- Opportunities by drawing to win individual prizes

Organizers

- SDG&E: ran the program
- Simple Energy: provided the software

Goals and Motivations

- Phase 1 goals: 1) Enable access to smart meter data for residential customers, 2) empower them to better manage energy, 3) support third-party access to provide value-added customer service, and 4) reduce peak demand energy use in summer
- Phase 2 goal: same goals as Phase 1 and save an average of 2-3% electricity consumption, with 20% participation in complementary programs

[23] For more information, see: http://www.sdge.com/newsroom/press-releases/2012-06-06/sdge-launches-reduce-your-use-day-rewards

Target Population

- SDG&E customers.

The Competition Prize

- $10,000 (households with the most percentage reduction earned prizes (computer or iPad)).

Theories of change

- Did not have an overarching theory of change.

Communication Channels

- Email, direct mail, and through outreach events at local San Diego middle schools, website
- Website (Simple Energy)

Activities

- Phase 1 - Part 1 of pilot program (July 2012 – April 2013)
    - Marketing and outreach (pull strategy)
    - Participants had to opt-in to the online software.
    - Earned points for taking simple actions and reducing electricity on peak days
    - Participants were required to join a middle school. Points earned by participant improved the ranking of the school.
    - Points redeemable for small prizes and entered into drawings for larger prizes.
- Phase 1 - Part 2 of pilot program (December 2012 – April 2013)
    - Large treatment group of SDG&E customers (44,000 in total) received weekly emails with neighbor comparisons and tips to save energy, plus they could further opt-in to the online software to earn points that they could redeem for prizes. This was only for individual participants, not for schools.
    - Participants could receive extra points for participating in a Reduce Your Use event to reduce peak time electricity consumption.

Behavioral Strategies Employed

Strategy	Description
Commitments	No
Goal setting	No
Prompts	Partially. During phase 1 there were alerts on “reduce your energy” days. Phase 2 – No prompts.
Social diffusion	Yes. Phase 1: Share or post badges. Earn virtual badges to encourage participation. Post badges on Facebook or Twitter. Not very successful. Phase 2: Earn virtual badges to encourage participation; and was an opt-out program.
Comparative Feedback	Yes, neighbor comparison.
Instantaneous Feedback	Partial, with online portal connected to smart meter data.

Tailored Feedback	Partial. Tips are tailored to their usage.
Descriptive norms	Yes. Testimonials with pictures and text
Subjective norms	No.
Scarcity	Yes. Limited time (to earn and use points)
Loss aversion	Yes. If you don't act now, you lose your points
Reciprocity	No
Local Messengers	Somewhat. Engaged principals but did not speak with teachers.
Imagery	Somewhat.
Rewards and incentives	Yes, there were prizes for individuals and schools in Phase 1; in Phase, 2 prizes just for individuals. In Phase 2, gift cards to a coffee shop were popular.
Competition	In Phase 1, schools were awarded financial prizes and recognition. In Phase 1, individuals earned gift cards and the top 2% were entered into a drawing for computer or iPad. In Phase 2, individuals earned gift cards.
Energy Coach / trusted advisor	No

Most effective strategy

- Loss aversion was most effective: people would lose points if they did not use them.

Cost-effectiveness

- Paper reports are more expensive. If similar results could be obtained with email, then that would be more cost-effective.
- Once users get online, they save more.
- The website needs to be maintained and make sure it works properly.
- Rewards: still testing to see if cost-effective. In Phase 2, great customer engagement and customers seem to like it – may keep it on for other reasons…customer engagement: helps move them from disengaged to engaged.

Scalability

- Phase 2 is possibly scalable to other utilities.

Resources Available

- Phase 1: $500,000 DOE grant, matched by SDG&E = $1 million. Phase 2: $2 million grant – matched and it became $4 million.

Outputs (for Phase 1)

- The *community segment* resulted in 5,634 enrollments with 4,011 of those customers competing on behalf of a local middle school.
- When the competition concluded in April 2013, the San Diego Energy Challenge had 11,391 "engaged customers," who had activated their account on the *Engagement*

Platform and approximately 36,600 "encouraged customers" who were receiving Weekly Energy Summary emails but had not activated their SDG&E account on the *Engagement Platform*.

Outcomes (for Phase 1)

- Participating households used 20% less electricity during 3 months compared to 9% savings for homes with dashboard alone.
- 6% Summer electricity savings
- 2.2% incremental peak load reduction
- 42,400 SDG&E customers receiving weekly emails
- 4,011 SDG&E customers supporting the community competition for San Diego middle schools
- 39 San Diego middle schools competing
- $26,500 in cash grants awarded to 9 schools

Persistence

- Not measured

Measurement and Evaluation

- Used treatment and comparison groups to measure savings.

Program Evaluation Findings

- None

Challenges and recommended improvements

- Difficult to prevent the control group from learning about the program through citywide marketing efforts, complicating the results.
- The program changed mid-course by closing down the opt-in schools program and moved to an opt-out information campaign, with individual prizes for those who opt-in to the website.
- There was some confusion on how customers earn points. More difficult actions should earn more points. Participation should also earn more points to encourage participation.

Key Lessons

- Not as easy as it looks.
- Experimental design is difficult to do, particularly for opt-in programs.
- A lot of offerings out there – if you want to scale up it, it makes it challenging.
- It would be helpful to bring on a customer design panel early on – get their feedback before launching the program. What we think is great may be completely different.
- San Diego School Challenge – there may be different ways to implement that are not as resource intensive: e.g., getting teachers involved, making sure timing is right, and aligning with curriculum.

Quotes from Program Managers

It's not as easy as it looks. The initial set-up and design is very important, so a good amount of time needs to be spent on that before a program is launched.

Experimental design is not practical. It's confining and makes it difficult to scale up.

As a behavior energy intervention strategy, I don't know how effective rewards really are compared to some of the other intervention strategies. However, as an engagement tactic, it may work very well to grab a customer's attention and get customers educated on energy usage and what they could do to save.

It would be helpful to bring on a customer design panel early on – get feedback before a program is launched. What we think is a great program design may not be effective and engaging to customers.

Points were motivating. We want to be able to tie points more closely to getting rewards.

Case Study 10: Opower Social
Intra-Community Residential Energy Conservation Competition

Description
Since 2012, Opower has partnered with Facebook and the Natural Resources Defense Council (NRDC) for this first-of-its-kind application of Opower Social. Consumers can compare their energy use to similar homes, share and discover energy saving tips and advice, compete with friends, and participate in team-related energy-reduction challenges. They provide ease of access to personal energy data via a unique utility data connect feature that overcomes a significant barrier to adoption. The opt-in design combines the broad reach of Facebook with Opower's growing utility partner network.[24] The application was taken down April 15, 2015.

Organizers
- Opower: App design and development. Developed the software.
- Facebook: Expertise on developing app. Marketing and association of brand.
- NRDC: Promote to environmental community. Helped to form partnerships.
- Utilities (17 in total) enabling 20+ MM households to participate by directly connecting their utility data.

Goals and Motivations
- Drive increased energy savings and customer engagement
- Experiment with social and gamification to drive behavior change in the energy space
- Explore additional methods to engage utility customers
- Create increased utility engagement through viral growth of user base. If it worked exactly as they'd hoped, it would be a self-sustaining user base and it would virally grow. Virality factor of over 1, and they would see return, and a reduction in usage.

Target Population
- Open to all consumers in the US. Consumers at participating utilities could also directly connect their utility data for comparison
- Initial targeting to utility customers at participating utilities and green oriented groups in Facebook and NRDC
- The people who participated were exactly like that…people who were really passionate about it.

The Competition Prize
- None. Gift cards available to some participants.

Theories of change
- Social norms
- Social comparison may be stronger if against people you know, versus neighbors.

[24] For more information, see: https://social.opower.com/

Communication Channels

- Website
- Every month users get an email
- Users could message each other – Facebook messages

Activities

- Marketing
- Customers opt-in. Customers voluntarily sign up using Facebook ID
- Users enter data: Manual, Green Button or utility direct data connection
- Friend comparison – your usage versus friends
- Create teams (public and private)
- Web pages, such as utilities or NRDC, companies, schools
- Generic comparison – enter home profile info (square feet, bedrooms, etc.) compared to 20 million customers. Your home is benchmarked.
- Recommendations – "ways to save" – a database of recommendations.
- Badges: savings are counted and users earn badges based on cumulative and monthly savings.

Behavioral Strategies Employed

Strategy	Description
Commitments	Partial. You could challenge people to sign up and use it.
Goal setting	Partial. Some utilities had goals that they would message to customers, e.g., 1% to 5% savings.
Prompts	Yes. For those connected to utility data stream, would receive email when new data arrived, prompting them to go check out standings. If people manually entered data, they would get a reminder to enter data when they received their bill.
Social diffusion	Yes. Through Facebook. This was a key strategy.
Comparative Feedback	Yes. You know where you stand compared to friends and typical households like yours.
Instantaneous Feedback	No.
Positive or negative feedback	Yes. Congratulating them when they do something well. Earn badges for cumulative savings and month on month improvements. Character would jump around and dance.
Tailored Feedback	No
Descriptive norms	Partial. Not explicitly but the social comparison shows what your friends are doing.
Subjective norms	Partial. In the pages, users could optionally add comments.
Scarcity	No
Loss aversion	No

Reciprocity	No
Local Messengers	Yes. It was messaged through social networks.
Imagery	Yes. Icons. Characters on the website conveying different emotions…jumping up and down, smiley face, etc. Badges conveying different achievements of energy savings that could be shared in Facebook.
Rewards and incentives	Yes. If they joined challenges, they were in the running to earn gift cards.
Competition	Yes. Challenges had a target to save. Leaderboard showed you directly against peers with direct rankings..
Energy Coach / trusted advisor	No
Gamification	Yes. Badges earned for month on month reduction and cumulative savings. Leaderboards for ranking against friends. Group competitions and leaderboards. Challenges sponsored by groups

Most effective strategy

- They were surprised that the project wasn't as effective as anticipated.
- As an opt-in approach, it did not reach a significant enough user base to rigorously measure energy change.
- For people who are engaged, this could be motivating.

Scalability

- Some of the elements are now included in the main Opower software. Points and rewards are now used at Opower to drive targeted engagement of some customers, and it drives satisfaction and getting them to do specific actions. Sharing features are within main Opower platform to share to social media.

Cost-effective

- Did not drive cost-effective energy efficiency relative to Opower's opt-out behavioral energy efficiency program
- Getting people to sign up in significant enough numbers to be effective in driving utility outcomes is a barrier.
- Interest in participating in a community experience was difficult.
- It could be cost-effective for every engaged customer, if you can give them a place in the software to do this.

Resources Available

- Staff time: not able to disclose
- Funding: not able to share
- Marketing: at launch, there was a PR team at NRDC, Opower and Facebook that reached out to national and international press. Utilities did their own press. Sent out hundreds

of thousands of emails. Some radio advertisements.

Outputs

- Low tens of thousands participated
- Usage & engagement
    - Active usage was 25-30% of signed up users
    - ~3 min average time on site

Outcomes

- None

Persistence

- Low persistence of return visits to website (80% were one time visits)
- Users that had connected to utility data stream had 60% return rates. Manual data entry is a very high threshold to participation.

Measurement and Evaluation

- Savings not measured. Not large enough participation group for statistically significant test/control measurement.

