A Review of Energy Reduction Competitions: What Have We Learned?

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Disclaimer

The findings, opinions, and conclusions expressed in this presentation are those of the authors and do not represent the opinions or policies of the CPUC or CIEE

Takeaway Message

- Energy reduction competitions are still in their infancy
- Diverse range of program designs & audiences
- Some promising results
- Questions remain about scalability and persistence
- Need to experiment!
- Need to evaluate!

Topics

- Research questions
- Competition and behavior change strategies
- Design of competitions
- Data collection and analysis methods
- Results
- Lessons learned
- Recommendations
- Community-Based Social Marketing

Research Questions

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

Energy Reduction Competitions – 1

- Typically conducted in a social, publicly visible setting where group dynamics are important
- Goals are set, commitments are made, information and feedback are provided and prompts are issued
- Competitions may be thought of as both a type of program and an intervention strategy of a larger program

Energy Reduction Competitions – 2

- Competitions are structured to:
  - Engage – catch attention and involve the target audience
  - Educate – communicate info on what, why and how behavior should change (increase awareness, understanding and knowledge)
  - Motivate – enhance desire to change behavior
  - Empower - increase competencies, capabilities and self-efficacy of individuals to create change

Behavior Change Strategies – 1

- Local messengers
- Comparative feedback
- Social diffusion
- Imagery
- Competition
- Rewards and financial incentives
- Social norms
- Prompts
- Public commitments
- Goal setting

Behavior Change Strategies – 2

- Scarcity
- Tailored feedback
- Reciprocity
- Gamification
- Loss aversion
- Energy coach/advisor

Issues Regarding Design of Competitions

- Technology and behavior
- Size of competitions
- Scaling up
- Equity
- Perverse incentives

Data Collection and Analysis Methods – 1

- Literature review
- Case study selection
  - Criteria: focus on energy, measured results, strong documentation, and representation from a range of domains (households, businesses, schools, etc.)
  - Reviewed 25 projects and 20 are in the report
  - Project types:
    - Campus energy conservation competitions
    - Inter- and Intra-community competitions
    - Inter-community home energy upgrade programs
    - Inter- and Intra-organizational competitions
    - National building energy competition

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

Data Collection and Analysis Methods – 2

- Interviews
  - Phone interviews, recorded and transcribed
- Case studies
  - Later reviewed by program implementers and evaluators
- Analysis
  - More qualitative than quantitative
  - Not a detailed statistical analysis nor a meta-analysis

Program Characteristics

- Relatively new
  - 75% occurring since 2010
- Program duration varies
  - A few weeks to several years
- Number of participants varies:
  - 6 cities in Kansas Take Charge Challenge; 12 libraries in El Paso's Energy Savings Challenge; 1 business in PECI Kilowatt Cup
  - 300,000 students and staff in the Campus Conservation Nationals; 5,800 buildings in EPA's ENERGY STAR Building Competition

Savings

- Energy - not measured in all programs
  - Mostly electricity savings – average of 5% or less, BUT:
    - ▲ 21% in the Sustainable Connections' Community Energy Challenge (annually)
    - ▲ 14% in CoolCalifornia Challenge & Energy Smackdown
    - ▲ Top 10% of participating buildings: 25-30% savings – in the Campus Conservation Nationals & Kukui Cup
- CO_2 – estimated for a few programs
  - NEEA's Kilowatt Crackdown: 50 million pounds since 2007; Campus Conservation Nationals: 7 million pounds in 4 years
- Financial – estimated for a few programs
  - EPA's ENERGY STAR Building Competition: saved over $70M in the last 2 years
  - Kansas Take Charge Challenge: saved over $2M

Measurement & Evaluation

- None of the programs used a Randomized Control Trial
- Only two programs conducted a quasi-experimental study
  - CoolCalifornia Challenge and San Diego Energy Challenge
- Most simply compared energy use during the treatment period with energy use in a prior period (either monthly or annual energy use)
  - No comparison group
  - Weather normalization done in a few cases
- Some relied on energy modeling
- Some did not conduct any energy evaluations