Program Evaluation Findings

- Compared to three metrics, the project didn't work. Metrics were 1) virality factor of over 1, 2) people would return, and 3) reduction in usage. From these three metrics, it didn't work. It didn't have enough users.
- No participant program evaluation survey.

Challenges and recommended improvements (Quotes)

Customers will give you feedback and will say it is interesting, but will they actually use it in real life on their own time? It is a very different outcome.

Some of these concepts are interesting. I think we would tie it more into our opt-out programs. Having to opt-in, there is a limited experience.

Social proof. If we know who is doing different tips, then we can show what actions your neighbors are taking.

Integrate it into the core Opower website that we have for the utilities.

Key Lessons

- The idea is appealing, but it is much harder to execute than you think it is.

Quotes from Program Managers

If it worked exactly as we'd hoped, it would be a self-sustaining user base and it would virally grow. Virality factor of over 1, and they would see return, and a reduction in usage.

If you are engaging in social experience or social experiences, you need to have a compelling reason why. If the customer individually cares about it, they will choose to engage, but it is really hard to push into social conversation concepts and ideas that they really don't identify with. It is really hard to create a super compelling game experience when the interest is not there.

We probably had the best shot out of everyone I've seen trying to do this in the energy space to succeed. We had Facebook's brand behind us, we had NRDC's brand behind us. We had 17 utilities including PG&E and ComEd. We had 20+ million homes preloaded into our system. There was major press and marketing, and in the end we got on the order of tens of thousands of people to sign up, and the user base did not grow itself, and it did not save energy as far as we could tell. We never got enough a large enough user base to do a randomized test control to measure impacts.

Case Study 11: NeighborWorks H.E.A.T. Squad Competition
Inter-Community Home Energy Upgrade Competition

Description
The NeighborWorks H.E.A.T. Squad program was launched in 2010 with $4.5 million of American Recovery and Reinvestment Act (ARRA) funding and a goal of upgrading 1,000 homes in Rutland County, Vermont.[25] The program provided comprehensive, personalized and objective advice, financing and support to homeowners, while small towns competed for recognition and prize money for the most per capita projects completed and highest average energy savings.

About 50% of Vermont housing stock was built before the World War II, with drafty envelopes in a cold climate. Whole home upgrades are typically complicated, expensive and difficult. Thus, primary goals of the program were to make energy upgrades simple, understandable and affordable. The program accomplishes these goals by lowering the cost of energy audits and providing a "one-stop-shop" of information, guidance and financing. The NeighborWorks team "holds the hand" of homeowners through the entire process, providing impartial advice and facilitating all steps of the process.

All of the towns (27) within the county competed for $25,000 in prize money, which was allocated to the top three communities with the highest percentage of homes completing upgrades and the highest average energy savings.

Organizers
- NeighborWorks ran the project and provided financing through a revolving loan fund
- Efficiency Vermont, an efficiency utility company, provided training and certifications for contractors, and they ran a similar program the following year for all Vermont communities
- Green Mountain Power utility company was a collaborator
- Housing authorities and community energy committees/champions helped provide local outreach

Goals and Motivations
- Goal of 1,000 homes (about 5% of homes in Rutland County) completing Home Performance with Energy Star projects.
- NeighborWorks is primarily motivated to help low and moderate-income households to save money, and make their homes healthier safer, more affordable and sustainable.

Target Population
- No specific segmentation work was conducted to target populations.
- Program developers wanted a larger portion of low to moderate-income households, not just upper income households who typically enroll in whole home energy upgrades.

[25] For more information, see: http://heatsquad.org/

The Competition Prize

- $10,000 to the top town with highest per capita completion of Home Performance with Energy Star projects, and $10,000 to top town with the highest average energy savings, and $5,000 to the third place town.

Communication Channels

- Word of mouth
- Website
- Phone calls with homeowners

Activities

- Outreach to residents
- Phone calls to residents to set up low cost ($100) audit
- Contractor conducts audit
- NeighborWorks provides impartial advice to homeowners using output of audit
- NeighborWorks arranges financing.
- Contractors conduct work

Behavioral Strategies Employed

Strategy	Description
Commitments	No
Goal setting	Program has a goal of 15% energy reduction per home, and 5% of homes completing program
Prompts	Yes. The program works closely with homeowners at every step of the process. Postcards are sent as prompts.
Social diffusion	Not explicitly, but word of mouth in communities is key.
Comparative Feedback	Yes. Ranking of cities on website, but this is not a major focus.
Instantaneous Feedback	No
Tailored Feedback	Whole home energy audit
Descriptive norms	Yes.
Subjective norms	No. “Vermonters don’t like that.”
Scarcity	Yes. Limited time offers
Loss aversion	No. Framed in terms of savings
Reciprocity	Not explicitly, but assistance is offered free of charge.
Local Messengers	Yes, through local volunteers. For example, in one town the 5 volunteers called every person in town…because between them they knew everyone. Local champions were key: “where there were good champions there were good results.”
Imagery	No. Communication is more one-on-one

Rewards and incentives	Yes. Discounted audit. Rebates.
Competition	$10,000 to top town with highest per capita completion of Home Performance with Energy Star projects, $10,000 to top town with highest average energy savings, and $5,000 to third place town. There was also a Contractor Competition: the contractor with the most retrofits in 6 months won blower door kit or infrared camera.
Energy Coach / trusted advisor	Yes, this is a key component. After audit by a contractor, an impartial NeighborWorks advisor offers advice to homeowner.

Most effective strategy

- Local messengers, when a champion is inspired to get the work done locally.
- Competition was a not a central focus of interventions with homeowners.

Resources Available

- $4.5 million in ARRA funding

Outputs

- Audits completed (June 2012): 1,031
- 40% conversion rate from audit to completed project
- Energy efficiency upgrades completed (June 2012): 350
- Completed over 1,138 retrofits as of December 2014 (4.5% of Rutland single-family homes)
- 12 contractors engaged
- Number of loans: 267
- Average cost of energy upgrades: $5,500 after rebates (payback of ~6 years)

Outcomes

- Average annual savings in energy costs: $914
- Average annual fuel oil saved: 360 gallons
- Average annual reduction in CO_2 per household: 5,300 lbs.

Persistence

- Whole home energy upgrades may be able to produce persistent savings, but this needs to be evaluated.

Measurement and Evaluation

- Modeled energy savings using Efficiency Vermont's auditors' software.

Program Evaluation Findings

- An evaluation of this program was completed in 2012.

- The organizers were very pleased with the results. “No one thought we would achieve what we did...[and] sixty percent of completed projects were in low to moderate income communities.”
- 98% of customers rated satisfaction as “very high”

Challenges and recommended improvements

- Difficult to get monthly billing data.

Key Lessons

- Word of mouth is critical
- Customer service was seen as more effective than incentives
- “Keeping the fires burning” was important and not letting customer service languish

Quotes from Program Managers

No one thought we would achieve what we did, from the grand jurors to the partners to just stakeholders, so there is a piece of us that feels like we did achieve our best dreams.

We are a housing agency in a national network of NeighborWorks organizations, and so we imposed this Heat Squad program on an existing nonprofit housing agency that already has home buyer education, home ownership counseling, construction inspection services, construction management for rehab of low income housing, and energy efficiency is just one element of rehab, and we have a lending program with our own revolving loan fund….so it’s not insignificant that we attached the Heat Squad to an existing infrastructure ready to do this kind of work.

We started in Shrewsbury where the 5 volunteer members of the conservation commission had to call every person in town because basically, amongst the 5 of them, they knew every person in town.

NeighborWorks is a nonprofit housing agency and is, to some extent, I think we're a trusted source. We're a nonprofit and because we've been here a long time and because we don't appear to be in it for our own good and our energy adviser is not going to make any money off of you and they're trusted to give good advice instead of self-serving advice and they are certified like the auditors/contractors.

The customers are able to talk to the energy advisers and say you know hey I really didn't like the auditor and I don't want to work with him anymore. They can't tell that to anybody else and maybe we would have lost that customer if there wasn't this impartial energy adviser talking to them.

It's definitely true that where there were good champions there were good results.

Word of mouth, word of mouth, word of mouth…that works every time.

Customer service is more effective than incentive payments over a certain threshold … We feel that we've proven that but we can't get everybody to agree that we've proven it…Well, on the overarching scale, we believe that customer service is more cost effective than inflated cash incentives. I mean after about a thousand dollars or 1,200 dollars cash incentives on a $7,000 project, the incremental cash incentives we don't think is as effective as like say investments in customer service.

Customer service can reduce dependence on cash incentives, and customer service is the magic bullet that we've all been looking for to get people through an otherwise low participation program. The Heat Squad model or the customer service model which are interchangeable in my mind cannot be pulled apart such that you do one piece and not the other, customer service tip to toe service and just helping them find something on the website or helping them with one aspect is not going to the effect that a full service one-stop shop customer service model does.

I think definitely for me one of the bigger lessons learned is you really have to focus attention on the work force. You've really got to focus on that piece of it as well as outreach and marketing…You've got to work on their customer service or you are not going to have a successful program.

Case Study 12: Vermont Home Energy Challenge
Inter-Community Home Energy Upgrade Competition

Description
The Vermont Home Energy Challenge (VHEC) was a year-long competition in 2013 between 79 small Vermont towns and communities to raise awareness of energy efficiency and increase completion of projects under Efficiency Vermont's Home Performance with ENERGY STAR® program.[26]

Organizers
VHEC was designed and launched through a partnership between Efficiency Vermont (the statewide energy efficiency organization), and the Vermont Energy & Climate Action Network (a coalition of Vermont towns and communities). Efficiency Vermont designed and administered the program, while community-based organizations volunteered time to conduct outreach to residents.

Goals and Motivations
- Help the state of Vermont reach its target of 25% of homes engaged in retrofits by 2020.
- Provide face-to-face engagement on energy efficiency via a network of town energy committees.

The Competition Prize
- Winner of competition: The community in each of six districts with highest percentage of homes weatherized.
- Awarded $10,000 monetary prizes to each winning community in each district to support weatherization of municipal buildings or other energy efficiency projects with broad community value.
- Recognition provided to communities with highest percentage of residents completing pledge cards.

Target Population
- Target was above median-income homeowners (no other segments targeted)

Communication Channels
- Monthly email to coordinators
- Webinar
- Workshops
- Website
- Communities engaged residents directly (no statewide program communication with residents)

[26] For more information, see: https://www.efficiencyvermont.com/For-My-Business/Energy-Leadership-Challenge/News/2013/01/25/The_Vermont_Home_Energy_Challenge

Activities

- Mini grants to help promote local efforts
- Training
- Guidance documents
- Marketing and educational materials
- "Button Up Day of Action" coordinated across communities
- Turnkey solutions – home energy visits, door-to-door outreach, home energy savings workshops, home energy parties, phone-a-thons, energy saving kits, contractor partnerships

Behavioral Strategies Employed

Strategy	Description
Commitments	Pledge cards
Goal setting	3% of homes retrofitted in each community in 1 year. Homes need to be 10% efficient to qualify for rebates.
Prompts	Encouraged communities to follow up by phone or email with people who filled out pledge cards
Social diffusion	Town energy committees – groups of volunteers
Comparative Feedback (community level)	Dashboard of how many completed jobs and community's progress toward their goal of 3% of homes.
Comparative Feedback (household level)	No
Instantaneous Feedback	No
Tailored Feedback	Whole home energy audit
Descriptive norms	Yes
Subjective norms	No
Scarcity	Limited time offer for discounted audits
Loss aversion	No
Reciprocity	Gift baskets worth $60 (2 CFLs, powerstrip, low flow showerhead, etc.).
Local Messengers	All messaging to residents initiated by local community groups
Imagery	Marketing materials with "the faces of energy efficiency" – pictures of people and how much they saved
Rewards and incentives	Rebates to households $10,000 each to 6 cities Recognition for cities with most pledges
Competition	Communities with highest percentage of homes weatherized win $10,000. Communities with most pledges are recognized.
Energy Coach	Whole home energy audit and recommendations

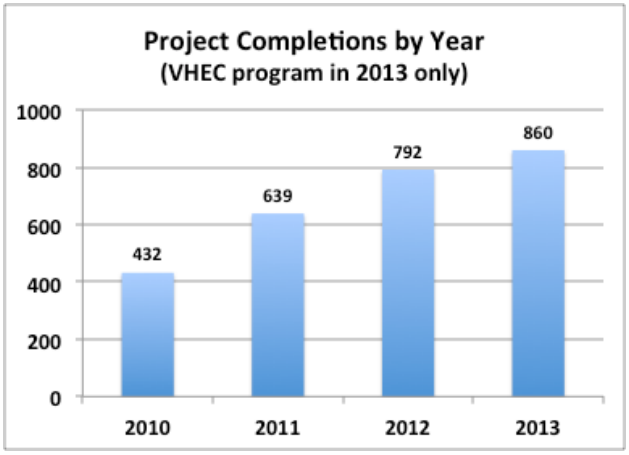
Most effective strategy
Social Diffusion: "the pillar of our program"

Resources Available
Rough budget:

$10,000 awards to 6 towns = $60,000
$60,000 to support community energy organizations
$100,000 (estimated) in staff support, marketing, travel and miscellaneous expenses
$220,000 - $250,000 total, not including volunteer time from communities

Outputs
1,512 VHEC pledge cards completed
Over 200 stories in print, radio and television

Outcomes
Figure 1 compares total Home Performance with Energy Star complete projects in the program year 2013 with historical completions for the years 2010 through 2012. Given the steady growth in completions in previous years (107 more jobs in 2011 and 153 more jobs in 2012), one might expect 2013 to continue this trend; however, there were only 68 more jobs in 2013 than 2012.



Program Evaluation Findings
Survey of local coordinators (54% response rate of 87 sent): 47% were either satisfied or very satisfied, 30% neutral and were 17% dissatisfied.

Recommended improvements

- Obtain more data on households, e.g., who completed audits
- Simplify the program – too complex or difficult for volunteer groups
- Increase financial incentives for homeowners
- Start earlier – giving communities more time to plan their strategies

Key Lessons

- Social diffusion and face-to-face interactions were key.
- Cities need long lead time to prepare the programs.
- Households need long time to make home energy retrofit decisions.
- Tried to integrate a big range of behavioral tools, because different people react differently.

Quotes from Program Managers

> *It was about moving beyond advertising to face time, personal experiences as a way to promote home performance.*
>
> *Sometimes it just went gangbusters, and people really embraced it and took it to heart and had stellar results…but I would have thought more towns would achieve bigger results, but maybe I was just being optimistic.*
>
> *Social diffusion was the pillar of the program…customers are your sales force.*
>
> *We had the program design and then we said, what else can we do, what else can we integrate… there are certain (behavioral tools) that grab different people.*

Case Study 13: Community Energy Challenge
Inter-Community Home Energy Upgrade Competition

Description

Sustainable Connections is a non-profit membership organization of independent Northwest Washington business and community leaders working to transform and model an economy built on sustainable practices. Sustainable Connections, and the local community action agency, the Opportunity Council, created the Community Energy Challenge in 2010 to help other businesses learn from each other to share best practices and help grow the market for best practices through community education and marketing.[27] The Challenge:

- Provided a one-stop-shop for home education and information (home energy audit, or business energy audit, marketing material, Opower reports, "hand holding" to find out rebates, etc.)
- Tried to remove financial barriers by making sure people take advantage of existing rebates and tax credits. The State of Washington provided incentive funds that were paired with utility rebates. Financing for energy efficiency projects was available.
- Tried to expand the size of qualified contractors. They provided training for contractors, screening of contractors, facilitating in getting bids, and quality assurance on all projects completed.

Initially, residential audits cost $95 per audit. The customer would get the money back if they implemented retrofits. They have increased the audit to $195. Initially, the cost of commercial audits varied and was based on annual energy consumption (e.g., $50-$800). But they had difficulty in obtaining the energy bills, so they first moved to a flat $65 per audit, and now they are not charging for commercial audits. It was a lost lead for them no matter what.

Organizers

- Sustainable Connections – implements and markets the program on the commercial side
- Opportunity Council: Fiscal agent, manage the residential side of the program

Goals and Motivations

- Confluence of opportunities to expand energy efficiency. Businesses and residences interested in reducing greenhouse gas (GHG) emissions. Opportunities for energy efficiency savings. Fixing problems in buildings is a way to stimulate the economy and create jobs
- Objectives: Now goals are based on a rate. Initially, they wanted 1,800 assessments. Now, they want 30 assessments per month.
- Develop a one-stop shop for homeowners and businesses to do home energy projects.

[27] For more information, see: http://sustainableconnections.org/energy/energychallenge

Target Population

- Homeowners: Initially (2010-2012), Whatcom County (Washington). Now, it has expanded to three other counties.
- Focus group testing: Focus marketing on energy efficiency, not as carbon footprint. A high percentage of participants are in urban areas, which suggests a trend toward more politically liberal, but certainly not a rule. Some areas are harder to get into.

The Competition Prize

- None

Theories of change

- Cambridge Energy Alliance was an influence.
- McKinsey report, "Unlocking Energy Efficiency in the U.S. Economy," was helpful to understand barriers
- Community-Based Social Marketing

Communication Channels

- Biggest source of new participants is referrals (past customers and participating contractors)
- Tables at social events
- Meetings at community events, neighborhood events
- Print media, some radio
- Businesses: help businesses tell their story…encourage customers and other businesses
- Homeowners have yard signs "this home is saving energy" – sometimes a few weeks, and sometimes for years at a time

Activities

- Residential and Business Programs
- Outreach
- Homes or businesses sign up for low-cost energy assessment
- Energy assessment
- Energy advisor helps choose cost-effective projects
- Vetting of contractors
- Quality assurance
- Provide access to incentives and rebates
- Test out (modeling of home energy usage at the end of program)

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes. During first home visit, homeowners are asked what have they done already, and what they are interested in doing.

Goal setting	They used to do this for businesses, but it was not very effective, so no longer doing it.
Prompts	Yes. Use home energy reports. Newsletter to all homeowners. Businesses have employee engagement program.
Social diffusion	Neighborhood associations. Business associations
Comparative Feedback	Get a rating. Benchmarking score. Washington State average. Washington State carbon goal. Businesses: report sent every 3 months
Instantaneous Feedback	No
Tailored Feedback	Full energy audit.
Descriptive norms	Yes. What other building owners are doing
Subjective norms	No
Scarcity	Somewhat. Limited time offer for certain assessments.
Loss aversion	Energy framed in terms of savings on the website
Reciprocity	Free audits. Free LED or CFL.
Local Messengers	Somewhat. Encourage employees to send a message to other employees stating they have participated.
Imagery	Yes. In marketing materials.
Rewards and incentives	Referral bonus. Get $25. Signs. List participating businesses. Stickers.
Competition	Had thought they would do this. Businesses didn't want this because they didn't know if they would do this well.
Energy Coach / trusted advisor	Yes

Most effective strategy

- "I don't think anyone who calls to sign up heard about it for the first time. They have seen it many times because it is in the community."

Scalability

- Have scaled up to 4 counties. Sustainable Connections thinks that this kind of program could be statewide.

Resources Available

- One-stop shop funded by American Recovery and Reinvestment Act (ARRA) funding. 2008-2012: state government continued funding community energy efficiency funds. Northwest Clean Air Agency grant. City of Bellingham grant. EPA Climate Showcase Community grant.
- $1.6 million annual budget in 2013. Program manager notes that $1.6 million was paid, but $750,000 in taxes comes back.

Outputs (as of 2013)

- 834 homes, 2,454 home energy assessments (57% conversion rate)
- 105 businesses, 372 commercial assessments (28% conversion rate)
- $10,929,97 value of total projects completed to date ($8.3 million residential; $2.7 million commercial)

Outcomes

- Homes: 21% average energy savings (kWh equivalent – includes electricity and natural gas), $472 average annual savings
- Average project cost: $4,901 with incentives ($6,292 without)
- Average simple payback (average cost / average annual savings): 10.4 years
- 6,723,511 kWh saved to date
- $1.39 of private investment for every $1 of public investment
- $591,426 in annual savings for all projects (residential and commercial)
- Annual GHG reduction from all projects: 5,832 metric tons

Persistence

- Not measured

Measurement and Evaluation

- Homeowners use Energy Performance Score software. Energy use of home is compared both before and after.
- Commercial. Use deemed (stipulated) utility savings if they are available. If not available, then an engineer on staff will do site-specific calculations. Some businesses do before and after measurements, correcting for weather and accounting for the savings of measures that are calculated elsewhere (e.g., changing the thermostat, aerators, etc.).

Program Evaluation Findings

- Grant deliverables: hit many goals, including some that were too ambitious. Number of homes was too ambitious.
- Exceeded expectations on conversion rate for residences. Conversion rate was between 50-60% for the entire time.
- Commercial side: Have worked with 400 businesses. Almost all just implement a few easy upgrades (like lighting). Many do larger upgrades. Few do deep retrofits now. They tend to do projects one at a time and often expect to continue to do retrofit projects into the future.
- Commercial survey: Additional handholding is what gets projects done. We can throw more money at it, but most of the projects people want to do but they don't have time to figure out the contractors, do the paperwork, etc. Just help them do the projects.
- Residential survey: budget management – hired more people to do audits internally (not external) and project management.

Challenges and recommended improvements

- It takes more effort to manage projects than initially estimated.
- Financing uptake was only 25% at best. The loan rates were very favorable, as low as 1% and not higher than 3%.

Key Lessons

- They don't believe financing is the whole solution. Either you end up with projects that aren't saving a lot of energy, or they aren't using the loans. The most important thing was overcoming the informational hurdle. To the extent that it is customized. Need a one-stop shop.
- Based on the IMPLAN model: for the year 2013, the program generated $5.27 of local benefit for every dollar invested. That is the value of the energy savings with a multiplier.

Quotes from Program Managers

> *Not too much on competition, which is funny because we are the Energy Challenge. We thought initially that we were going to do more competition…Even businesses that thought of themselves as sustainability leaders had no idea how they would do in a competition, on a per square foot basis. They didn't want to get involved with something they were going to lose. They didn't want Sustainable Connections to say this business won and this one lost; they didn't want to be rated in that way, so we didn't. We kicked around developing a really complicated rubric which would rate whether they improved or not or whether they have made effort or not, and give extra points for doing all kinds of things and we never got any buy in on that either.*
>
> *If we can get the business owner to participate in the audit, an hour of time, that is enough to show they are serious.*
>
> *The biggest reason people don't do projects is not because of a lack of financing…. I think we are still getting a high conversion rate without financing. The biggest barrier is not knowing what to do, not knowing where to go to find out the third party trusted source. I think that is the most valuable service that we provide.*
>
> *The bottom line is. This is a great way to save energy, it is an important way we can reduce our carbon footprint. It is also a pretty smart way to stimulate the economy. If you want to do economic developing, this is hard to beat.*

Case Study 14: 10 for Change Challenge
Type: Inter-Organization Energy Conservation Competition

Description
The 10 for Change Challenge was a program initiated by the city of Boulder, Colorado, in 2009 to encourage businesses to commit to reduce energy consumption by 10% for a year.[28] Considering that most businesses operate in leased spaces, the program focused on actions that tenants could take without investing significantly in capital improvements.