Persistence

- No formal evaluation of persistence
- Anecdotal information only
  - Campus Conservation Nationals: savings were sustained 2-3 weeks after competition
  - Energy Smackdown: participants reported doing the same behaviors six months or later
- Remember: most competitions were of short duration (weeks or months)

Communication Channels

- All programs had websites – primary means of communicating with participants
- Most programs used email communication, in-person communication, informational flyers or posters, events, newsletters and social media
- A few programs used television, phone hotline, energy advisor, snail mail, building dashboard, and lawn signs
- Behavior change strategies: more critical

Most Common Behavior Change Strategies

1. Local messengers
2. Comparative feedback
3. Social diffusion
4. Competition
5. Imagery
6. Financial incentives and rewards
7. Descriptive norms
8. Commitments
9. Goal setting

Lessons Learned

- Competitions have been effective at changing behavior and reducing energy use
- We do not know how long the energy savings or practices (habits) persist
- Competitions used differing metrics and designs, mostly without experimental design
  - Difficult to identify the most effective competitions or even the best practices for the design and implementation of these competitions
- But we have some general lessons learned

General Lessons Learned – 1

- Competitions have the ability to massively scale up interventions
- Competition is a program strategy but does not guarantee savings
- Continuous engagement is critical
- Competitions can achieve significant savings per retrofit
- Competitions often rely on social norms, particularly through comparative feedback mechanisms and marketing materials
- Competitions can increase participants' self-efficacy but not all competitions may lead to increased self-efficacy

General Lessons Learned – 2

- Competitions used a variety of software tools, and the most compelling incorporated the following:
  - Leaderboards
  - Goals
  - Stories
  - Commitments
  - Incentives and rewards
- Measurement and evaluation of competitions varied substantially, with many of them significantly deficient – evaluation is challenging for competitions

General Lessons Learned – 3

- Given the short time span of most competitions:
  - Investments in energy-efficient equipment or whole home retrofits is challenging
  - Persistence of energy savings is unknown
  - Habits can change, but their persistence is unknown

Most Effective Behavior Change Strategies

- Comparative feedback
- Recognition & financial rewards
- Local messengers
- Game mechanics (e.g., competition, points, levels)
- Social networking & social diffusion
- Person-to-person contact
- Deadlines (also related is loss aversion)
- Education (particularly in student competitions)
- Energy plans (although not common)
- Energy advisors/coaches (although not common)

Campus Competitions

- Motivation and training of the people implementing these programs are key to success
- Primary purpose is educational
  - High quality educational components are critical
- Do not necessarily increase self-efficacy
  - Feedback may be disempowering: students realize they have little control over the total energy use in their buildings

Inter-Community Competitions

- Motivation and increasing capacity of local program managers and stakeholders are key to success
- Low cost competitions are possible by being less resource intensive but may not be as effective
  - Personal engagement is critical (but costly)
- Recognition should be granted for all communities achieving particular goals, not just outperforming peers
- Rewards (recognition and prizes) can enhance intrinsic motivation and long-term behavior change

Inter-Community Home Energy Upgrade Competitions

- Community-based Social Marketing (CBSM) strategies can be used to increase program uptake [we return to CBSM at the end of this talk]
- Success depends on the availability of highly trained, trusted energy advisors, simplification of the process for homeowners and clear communication of non-energy benefits to homeowners

Intra-Community Competitions

- Competitions may be more motivating for sub-groups within communities (than competition between cities)
- Campus programs
  - Competitions between residence halls on individual campuses
  - Competitions between floors within residence halls
  - Tool kit available from Campus Conservation Nationals – can be used for all types of competitions
- Households affiliated with elementary, middle or high schools within the community: possible but considerable effort needed for coordination
- Neighborhoods also possible, but lack results