Organizers
- City of Boulder
- Technology firm developed the website
- A law firm provided meeting space

Goals and Motivations
- Empower businesses to understand that there are still low-cost strategies that they could take to reduce energy consumption even though they don't have much control over the equipment in buildings.

Target Population
- Business tenants (not owners) that were confronted with split incentives problem.
- A wide range of business types: financial, design, construction, hospitality, nonprofits, retailers, schools, services, technology firms, breweries and consulting companies. Many of the businesses and non-profits provide energy services.

The Competition Prize
- There was an awards ceremony for the most reductions, most improved, etc., but the focus of the program was on making reductions compared to personal benchmarks. The program recognized that businesses are very different, so it is difficult to have fair comparisons.
- Awards were presented to those for most electricity reduced, most natural gas reduced, most combined electricity and natural gas, Innovation in Energy, and Total metric tons avoided, as well as for Innovation in Water and Waste, Innovation in Education / Outreach, and Sponsor of the Year.

Theories of change or model program
- The program was modeled on the Chicago Green Office Challenge and other programs.

Communication Channels
- Website: including resources and support, media room, etc.
- Monthly meetings and a participating business (30-70 participants). Free food and drink

[28] For more information, see: http://www.10forchange.net/

at some of the events helped with turnout.

- Monthly e-blasts / newsletters developed by marketing staff person.
- Facebook and Twitter
- In-person visits by staff

Activities

- Businesses complete an application.
- Submit the businesses' utility account number, so the city has access to utility bills.
- Networking meetings hosted by one of the business members and showcase the business's efforts, including energy, zero waste, water, public transportation and other efforts.
- Email newsletters.
- City staff would visit businesses and encourage them to become members.
- Direct businesses to other city or utility programs.
- Annual celebration with awards for most energy reductions in a year, highest percentage energy reduction, most innovative projects, etc.

Behavioral Strategies Employed

Strategy	Description
Commitments	Action plan: scorecard with what the business will do
Goal setting	Yes. 10% reduction goal
Prompts	Sort of. Sent newsletters and quarterly data but not reminders to do specific actions.
Social diffusion	Yes. Business associations.
Comparative Feedback	No
Instantaneous Feedback	No
Tailored Feedback	Yes. Quarterly data reporting from utility bills.
Descriptive norms	Yes. Showcasing what other businesses are doing.
Subjective norms	Not explicitly.
Scarcity	No
Loss aversion	Yes. Initially focused on savings but now more on wasted energy.
Reciprocity	Not explicitly, but the city is clearly engaged for the purposes of helping businesses.
Local Messengers	Yes. Meetings held at businesses around town. Each business carried out its own plan.
Imagery	Yes. Graphics breaking down energy use. Newsletters used images, particularly highlighting other businesses.
Rewards and incentives	Recognition at awards ceremony. Opportunity to advertise in business report at 50% discount for participating businesses.
Competition	Somewhat. Awards were for additional recognition, but

	focus was on their reductions compared to their personal benchmark.
Energy Coach / trusted advisor	No

Most effective strategy

- Person-to-person contact is critical.

Scalability

- Yes. All city programs learn from each other and evolve.

Resources Available

- Probably between $40,000 to $60,000, mostly in redirected city staff time: 15% FT marketing person, 50% FTE project manager

Outputs

- At least 6 program meetings at businesses
- Monthly e-blasts
- Quarterly data reports, customized for each business
- Office visits, phone calls and other interventions were not tracked

Outcomes

- 2009: Recognized top 5 businesses that reduced the most
- 2010: 4% collective energy savings
- 2011: 8% collective energy savings by all members

Persistence

- Not measured.

Measurement and Evaluation

- Compared usage to previous year.
- Percent reduction is not always an appropriate metric, particularly for businesses that are growing and changing.

Program Evaluation Findings

- No program evaluation conducted.

Challenges and recommended improvements

- Very difficult to keep up with the data requirements of all the participating businesses to get credible results.
- The program has now evolved into a new program providing a more holistic, energy advisor approach to help businesses with energy management.

Key Lessons

- The program was very cost-effective, but if you have ambitious targets and reduction goals then you need to be realistic about how much effort will be needed to engage and support businesses to achieve the reductions. It is not always about being cost-effective, but also about being effective.
- Keep building on a program to gain brand recognition. It may take many years of hearing about a program before businesses engage. Programs need to have time to grow and evolve.
- Start with the extensive stakeholder process to see what your businesses want.
- "Make it simple, make it easy, make it streamlined, and give it enough years to take hold in the marketplace."
- "Get them to commit, give them metrics and feedback, give them recognition, and be around long enough so they can feel like the program was valid."
- Build relationships and have longevity to make efforts worthwhile

Quotes from Program Managers

[The new program, Partners for a Clean Environment (PACE), is] helping businesses look at the sustainability opportunities that they're interested in implementing at their business, helping to navigate the complexities of incentives and rebates, helping them look at contractors bids, deciding on a bid, scheduling the work and then doing quality control/assurance on all of the improvements. PACE builds relationships with businesses so it's important to be responsive and call them back whenever they're interested and have time to implement best practices. Every year, businesses are doing a little more and feeling great success with what they're implementing. So it's about building a relationship, keeping the program consistent on the ground for a long enough period of time so they, number one, get to know and acknowledge that there's this one program that they can call to receive all of what they might need. The one-stop shop business sustainability PACE program model, now encompasses behavior change into technical assistance, financial advisers, and energy, waste reduction, water conservation and reducing single occupancy trips to their office - we have it all under one program name.

…you never want to be, reduce, reduce, reduce, your energy because you don't want to be anti-growth or anti-economic vitality, so we learned all those messaging tactics. It's not businesses have to reduce their energy, it's basically kind of reducing the wasted energy that is possibly happening in your building or your operations, and so that's where we come more sophisticated with really understanding on how to message to our businesses, so I think we would in our quantification, if there was increase energy use, you know has anything changed, did you add on to your building, did you get more employees, did you expand your hours, so we try to really help them with the nuisances, it makes them aware that, trying to looking at productivity, did you increase sales, and so the metrics get a lot more difficult when you involve a lot more different variables, right?

In the business sector, it's about building relationships, building trust, and being consistent with program delivery.

I think the goal of city programs are to always be transferable that we just don't want our own customized program that no one else can use. Because I think that's how we all evolve our programs by looking at the accomplishments of other programs across the country and world for that matter.

If you can keep a program stable in the community for a good amount of years, it builds traction, recognition and businesses are the best advertisement you could have if businesses talk to other businesses about it. And so I really think, you know I mean people don't want to hear that longevity works but you know you have to hear about a program so many times before you say I'm going to try that.

It's just really critical to build these relationships and to have a lot of credibility in your program.

Case Study 15: Energy Savings Challenge
Type: Inter-Organization Energy Conservation Competition

Description
The City of El Paso, Texas, engaged libraries in the first year (May 2012-November 2012) and fire stations in the second year (May 2013 – November 2013), in a six-month energy reduction competition.[29] During the first month, the libraries and fire stations created a plan to save energy, and the best plan won the first month of the competition. They focused on plans since plans act as a form of commitment and a means of engaging employees and management in the program. Electricity consumption was compared to previous years and buildings were ranked based on their percentage reduction from the previous year.

Organizers
City of El Paso, Texas – Sustainability Office

Goals and Motivations
- Educate employees on ways to save money for their departments by saving energy
- Complementary reductions were being made with structural improvements in buildings with conservation behaviors through education and outreach

Target Population
- Focused on libraries because they are very similar and their educational aspects were valued
- Fire stations are more competitive and are all very similar
- Did not choose police stations because each is somewhat different

The Competition Prize
- Library and fire station with highest percentage reduction for same month over previous year were the winners.
- Winning library or fire station each month received a small celebration with cake or lunch, and the overall winner received a $500 award to be used for improvements toward their library or fire station.

Communication Channels
- Flyers
- Personal outreach to library and fire station managers
- Monthly newsletters

Activities
- Monthly analysis of energy data and ranking of libraries and fire stations
- Fire stations created energy plans

[29] For more information, see: http://home.elpasotexas.gov/general-services/sustainability/energy-savings-challenge.php

- Monthly newsletter announcing winners
- Monthly lunch for winner

Behavioral Strategies Employed

Strategy	Description
Commitments	Each building created an energy reduction plan indicating what they would do during the competition.
Goal setting	No
Prompts	Plans and information were posted to walls in stations and libraries as a reminder
Social diffusion	No
Comparative Feedback	Monthly ranking of libraries and fire stations
Instantaneous Feedback	No
Tailored Feedback	No
Descriptive norms	Stories of winners posted in monthly newsletter.
Subjective norms	Supervisors enforced expected behaviors. This was particularly effective in fire stations, with top-down management structure, similar to military.
Scarcity	No
Loss aversion	No
Reciprocity	No
Local Messengers	Fire stations and libraries developed their own plans and motivated themselves
Imagery	No
Social Networks	No
Rewards and incentives	Emphasized saving money for city. Provided lunch and $500 award for winning library or fire station
Competition	$500 to winning library or fire station. Recognition and competition between firehouses was an important motivation.
Energy Coach	Yes – Sustainability Office staff

Most effective strategy

- Creating energy plans in fire stations (natural rivalries existed between fire stations).

Resources Available

- Extremely low budget. All resources were internal and reallocated as normal cost of city operations, including:
    - Four hours per week of staff time = about $4,000 (estimated based on $30/hr x 30 weeks)
    - $1,000 reallocation of city resources to pay for improvements in libraries and stations ($500 x 2)

- $1,800 ($150 / month) spent on plaques and lunches (12 months—6 months for libraries and 6 months for fire stations)
- Total budget is about $6,800, all of which was just reallocation of city resources

Outputs

- Flyers
- Party or lunch for each winning library or fire station each month
- Energy reduction plans for each library and fire station

Outcomes

- Round 1 (12 libraries): $21,000 in savings
- Round 2 (34 fire stations): $8,000 in savings
- 82% of 35 fire stations saw reductions
- Winning library reduced energy by 19%
- Winning fire station reduced energy by 21% for six months

Persistence

- Libraries reduced energy an additional 3% the following year.

Measurement and Evaluation

- Compared monthly energy bills with previous year.
- Did not adjust for weather.
- Did adjust for major changes in equipment.
- Did not adjust for longer library hours (but there were reductions regardless).

Program Evaluation Findings

- No formal program evaluation

Challenges and recommended improvements

- Difficult to get monthly energy data.
- Need to work with utilities to get data more quickly.
- Libraries concerned about not compromising service to visitors (e.g., keeping areas well lit). Need to identify solutions.

Key Lessons

- Extremely cost-effective: $6,800 reallocation of city funds resulted in $30,000 in savings, plus potential for spillover and persistence.
- Natural rivalries between fire stations were important.
- Top-down decision-making structure in fire stations was important.
- Creating energy plans was useful.

Quotes from Program Managers

Interviewer question: Did you find that fire stations were more competitive with each other than libraries?

Answer: Yes, completely. That was the main driver….all you need is just to say, well Fire Station 6 is winning and that is all the motivation they need. They really don't need lunches. They don't need anything else. Just that.

For the library, we brought them pizza, and we framed certificates, and they seemed to enjoy that.

They (a fire station) used to keep air conditioning on, and they were cooling all night long and there was nothing in there - it was just their truck. Now, they stopped doing that, and now they just open them up in the morning and air it out.

Case Study 16: Green Office Challenge
Type: Inter-Organization Energy Conservation Competition

Description

The Green Office Challenge is a program of the city of Chicago and administered by Delta Institute, with software provided by Green PSF.[30] The program engages tenants in offices to compete together to earn points and recognition for making their offices more "green" by managing energy, water, procurement and transportation. More points are earned for more difficult actions. Smaller amounts of points are earned for simple educational activities and reporting energy, water or other data. Larger amounts of points were earned for taking specific actions to improve the performance of offices, such as hiring contractors to complete work.

The program draws on peer pressure and social support within offices as well as between offices, to motivate individual and collective action. Participants receive free access to the software. Team members share the same portal and are able to earn points collectively. There are monthly workshops and newsletters. Teams are awarded for earning the most points, and all participants get a certificate for their participation. There are no tangible rewards, just recognition. In 2013, the program engaged about 50 businesses in 30 buildings, and engaged about 1,000 participants. The program is ongoing.

Organizers

- Delta Institute (years 3 and 4)
- Green PSF: Develop web platform

Goals and Motivations

- Change behaviors in office settings to reduce energy, water, waste and materials, purchasing and transportation related to work
- No target or goal

Target Population

- Employees in commercial office buildings
- Making it social tended to address young professionals. Typically, there was one leader like an office manager or a marketing manager.
- Four target groups, but people may have more than one of these motivations:
    - Socializers – interested in trying to build social aspects
    - Explorers – interested in gamification and learning
    - Achievers – want to see real results and go to next level – make progress
    - Killers – they are in it for the competition

The Competition Prize

- No monetary prizes, only recognition-based awards

[30] For more information, see: http://greenpsf.com/go/community/index/chicago

Theories of change

- Peer pressure. Building a community around the conduct - norms

Communication Channels

- Website
- Monthly newsletters
- Monthly lunches
- Social media – spontaneous communication – celebrating small successes
- Face-to-face at different events.

Activities

- Sixty activities across 5 categories: education, action, reporting. For energy, they focused on lighting and plug loads.
- Website: actions ranged from taking surveys, to replacing equipment, signing up for utility programs and making appointments with contractors to do work.
- Lunch and learn events once a month
- Social media – building a community and getting information out
- Participants log in
- Complete an activity – writing narrative, submit documentation, etc.
- For every action completed, the participants move up and down on the leaderboard
- Staff would visit offices to answer questions

Behavioral Strategies Employed

Strategy	Description
Commitments	No
Goal setting	No
Prompts	Sort of. Each month had a theme.
Social diffusion	Sort of. Teams were formed within offices
Comparative Feedback	Yes. Leaderboards for businesses
Instantaneous Feedback	Yes. Received points every time action was completed.
Tailored Feedback	Yes. Buildings get tips based on attributes entered in the software.
Descriptive norms	Yes. Sharing what other participants are doing
Subjective norms	Sort of. May have been embedded in communications
Scarcity	Yes. Mini-challenges. Week-long sprint: limited time to take a particular action - urgency
Loss aversion	No
Reciprocity	No
Local Messengers	Yes. Working with likeminded organizations. Most communication happened between participants.
Imagery	Yes. Important in newsletters – one of the staff members had a background in design – e.g., using info-graphics to

	break down complicated information.
Rewards and incentives	Based entirely on recognition. Awards for top performers. Certificates for everyone. No prizes.
Competition	Yes. Offices that earn the most points are awarded.
Energy Coach / trusted advisor	No
Gamification	Yes. Participants earn points for taking specific activities: educational, new energy efficiency equipment

Most effective strategy

- Normative information: leaderboard, featured stories

Scalability

- The software is already being expanded to other cities.
- It was also important to personalize the program to Chicago.

Resources Available

- Delta Institute and City of Chicago, in terms of design, but the City did not fund it.
- Funding came through corporate sponsorship that Delta secured.
- Part-time project manager, full-time project assistant, part-time interns.
- Different staff at Delta contributed in a consulting capacity.
- Software developed by third party. The Challenge drives traffic to their website. Now multiple cities using the software. Offices get free access to software, instructions to complete actions.
- Offices contributed staff and volunteer time.

Outputs

- 150 offices actively engaged, 30 buildings, over 1,000 individuals completing activities
- Program runs for 9 months: 9 newsletters and 9 informational workshops
- Visits to individual buildings

Outcomes

- Not possible to measure savings for all buildings.

Persistence

- Not measured

Measurement and Evaluation

- Buildings are not metered at the tenant level so difficult to measure
- Pre and post measurement of energy and water

Program Evaluation Findings

- Evaluation findings not yet available.

- Did the program meet its expectations? Success would involve active participation of a large number of buildings and individuals. Creating an energy-aware community. We had a lot of success in those areas. Looking forward to seeing program go.
- Participants did not fill out evaluation.
- Sixty individual actions that participants could take. Possibly will scale back the number of actions in the future.

Challenges and recommended improvements

- None

Key Lessons

- Find a balance between participants taking actions and reporting savings. Be aware of their time and resources.

Quotes from Program Managers

Something that drove the program design for us was the concept of peer pressure…really trying to not only instruct participants on how to reduce their energy and report on it, but also to build a community around it and socialize the process around it.

In addition to thinking about how to engage offices, we were also thinking about how to engage and get at the motivations of individuals as well…their passion kind of infects the rest of the office and permeates through.

On social media, people were calling each other out: "we're doing this in the office, why aren't you?"

Our hypothesis is that if we wanted to make it more fun, make it more of a game and engaging, that this would be a good way to think about motivations of individuals…. I think it was definitely clear that individuals were not one type of gamer. They could be multiple types or a combination. At times, they are motivated by competition, and at other times, they were motivated more by socializing.

Case Study 17: Kilowatt Crackdown
Type: Inter-Organization Energy Conservation Competition

Description

The Kilowatt Crackdown is an energy reduction competition between office buildings in cities across the Pacific Northwest.[31] The program engages building owners, managers and operators to adopt energy efficiency best practices, starting with benchmarking through the EPA's Portfolio Manager. Program staff support participating teams in a twelve-month process to identify, plan, implement and measure operational and capital improvement measures in their buildings. The program is primarily focused on electricity, but they encourage buildings to look at natural gas, and in many cases, both sources are intertwined. NEEA ran the program from 2007 through 2013

Organizers

- Northwest Energy Efficiency Alliance (NEEA) - design, implementation, funding; NEEA is funded by utilities in the 4 state region
- Partner: Building Owners Management Association (BOMA) – recruits participants, participates in design, and advocates in the community
- City of Portland- recruits participants by city buildings, program design, support of awards and recognition
- Utilities – the Kilowatt Crackdown is tightly coordinated to push building owners and managers into utility programs
- Energy Trust of Oregon, Seattle City Light, Puget Sound Energy, Idaho Power

Goals and Motivations

- To promote energy management best practices, from benchmarking as a foundational step, to implementation and continuous measurement and reporting

Target Population

- Leased office buildings – multi-tenant. Engage the building owners and property managers.
- Offices have challenge because of split incentives[32]
- Benchmarking and energy management improvement is a financial opportunity
- Incentive to participate is getting public recognition for potential tenants is valuable to owners

[31] For more information, see: http://www.betterbricks.com/commercial-real-estate/kilowatt-crackdown

[32] An example of split incentives occurs when the building owner pays the utility bills and the office tenants do not pay the bills, so the latter have no incentive to make energy efficiency improvements.

The Competition Prize

- Grand Prize trophies, lobby plaques for all teams completing competition requirements, public recognition through business journal ads

Theories of change

- Benchmarking
- Public commitments, goals, social norming

Communication Channels

- Each building participating in the Kilowatt Crackdown gets an Energy Coach and a technical advisor. The coach acts as a guide throughout the competition, assisting the participating building with data gathering, benchmarking, coordination, and the development of an action plan. Technical advisors provide free building walkthroughs and scoping reports, detailing operational and capital improvement opportunities. NEEA/BetterBricks provides these through its consultants, and are available free to participating buildings for a set number of hours. Participating utilities have supported participants with incentive opportunities, communicated via program email announcements, coaches, and through meetings with utility customer account representatives.

Activities

- Start with benchmarking energy use of buildings with EPA's Portfolio Manager
- Send an engineer to technically scope the capital and operational opportunities
- Meet with the property team to support them in committing to energy reduction goal during the 12 months
- Support the property team in implementation of measures that are most feasible
- Continue to support the monthly benchmarking of buildings
- At the end, encourage the property team to do an internal review of how successful they were of implementing their action plan. Review of data to see if there were improvements.
- Evaluate the buildings by a third party evaluator
- Every team has to benchmark 12 months prior and 12 months following installation of measures.

Behavioral Strategies Employed

Strategy	Description
Commitments	Yes, each building makes a plan. Not public, although they may optionally advertise their participation in the program.
Goal setting	Yes, each building has an energy reduction goal. They may optionally share this goal
Prompts	Yes, the program manager follows up with them. One-on-one consultation to each building. Phone and in-person. Monthly - sometimes more frequent emails.

Social diffusion	BOMA and City (in case of Portland, OR). Most building owners are larger than 50,000 square feet. It is not a requirement to be a BOMA member
Comparative Feedback	Yes. Constant feedback from coach. Monthly comparisons to baseline of prior year.
Instantaneous Feedback	No
Tailored Feedback	Yes. Tailored energy plan.
Descriptive norms	Yes. Market intelligence about norms. Their building is placed on a matrix of energy score by building size.
Subjective norms	No
Scarcity	Not really. Limited supply of number of buildings that can participate.
Loss aversion	Yes. Opportunity loss and cost of not staying competitive. Money lost due to higher operating costs, or loss of tenants.
Reciprocity	Sort of. Underlying the program is providing something of value.
Local Messengers	Yes. BOMA does recruiting. Also City of Portland. NEEA does the interventions.
Imagery	Yes. Graphic website and emails. Simple graphics and communication.
Rewards and incentives	Awards ceremony covered by media. Trophy. Plaques for each participant. Gift cards for completing small actions, like completing benchmarking. Winners get a gift certificate to a sporting or cultural event.
Competition	Awards for highest performing. And most improved.
Energy Coach / trusted advisor	Recruitment by trusted partner, BOMA. BOMA acts as a technical advisor and a program coach. Coach helps them implement their plan.

Most effective strategy

- Energy advisor and a coach are core strategies
- Element of competition. “It is a relationship-driven community”

Scalability

- The goal of NEEA has been to test the model.
- Other building types: warehouses, publically owned buildings, hospitals.

Resources Available

- Staff and consultant time (2 FTE)
- In-kind contributions from BOMA (dedicated staff member). City provided in-kind in partner meeting management, recruitment, PR and recognition.