Inter-Organization Competitions

- Business competitions can be very effective
  - Need to support all businesses and minimize potential negative impacts of businesses that do not do as well
- Ensure competitions are fair
  - Use multiple metrics and multiple winners
- Provide tools and resources for comparing energy use across businesses
- May be best to segment the market and focus the competition on specific business markets
- Programs should be simple and easy to use and designed to last for multiple years
- Normative information works well: leaderboards

Intra-Organization Competitions

- Help boost employee morale and improve the team-focused culture of the company
- Games are important and can make "work" more fun
- But challenging to get employees to save significant amounts of energy use in commercial buildings
- Business competitions can include actions taken at home (good way to get positive feedback for this)
- Need to provide the right amount of feedback on results

National Buildings Competition

- Works well and motivates the building sector to participate in the competitions
- Other types of competition could be introduced
  - Most energy innovative building, "greenest" building, etc.

Recommendations

- Create well crafted intervention strategies
- Change the focus from winning to doing well
- Know your target audience
- Simplify engaging software
- Be careful in scaling up
- Use rewards but be careful
- Experiment!
- Devote more resources to measurement and evaluation
- Ensure persistence

Takeaway Message

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Report Availability

Report is available at CIEE website:

http://uc-ciee.org/behavior-decision-making/1/lbrsearch

Community-Based Social Marketing
(CBSM)

- Five steps*:
  1. Identify the target behavior for your population,
  2. Identify the barriers preventing people from doing the behavior, and the motivations of those who do,
  3. Use appropriate behavior tools to overcome barriers and highlight the benefits,
  4. Pilot the intervention, and
  5. Evaluate, modify and scale up as appropriate.

* Based on: Doug McKenzie-Mohr and William Smith, *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing*, New Society Publishers, 1999.

CBSM Projects

- Projects that met CBSM definition (follow at least first 4 steps)
  - 2 CBSM projects for Urban Sustainability Directors Network (office computers; residential cold water laundry)
  - Rewire - monthly behaviors encouraged on University of Toronto campus
- Community-based behavior change projects that did not follow CBSM steps
  - Cool Choices
  - BC Hydro's Team Power Smart program
  - Efficiency Vermont
  - Envision Charlotte's Smart Energy Now
  - CBSM in Alameda County
  - Cape Light
  - ClimateSmart Home Service
  - Environmental Health Coalition Health Homes Program
- Other projects reviewed but expert did not agree to an interview
  - Burlington Ice Rink
  - iCanConserve Program
  - 20/20 The Way to Clean Air

Few Energy Reduction Programs Fit CBSM Criteria – 1

- Buildings are complex systems with multiple end uses and diverse populations using them
- The first step of CBSM is to identify a single behavior to change that is an "end use" and is "non-divisible" for a specific population
- Most programs that we evaluated did not focus on individual end uses, but rather on motivating building owners to implement comprehensive building energy upgrades or to participate in games, competitions, or other programs that target multiple end use behaviors
- Since programs do not target single end uses, but rather multiple end uses often for diverse populations, it becomes very difficult to evaluate barriers and benefits (step 2)

Few Energy Reduction Programs Fit CBSM Criteria – 2

- Each behavior has a unique set of barriers, and these may be different for diverse population segments
- If barriers and benefits are identified, programs rarely take the next step to design behavior change strategies to overcome those barriers and highlight the benefits of the behavior
- Most behavior change programs essentially use as many behavior change strategies as possible in hopes that they will be effective for different populations
  - Common behavior change strategies are those mentioned under Energy Reduction Competitions

Key Findings for CBSM

- The use of community messengers was the single most common behavior change strategy (the hallmark of CBSM)
  - Successful whole building upgrade programs almost universally offer a full set of customer service (marketing, audits, independent energy advisors, safety testing, contractor vetting, financing, testing) to facilitate the process of building owners
- There is a challenge between scaling programs (from small to large) and maintaining local buy-in with high touch needed to achieve deep savings
  - The CBSM programs were all at very small scales (e.g., a single college campus, an office or a neighborhood)
  - None of the programs have been successfully replicated or extended beyond the initial small scale (step 5), although the programs themselves do seem successful enough to replicate

Time for Questions