Outputs

- Over 300 office buildings in Pacific Northwest (Oregon, Washington, Idaho): close to 25% of office market in the Northwest

Outcomes

- 3-7 % electricity savings: over 70 MWh of electricity saved since program keeping track in 2008.
- 2011 program had the largest savings (approximately 5 average megawatts or 43.8 million kWh).

Persistence

- Not measured

Measurement and Evaluation

- Energy compared to previous year. Regression analysis.
- EPA's Portfolio Manager is industry standard.

Program Evaluation Findings

- Each year, the program has exceeded goals and points toward the next evolution of the program.
- In many cases, the program has exceeded savings goals.
- Program has been formally evaluated in terms of energy savings, and most recently, as an intervention strategy to promote adoption of energy management best practices. Evaluations are available on the NEEA website under Market Research / Commercial Real Estate

Future of the program

- NEEA is creating guidelines for other institutions to run the program locally in the future
- NEEA will provide a playbook, including resources available to run the program

Challenges and recommended improvements

- None

Key Lessons

- Partnerships with trusted organizations, such as BOMA, are key
- Engineering advice is very valuable, but it can be expensive. You have to identify ways to identify the building capacity of building operators, while keeping costs low. Need to understand what the market needs in terms of knowledge and skills.

Quotes from Program Managers

The core part of the program is the provision of a coach and a technical advisor. That has been the very core strategy that has been successful. We have heard how valuable the

program services have been to people. We have seen an ongoing repeat in participation…there have been many buildings that have participated multiple years.

Case Study 18: Cool Choices
Type: Intra-Organization Energy Conservation Competitions

Description
Cool Choices is a Wisconsin nonprofit that inspires actions that reduce greenhouse gas (GHG) emissions. Since 2010, Cool Choices partners with companies and public entities (including schools) to make environmentally sustainable actions the norm via innovative game-based programming. Cool Choices' approach reflects decades of social science research on human and organizational behavior. One effective change strategy is social norms—Cool Choices uses game mechanics to highlight and celebrate participants "Cool Choices," which makes those actions visible and ultimately normative.[33]

Organizers
- Cool Choices

Goals and Motivations
- Ways to reduce individual or household GHG emissions by 10% annually.

Target Population
- Implemented through workplaces, because they are an important place for peer influence. Implemented in places where management is committed to sustainability.
- Stronger participation rate in commercial offices (where everyone has ongoing access to computers) than factory floor settings, though participation at one industrial facility exceeded 50%. Lowest participation rates tend to be public agencies—like local government—which might reflect the current state of public employee morale in Wisconsin.
- Teams are critical; players report that they continued to take new actions because they did not want to let down their teammates. There is a good deal of evidence of players coaching one another, essentially nudging colleagues to adopt specific sustainable behaviors. That is not typical behavior in the Midwest.
- Attitudes: big range - people who already care, but maybe 25% of people don't believe in climate change, but may want to save money.
- No difference in game performance or savings for those who are climate change skeptics.

The Competition Prize
- Winning team is the one who participates the most consistently; typically, the team wins some sort of internal recognition and bragging rights. In-game prizes, often based on participation, tend to be recognition-oriented (e.g., hosting a trophy for the week) or sustainability oriented (re-usable water bottle). Local green teams have a role in planning prize specifics for their organization, which creates additional buy in.

[33] For more information, see: http://coolchoices.com/

Theories of change

- Hybrid of multiple theories of change: behavioral economics, psychology, etc.
- Celebrate what individuals are doing right to make those actions visible and facilitate new social norms
- Fun, social and easy: removing barriers, leveraging social norms, making sustainable practices more transparent in the community.

Communication Channels

- In-person workshops with green team to plan game rollout, prizes and communication strategies
- Posters, table tents, newsletter announcements promoting the game
- Email
- Card decks (used as props)
- Online game portal
- Phone calls to project managers within each organization during the game to provide support and advice

Activities

- Game format. Games accomplish a lot of things: clear and simple path to follow to earn points. Get participants to report what they are doing so that we can make practices more transparent and create social community of people taking action. Games provide people with a comfortable way to be social. A game was a clever way to do several things (track player actions, provide feedback, make actions visible) at the same time coherently.
- 1/3 to 70% of employees participate. People are seeing that their colleagues are committed. Player perceptions of their colleagues change during the game.
- Pre-game planning with a local green team determines some of the specifics of the game rollout, prize logistics and end-of-game celebrations. Some entities also opt to customize game actions to their specific circumstances.
- Baseline survey among employees. 20-30% respond to survey.
- Two-week sign up period
- Employees get points for home and work activities. Water, energy waste, transportation and some general wellness efforts (non-toxic cleaners, less red meat).
- When a participant logs an activity, they report whether the action is something they did prior to the game or new. Coupled with action-specific savings and persistence estimates, these data are used to estimate game impacts.
- When a player logs into the system, they see the cumulative annual impacts of their organization, which reinforces self and group efficacy.
- Team photo challenge or other activities to get points and increase social aspects of the game; these photos appear in the in-game social media stream.
- At the end of 8 weeks, there is recognition for outstanding players. It is more about participation than winning.
- Calculate savings in dollars, CO_2, water, kwh, therms, gasoline, and pounds of waste

- Post-game publicity about accomplishments enables the sponsoring organization to show off their employee actions.
- Alumni can stay engaged. Aiming to build a movement of people who believe they are part of a climate solution.

Behavioral Strategies Employed

Strategy	Description
Commitments	Partial. Commit to be part of team and participate, but no specific commitments for particular behaviors.
Goal setting	Participation goals set by each planning team
Prompts	Yes. Players get daily emails for new actions available that day. Online deck starts out with 15 actions, and then things get added each day.
Social diffusion	Team formation. People feel accountable to their teams.
Comparative Feedback	Yes. Players can view the actions of any player in the game.
Instantaneous Feedback	Yes. Get points immediately on website and positive feedback.
Tailored Feedback	No
Descriptive norms	Yes. In-game social media stream features and photos submitted by colleagues – e.g., a photo of a colleague biking to work might generate a discussion and motivate other players by showing what others are doing.
Subjective norms	No
Scarcity	Yes. Some actions (like a photo submission) available for a limited time. If you don't do this now, you lose opportunity to earn points.
Loss aversion	Yes. Tips and communications emphasize the money lost by not acting.
Reciprocity	Partial. Companies are offering employees access to a fun tool that helps employees save money at home.
Local Messengers	Yes. Local planning team, led by a local game manager, represents the game to employees so that it belongs to the specific company.
Imagery	Yes. Very important. Use a lot of photos of participants - people see photos of people they know
Rewards and incentives	Partial. While there are game prizes—including recognition, sustainability items (e.g., tote bag), possession of traveling trophy—most players do not get an incentive.
Competition	Yes, winning teams get recognition.
Energy Coach / trusted advisor	Partial. Players spontaneously coach each other—the game gives people permission to offer advice and encouragement to colleagues.

Most effective strategy

- The social aspects are the most important. Sharing photos. Having impromptu conversations around the office, that creates the lasting change. "This is a shared value that we have. I didn't know we both cared about that … You can't just play this game alone. It is about interacting and being part of a community."

Scalability

- The program has worked in many different commercial, industrial and institutional settings.
- Some companies have facilities in many states. Looking to expand the program.

Resources Available

- Corporate and public partners pay a portion. Cool Choices is funded externally
- Executive director, director of programs program manager, in-house game developer, marketing manager, and some part-time intern help.
- Game costs start at $5,000 and scale up based on employee base and level of customization.
- Companies feel that they get good value for their money.

Outputs

- Number of players
- Actions taken: many actions, such as adjusting thermostats, replacing incandescent bulbs with CFLs or LEDs, turning off lights, installing low-flow showerheads, turning off computer monitor at work.

Outcomes

- Estimated annual savings (dollars, CO2 emissions, kwh, therms, gallons of gasoline, gallons of water, waste avoided) associated with actions and estimated persistence of those savings.
- Evaluation of first game by Energy Center of Wisconsin: billing analysis found average electricity use reductions of about 400 kWh per active players (or about 4% of annual consumption). Some natural gas savings – about 1% of pre-game natural gas usage.

Persistence

- Not measured.
- In some cases, they have looked at energy data into the future. Persistence varies based on the specific behavior. Driving is less likely to persist. Water heater settings are largely permanent.

Measurement and Evaluation

- Calculated savings on average based on reported actions. If you report a habitual action 10 times, then you get the full annual savings.

- Players asked if an action is new during the game or not; impacts are calculated based on new actions only.
- Energy is measured before, during and after the game.

Program Evaluation Findings

- Evaluation survey at the end of the game: we know social matters, because we ask. There is a strong correlation between people who speak to others and how engaged they are.
- Evaluations were conducted by Energy Center of Wisconsin

Challenges and recommended improvements

- The game has exceeded expectations. How do you drive people to larger actions? Points are a combination of level of difficulty and impact (e.g., they get points every time they carpool, or ride public transit).

Key Lessons – Quotes from Program Managers

- *For me the key piece is to be willing to simplify and streamline in a way that is appropriate for the audience. There is always an option to get more information. Letting go of the idea that people have to pay attention to the things we think are important.*
- *Try things to stretch your comfort zone" and do incorporate strategies that are new to you.*
- *Address people where they are at, not where you think they should be.*

Quotes from Program Managers

Advances employee understanding as sustainability as a corporate priority.

It is situational to a specific environment. We just did a project with a small manufacturer where over half played the game for eight weeks. And at the end of the 8 weeks, close to 80% of them were still playing on a weekly basis…they got hundreds of ideas of things to do within their facility to be more sustainable, and there is amazing momentum behind their sustainability manager now about what the path is forward.

Sometimes organizations are better positioned. First, they had an internal advocate with the soft skills to make that game work and the bigger vision to see how it would propel them forward, and it was in a climate where people understood their company had a commitment to sustainability…where in other environments, like local governments which are underfunded, people have been attacked in various ways for being privileged…it is hard to engage people partly because they are just so beaten down about things.

We are getting feedback that it was refreshing to play the game, to celebrate what's working with colleagues. It is hard to go into a place where there is a lot of other

baggage; it is hard to have as successful intervention. Inevitably, the game is mitigated by all the other stuff going on.

This is a game, but it is more about participation than about winning. Because if we frame things as whoever gets the most points wins, then that encourages players to cheat.

We use competition, not in "who can do the most extreme thing," but more slow and steady. People are motivated to see how their team is doing compared to other teams to show their effectiveness.

We have gone to places like healthcare, where people say to us, "we are really not competitive, we work together to save the patients." And that might be true but employees are still competitive. Everywhere we go, we see people really liking the opportunity to have a little competition in what they do, the opportunity to show off.

This is the Midwest, we don't like to tell each other what to do, but if we are in a game and my standing is dependent in some way on you, it is ok for me to coach you. We see players telling us that it is the game that gave them permission to have these conversations with people….maybe there is this person who prints everything single sided and it makes me crazy, but there is no way for me in the regular world to say something about that. In the game, you've got to start printing double sided, so we earn points. So it opens doors.

Case Study 19: Kilowatt Cup
Inter-Organization Energy Conservation Competition

Description
PECI is a national energy efficiency consulting firm, with headquarters in Portland, Oregon.[34] A unique component of PECI's competitions is the use of highly granular metering, which PECI designed prior to moving into their new office space, and automated M&V of savings in real-time using Pulse Energy Manager software. The circuit-level metering is aggregated into lighting, HVAC, and plug loads by floor and zone. In 2012, PECI organized the first annual Kilowatt Cup to inspire and educate their employees to reduce plug loads over a period of two weeks.[35] The program was expanded in 2013 to also include lighting for a period of one month. Then, in 2014, it was revised to include the office versus a sub-tenant who have the same lighting and plug load metering and controls. PECI used new engagement strategies including gamification software and a charity component.

Organizers
- PECI, now CLEAResult employees

Goals and Motivations
- As buildings become more efficient, lighting and plug load energy uses controlled by end users are becoming a larger portion of commercial building energy use.
- A competition was perceived to be a good mechanism to inspire people in the office to learn about office lighting and plug load energy usage and the control systems.
- Figure out what strategies work best for engagement and learn something every year to improve our behavior program designs.

Target Population
- PECI employees in a commercial office (2012 and 2013). CLEAResult and Interface Engineering employees in a commercial office (2014).
- PECI employees were already somewhat aware of the office's energy consumers and the controls used due to previous trainings on the energy-savings devices.

The Competition Prize
- Winning floor/company gets a trophy (Kilowatt Cup) and bragging rights. If CLEAResult met their savings goal, they donated money to the Community Energy Project (2014). Top teams and individuals were given certificates of recognition. Team captains were given gift cards (2014).

Theories of change (2014)
- Reciprocation – Team Captain/Contributor Happy Hour, Contributor Happy Hour

[34] In October 2014, CLEAResult acquired PECI's assets.
[35] For more information, see: http://beccconference.org/wp-content/uploads/2013/12/PECI-KilowattCup-BECCPresentation-v10-Rose.pdf

working session, Awards Happy Hour. Charity donation in name of company if we met goals.

- Authority/Social Proof – team leaders read handouts in conference room – team peer pressure
- Consistency – The challenge email format was always the same. We also created a self-image consistency trap; commit first, then tell us later how you did (self-fulfill your self-image).
- Low ball – once opted in to the game, we kept sending them commitments
- Liking – Team Captains, cooperation vs competition tactics
- Framing/choice architecture – curation of options in challenges
- Loss aversion – goals tied to loss. Loss aversion becomes motivation.

Communication Channels (2014)

- Pulse Energy Dashboard: Energy management information system (EMIS) used to show the standings, actual energy use and baseline energy use per team
- Kickoff meeting
- Team captain kickoff happy hour
- Awards happy hour
- Email reminders
- Conference room handouts
- Signs around the office
- Weekly e-newsletter
- Floor/Team captains communicated directly – 1-3 times per week
- Gamification software with recommendations, commitments, leaderboard (2014)
- Follow up communication once every few months to encourage persistence

Activities

- In the Pulse Energy Software: collected real-time end use energy data, created and ensured adequate accuracy of baseline models, compared actual energy use to baseline energy use.
- Had kickoff meeting, wrote article in newsletter, flyers
- Floor/Team leaders: Different leaders had different strategies. For example: get a pledge card (public pledge), in-person reminders, team emails, random cube checks.
- Educate: give people tips and show them floor and company-wide energy savings.

Behavioral Strategies Employed (2014)

Strategy	Description
Commitments	Yes. They could make pledges public on website or by stickers.
Goal setting	No company wide energy savings goal besides to beat the competition. An average of 65% of employees made a commitment through the gamification software, with 88% committing to the first of seven commitment challenges

	(2014).
Prompts	Emails from team captain. Emails from gamification software. Flyers. Notices. Happy or sad face stickers on computers if left on or not (2013).
Social diffusion	No
Comparative Feedback	Yes. Comparison between floors/companies shared in weekly e-newsletter and in online monitoring dashboard. Comparison between teams shown in gamification software.
Instantaneous Feedback	Yes. Floor/company level dashboard was real time. Team individuals and team total leaderboards were real time.
Tailored Feedback	No
Descriptive norms	Yes. Each of the seven commitment emails in the gamification aspect suggested three potential actions. Handouts in conference rooms repeated facts and messaging in each commitment email.
Subjective norms	Yes. Team captains encouraged their teammates to participate so they would do better than other teams, floors and as a company, Interface Engineering. Team captains were encouraged to read aloud handouts in conference rooms.
Scarcity	No
Loss aversion	Yes. If we didn't meet our two goals, we wouldn't be able to donate any money to charity. If we only met one goal, we'd donate less than the full amount.
Reciprocity	Yes. Some team captains gave their teams treats. Donation to charity on behalf of company if we met our game's point goal, or larger amount if we met a second goal (beating Interface Engineering).
Local Messengers	Yes. Team captains.
Imagery	Yes. Snapshots of dashboard in e-newsletters, emails, and kickoff and award presentations. Pictures of winning teams in e-newsletters.
Rewards and incentives	Yes. Kilowatt Cup trophy to winning team.. Bragging rights. Charity donation. Happy hour and gift card for being a team captain.
Competition	Yes. Competition between teams, between floors, and between companies.
Energy Coach / trusted advisor	No

Most effective strategy

- For those extrinsically motivated: peer messaging, camaraderie, competition and spot

checks of individual cubes with sticker feedback.
- For those intrinsically motivated: providing many discrete action suggestions to choose from, and method to get credit and recognition in gamification software.

Scalability
- A similar concept might work elsewhere if sub-metering exists or the energy users can influence a large portion of the equipment's energy use.

Resources Available
- Staff time (in addition to regular job duties)
- Small budget: trophy, team captain happy hour, awards happy hour, gift cards
- Printed material: colorful certificate awards

Outputs
- 2012: 86% of employees participated
- 2014: an average of 65% of employees participated, with 88% committing to the first of seven commitment challenges. 62% of PECI survey respondents said it encouraged them to adopt a new behavior.

Outcomes
- 2012: 14% reduction in plug load energy use (719 kWh) and 4% reduction in our total energy consumption during the two week competition period.
- 2013: 20% reduction in plug and lighting energy (3,100 kWh), and 7% reduction in our total energy consumption during the month long competition period. Plug load savings account for 2,072 kWh of the 3,100 kWh.
- 2014: 9% reduction in plug and lighting energy (1,500 kWh) during the month long competition period. Plug load savings account for 1,170 kWh of the 1,500 kWh.
- If savings can be achieved in a highly efficient building, for energy conscious residents, where year over year the baseline energy use may even decrease due to these efforts, even more savings may be achieved in other settings.

Persistence
- It is difficult to measure persistence in an office environment where the number of occupants changes overtime. So every year, the baseline model had to be re-created.
- By 2013, most of the savings of the 2012 competition had eroded.
- In 2013, the competition helped identify opportunities for automation, for lasting savings, e.g., altering the existing lighting controls.

Measurement and Evaluation
- Within the energy management information system software, we compared actual usage to the estimated "baseline" usage (modeled energy usage based on previous usage, occupancy calendar and outside air dry bulb temperature).

Program Evaluation Findings

- They achieved savings and have learned something new each year, which met their goals.

Challenges and recommended improvements

- **Persistence** of behavioral change continues to be an issue. We continue to seek ways to institutionalize the behavior changes made during the competitions (i.e., implement changes to lighting controls, add timers to coffee makers and copiers, install power management software on computers). It is difficult to measure persistence due to the baseline issue described above.
- **Submetering**: Without it, it would be difficult if not impossible to see the savings at the company wide level due to larger equipment loads such as our data center.
- **Timing:** Time of year is very important. Behavioral change requires employee time, and there are often other competing priorities for that time.
- **Complexity:** Making it interesting and engaging every year yet keeping it simple enough so as to not make it confusing to participants.
- **Outreach:** Email overload is always an issue, especially for high-level and 100% billable people. More than twice a week is too much.

Key Lessons

- Used the competition to understand employee behavior and further their understanding of the existing building control systems: e.g., they discovered that requiring occupants to turn lights on, rather than off, saved more electricity and wasn't a burden. So we updated the lighting control system to require employees to use the switch to turn the lights on when they need them. We wouldn't have known that this strategy would be feasible for our staff if not for the competition.
- Embed energy savings in control systems when possible. The completion can help the company understand what can be automated and what should be driven by behavior.
- Timing is very important. Keep it simple and engaging.
- Every year we learn more about how to engage employees' competitive spirit, and have found when people really get into it, they get creative about saving energy.

Quotes from Program Managers

Every place is different. So, if you were going to build your own competition, some of the engagement methods we used might not be as effective. Be willing to make changes along the way and don't give up. Come up with a strategy and be willing to adapt and change based on the culture and what is working and not working even during the competition.

The second year, we included lighting energy. The only control that people in our building have is through a wall switch. Prior to the competition, when someone walked into the space between 7am and 7pm, the lights would automatically turn on. One of our

tips was to turn the lights off during the competition using the light switch. We noticed a lot of people had their lights off. So we changed the control so that when you come into the office now, you have to turn it on at the wall switch. That one change can make the lighting energy savings last after the competition. Without the competition, we probably would not have identified this as an opportunity to save energy.

In the third year, we included some other sustainability actions in addition to energy conservation, to try and make the competition more appealing, which seemed to work for some people. We knew it would be a tough time of year, which in hindsight, meant that we should have simplified the planned number of suggested actions and emails. We got a lot of feedback that people were confused since the numbers didn't line up on the two separate software systems: the Pulse Energy dashboard showing actual energy savings and usage, and the gamification software, where they could get credit for self-reporting action completion. We were hoping to see if we could correlate company-wide energy savings to the self-reported actions, but it wasn't possible because of the number of emails, and varying levels of commitment responses. We learned a lot from the gamification software data about how many people answered each kind of commitment challenge, how many actions they committed to, and if they reported actually doing what they said they'd do. But triggers, like employee-created funny emails before a long weekend, or team captain emails, made more of an impact than the commitment email itself. Many people didn't read e-newsletters or emails, so it was challenging to find other ways to engage them that didn't take too much staff time.

Overall, we reduced our baseline energy use each year through automation, but we also lost savings from behavior backsliding after each Kilowatt Cup ends. The challenge each year is to come up with ways to make the habits stick.

Case Study 20: EPA's ENERGY STAR National Building Competition
Type: National Building Energy Competition

Description

Since 2010, the U.S. Environmental Protection Agency (EPA) has been hosting the ENERGY STAR National Building Competition: "Battle of the Buildings." Buildings battle the scale and each other as they compete to find out who will become the nation's biggest energy loser. Buildings compete to save energy, save money, and fight climate change. Competitors work off the waste through improvements in energy efficiency with help from EPA's ENERGY STAR program.

All competitors track their monthly energy consumption using EPA's online energy tracking tool, ENERGY STAR Portfolio Manager®. At competition launch, midpoint, and end, they report their progress. At the end, the overall winner is the building that demonstrated the largest percentage-based reduction in their "energy weight," defined as their energy use, adjusted for weather and the size of the building, during the present calendar year as compared to the previous calendar year baseline. EPA also recognizes buildings that are the best in their category (e.g. "top hospital"), and all buildings that reduce their energy use by 20 percent or more. Energy use reductions are required to be verified by a licensed Professional Engineer or Registered Architect at the end of the competition for each competitor that receives recognition from EPA.[36]

In the first year, EPA chose only 14 buildings from a pool of 200 applicants. Like the Biggest Loser TV show, you could follow along and see how each building was doing. Competitions last twelve months, with energy data collected for a baseline and comparative year.

Organizers

- U.S. Environmental Protection Agency (EPA)
- Utilities, services providers and others serve as energy coaches and provide services.

Goals and Motivations

- The initial goal was to bring energy efficiency into the mainstream.
- Intended to reach a national audience. Wanted a spokesperson and to raise awareness with messages like "30% of energy is wasted."
- Now in its fifth year, the goal has shifted to engaging more buildings and achieving more reductions. This year ENERGY STAR is also offering recognition for water savings.

Target Population

- The Energy Star certification program is only available to the top 10% of buildings. This program is open to any commercial building: offices, schools, hotels, wastewater treatment, stadiums, libraries, churches, firehouses, etc. It especially appeals to

[36] For more information, see: http://www.energystar.gov/buildings/about-us/how-can-we-help-you/communicate/energy-star-communications-toolkit/motivate-competition-0

organizations that own or manage buildings that are not eligible for other types of ENERGY STAR recognition, such as ENERGY STAR certification, either because EPA does not yet have a 1 -100 ENERGY STAR score available for that building type (buildings must have a score of 75 or higher to be eligible for ENERGY STAR certification) or because the building is a poor performer.

The Competition Prize

- National recognition from EPA. Winners are included in a national EPA press release, listed on the ENERGY STAR website, and they receive a signed certificate.

Theories of change and models

- Modeled on the Biggest Loser TV show.
- Academic literature on competitions

Communication Channels

- Website
- Emails
- Webinars
- Social media
- Materials sent at launch, midpoint, and end.
- Provide businesses with templates for media releases, banners, newsletters, etc.

Activities

- Annual call for applications
- Agree to baseline the previous year and track the current year
- Make the information transparent. The energy intensity of buildings is posted publically.
- Educational materials, including ways to engage employees.
- At the end of the competition period, there are awards for overall performance by building category, and by achievement threshold (i.e., buildings saving more than 20% energy use are recognized). Buildings can earn multiple awards.

Behavioral Strategies Employed

Strategy	Description
Commitments	Partial. Participation is a sort of commitment.
Goal setting	Partial. If they achieve 20% reduction, they are rewarded.
Prompts	No. They get some emails and information at midpoint.
Social diffusion	No
Comparative Feedback	Yes. Energy intensity is posted on the national website. EPA's Portfolio Manager is a benchmarking tool.
Instantaneous Feedback	No
Tailored Feedback	No
Descriptive norms	Somewhat. They provide examples of what others have

	done
Subjective norms	No
Scarcity	Partial. The first year there were only 14 spots, but no more limits in later years.
Loss aversion	No
Reciprocity	No
Local Messengers	No
Imagery	No
Rewards and incentives	Recognition for winners
Competition	Buildings compete with another based on how much energy they use
Energy Coach / trusted advisor	No

Most effective strategy

- No single strategy identified.

Scalability

- Already scaled to the national level.

Resources Available

- This is part of EPA's Energy Star Program. Much of the tools, such as Portfolio Manager, already exist.
- Estimate: $80,000 per year to support marketing, communication, web, resource development, and data collection and review. About 2 part-time staff, plus communications.

Outputs

- Year 1: 14 buildings (chosen from pool of 200 applicants). Monthly webinars and more interaction when there were just 14 buildings.
- Year 2: 245 buildings
- Year 3: > 3,200 buildings
- Year 4: > 3,300 buildings
- Year 5: > 5,800 buildings

Outcomes

- Year 1: 14 competitors saved 44 million kBtu, more than $950,000, and prevented 4,896 metric tons of greenhouse gas emissions.
- Year 2: 245 competitors saved 240 million kBtus, $5.2 million, and prevented 30,000 metric tons of greenhouse gas emissions.
- Year 3: 3,000+ competitors saved 3 billion kBtus, $50 million, and prevented 290,000 metric tons of greenhouse gas emissions. 89 buildings reduced their energy use by 20% or more

- Year 4: 3,000+ competitors saved 1 billion kBtus, $20 million, and prevented 130,000 metric tons of greenhouse gas emissions. More than 50 buildings reduced their energy use by 20% or more.
- Year 5: 5,800+ competitors. Final results available in May 2015.

Persistence

- Not measured

Measurement and Evaluation

- All buildings measured using EPA's ENERGY STAR Portfolio Manager. Energy (kBtu) per square foot is compared to previous year, adjusting for weather. Metric of comparison is: weather normalized percentage change in energy use per square foot

Program Evaluation Findings

- No evaluation

Challenges and recommended improvements

- In 2014, there was a streamlined application process.
- In year 2, the winner was a parking garage (63%). Offices thought this was unfair.
- In year 3, the winner was a school (52%).
- In year 4, the winner was a school (46%).

Key Lessons

- Comparative feedback is the key motivator.

Quotes from Program Managers

> *All we have to offer is recognition. We can award more than one, but we can't give awards to everyone.*
>
> *Creating a platform that gets everyone involved, not just a program about lighting. That is, just finding waste and stepping on a scale, has been very valuable.*

Appendix B. Interview questions

Energy Reduction Programs Evaluation Research Survey

Thank you very much for participating in this survey of energy conservation programs. We are asking you to share your experience as a program implementer or topic expert to help us understand which program strategies are more or less effective under different circumstances. Your feedback will make a critical contribution to improving future program efforts. .

This interview should take about 45 minutes but could be shorter or longer depending on the length of the answers you give. Feel free to answer the questions to the extent that you feel comfortable. I will be asking 30 questions, some with multiple parts.

As indicated in the consent form, I will be recording our conversation to verify and correct my notes. When we write our reports, we may use quotes from the interviews.

During this interview I will be asking about your opinions on the design, implementation and evaluation of energy conservation programs. At the end of the interview you will also have a chance to tell me anything else you think would be useful for this research.

You may choose not to answer any question by simply stating, no answer.

Do you have any questions? Are you ready to begin? OK, let's get started.

Identification and Overview

1. Just to make sure I have the accurate information, please state your name, title and institution.

2. What was the name of the energy reduction program (or programs) that you are commenting on and what was (or is) your role in the program(s)?

A) Motivation, Goals, Expectations

3. Thinking back to when the program first began, what were the primary motivations of the program designers?

4. What specific problem was [program name] designed to address?

5. What is the goal, or goals of this program?

6. How did/does the program seek to accomplish the goal/s? In other words, what are the key interventions of your program, and what is the impact anticipated from each?

7. Did the program follow a specific well known theory of change? Alternatively, did you pattern your program on other programs? If so, which one(s)?

8. Did the program work exactly as it was supposed to? If not, what would the outcome look like? [prompt for best result in terms of program goals, if necessary]

9. Very few programs work exactly as intended or accomplish everything the designers hoped for. For [program], to what degree were the design expectations met?

B) Target Population

10. Most programs are designed to encourage participation by specific groups of people. Was your program originally designed to reach a specific target population? Is so, why did you target them?

11. What research was used to determine the target audience?

12. Who ended up participating—in other words, how would you describe the program participants as a group, or as multiple groups, compared to the original target population.

C) Inputs (Resources)

13. What organization or group was primarily responsible for developing and implementing the program? [prompt if they do not respond with name of institution or specific department within institution]

14. What resources did the program have at its disposal to meet its objectives? Resources typically include things like volunteer and staff time, funding, access to publicity, print materials, etc. Please try to be as specific as possible.

D) Actions - Activities

15. What specifically did the program do? Please briefly describe the primary activities of the program.

16. What kinds of communications channels were used to approach and then engage participants? [prompt to elicit the means, frequency and who was primarily responsible for generating that content].

17. I am going to read you a list of strategies that are frequently employed by behavior change programs. For each strategy that I mention please tell me whether your program utilized it and very briefly describe what the strategy entailed.

    a. Commitments: encouraging participants to pledge to take particular actions. [prompt to elicit whether commitments were made public]
    b. Goal setting: giving participants an individual or group target to achieve.
    c. Prompts or reminders to accomplish certain actions
    d. Persuasive messaging:
        i. Descriptive norms: what others like them are doing
        ii. Subjective norms: how others like them think they should act
        iii. Scarcity: when supply of something desirable is limited
        iv. Loss aversion: what they might lose if they don't do something (as opposed to what they might gain)
        v. Reciprocity: helping or being kind to participants with no explicit expectation of them returning the favor
        vi. Local messengers: when messaging is by someone local or known
        vii. Use of powerful imagery to convey messages
    e. Social networks: working through participants' different spheres of influence, like friends, schools, business, social groups, etc.
    f. Incentives: tangible items like prizes or rewards, or intangible things like recognition
    g. Feedback: letting people know how well they are doing. [probe to ascertain types of feedback (usage compared to prior usage, usage compared to goals that were set, usage compared to similar households or businesses, etc) and how they provided the feedback]
        i. positive feedback
        ii. negative feedback
        iii. instantaneous feedback
        iv. tailored feedback based on detailed knowledge of participants' options
    h. Competitions: provide a means for individuals, households or groups to win a prize by reducing energy consumption more than others participating
    i. Can you think of other techniques that you used?

18. Which of these techniques have you found most effective with your target populations? Why? Given your experience, do you have any ideas on improving these strategies?

E) Outputs

I'd like to discuss how much the program accomplished in terms of the actions taken by implementers.

19. To the best of your ability, please describe the quantity of different program activities. Typical activities (sometimes called outputs) include things like number of recruiting events, newsletters, emails, workshops, website views, etc.

20. Did the program ask participants to evaluate the quality of any of these activities? If so, what were some of the main lessons learned?

21. To what extent did the program meet its objectives for the quantity and quality of program activities? Which activity worked the best and which worked the least well? What might you do differently if you were running the program now?

F) Outcomes

I'd like to discuss program outcomes in terms of how well the program achieved its goals.

22. What specifically, did the program accomplish (or do you expect will be accomplished)? For example, kWh or CO2 reduced, number of actions taken by participants, etc.? Are you satisfied with this level of project outcomes?

23. How did/will the program measure these results? (prompt to elicit type of design (pre-post, randomized controlled trial, etc.)

24. Was this the level of project outcomes that you anticipated?

25. What happens when the program ends? Do you expect the changes to last, or persist, for some period of time? Do you have evidence for this?

G) Other

26. What is the total annual budget for the project and who were the funders? What level of resources do you think is would have been needed to truly achieve the project objectives?

27. Was the project a one-time pilot or an ongoing program? Did you start the program with a smaller test and then scale it up?

28. Let's talk for a minute about "bang for your buck". For the amount of resources put into this program, do you think the outcomes justified the investment? How about compared to other programs you know of that were intended to achieve similar goals? Why?

29. Do you think this program could be successfully expanded in your area to include more participants? Could it be expanded to different target populations? Do you think the program design could work in other places? (prompt if they do not mention scaling to other populations)?

30. What are the key lessons or takeaways you would give to other potential program implementers? PROBE: What do you know now that might have led you to change your program implementation, had you known it then?

31. Have you or anyone in your organization-received training in Community-based Social Marketing?

    a. If yes, where did you get the training? Did you follow the CBSM steps? If so, to what extent?

32. Will you be able to send me copies of any relevant program materials? We'd be interested in program guides, outreach materials, messaging, evaluation or any other materials you'd be willing to share on the program.[Thank them for agreeing to send]

33. Is there anything else you would like us to know that will help us understand the program better?