CHANGING BEHAVIOR FOR A BETTER ENVIRONMENT

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Best Practices for Stimulating Energy Efficiency Action Among Citizens of Sonoma County

Report For: Sonoma County Water Agency

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EXECUTIVE SUMMARY

The Sonoma County Water Agency requested the help of a team of students from the University of California, Berkeley's Goldman School of Public Policy in order to answer one central question: What makes people change their behavior to improve energy efficiency?

This study reviewed programs from around the globe to find ten cases that attempted to create lasting behavior change to improve energy conservation and efficiency. The selected programs come from North America, Europe, Asia, and Australia and include a variety of mechanisms to influence behavior change, such as lotteries, energy audits, and community building activities. The studies yield many lessons learned regarding the design and implementation of policies that have been utilized to change consumer behavior to increase energy efficiency.

An economist might think: why can't the utilities just raise energy rates to a level that discourages excessive use? While some case studies explore time-of-use pricing, under current state law, utility rates cannot be raised simply to achieve public policy goals. Any increases in utility rates must be tied to the actual cost of providing service, and are highly regulated and monitored by public interest groups. Additionally, for a public utility, rate increases raise equity concerns as they may disproportionately impact lower income customers. As such, the energy efficiency programs examined within this document do not focus on achieving results through overall rate increases or heavy-handed government intervention. Rather, these cases seek to influence consumer behavior through the social science using cognition, calculus, and social interaction strategies.

For four of the strongest programs, this document explores potential application to Sonoma County and estimates energy savings to a defined service area, and to the average household within that service area. This document is intended to be an initial guide and source of inspiration for future policy development. Potential implementation of any of the programs included in this analysis should be carefully evaluated in order to ensure feasibility and effectiveness before policymakers proceed.

The following **Table ES.1** presents an overview of the ten international case studies included in this report.

TABLE ES.1: SUMMARY OF INTERNATIONAL CASE STUDIES

Program (Country)	Implementing Agency	Description	Behavior Change Strategy Employed	Uptake
In-Depth Case Studies				
aWattgarde (Austria)	Illwerke VKW AG	Gaming, app, infotainment	Cognition, Calculus	6,919 (within first 6 months--10% of eligible population)
Block by Block Program (The Netherlands)	Netherlands Enterprise Agency	Home Retrofitting and Re-insulating	Cognition, Calculus and Social Interaction	1,500-10,000 homes
Community Energy Diet (Canada)	City of Rossland, Sustainability Commission Energy Task Force, Nelson & District Credit Union, Columbia Basin Trust, FortisBC	Energy Audits and Subsidies for Home Retrofits	Calculus, Cognition, and Social Interaction	11%
National Smart Meter Plan (Ireland)	Commission for Energy Regulation (CER)	Smart Meter/IHD Rollout	Cognition and Calculus	100% (Federal Mandate)
Cursory Case Studies				
10% Energy Challenge (Singapore)	National Environment Agency	Energy Savings Competition, lotteries	Cognition and Calculus	N/A
Community Energy Saving Programme (UK)	Office of Gas & Electricity Markets (Ofgem)	Energy Audits	Calculus	40,000 homes (less than 50%)
Eco-Points Program (Japan)	Ministry of Environment, Ministry of Economy, Trade and Industry (METI), Ministry of Internal Affairs and Communications.	Rebate	Cognition and Calculus	N/A
Energymark (Australia)	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Peer Champions, Community Building	Cognition and Social Interaction	Over 2,000 households
Free CFL Program (USA)	FirstEnergy Corp at Ohio	Low-Energy Light Bulbs	Cognition	0%
Warm Up New Zealand: Heat Smart (New Zealand)	Energy Efficiency & Conservation Authority (EECA)	Subsidies for insulation upgrades	Cognition, Calculus, and Social Interaction	200,000 homes (100%)

1. PROJECT INTRODUCTION

Energy use is a topic that is relevant to our homes, businesses and lives, yet fails to capture the imagination of most citizens. This inattention may be attributed to a perceived belief that the cost of learning about this seemingly technical and complex problem and then acting to curb energy use seems much too high.

Currently, most energy efficiency programs consist of rebates and other monetary incentives, which have been moderately successful in reducing aggregate energy consumption, but have done little to spur individual action. Recently, a growing number of utilities have recognized that financial incentives alone are not effective at motivating behavior change with regard to efficient energy consumption, and are increasingly turning toward integrating behavior change principles into their programs and services.

As a result of this growing interest, the Sonoma County Water Agency has requested the consultation of Goldman School of Public Policy graduate students to explore and investigate innovative energy efficiency and conservation programs that leverage findings and insights from behavior science. The intent of this report is to give the Agency guidance as it moves forward with a potential energy efficiency program rollout in coordination with the newly formed Sonoma Clean Power, a community choice aggregation.

To complete the aforementioned analysis, we began by reviewing the current state of energy efficiency programs in California and Sonoma County in order to determine the type of programs already in place and potential gaps in program offerings. Next, we reviewed the high-level findings on different behavior change strategies used in the energy efficiency field, which provides a framework for analysis of the subsequent case studies.

We then performed case study research and determined the best practices of ten innovative energy efficiency programs from around the world. We selected four of the 10 case studies for in-depth evaluation of uptake, energy savings, feasibility, and cost effectiveness. Finally, we wrote policy recommendations based on our evaluation and how the best practices could be applied to the Sonoma County context.

ORGANIZATION OF THIS REPORT BY CHAPTER

1. *Project Introduction* introduces the analysis and work plan used to guide the project.
2. *Sonoma County Demographic and Energy Profile* provides a brief overview of Sonoma County's demographics and energy consumption characteristics. Data collected in this chapter represents the baseline of energy usage against which potential savings from case studies are evaluated.
3. *Current State of Energy Efficiency* examines the full extent of energy efficiency programs already implemented in the State of California and Sonoma County. The programs already implemented will inform the selection of the case studies in the report.
4. *Behavioral Science Applied to Energy Efficiency* examines the main types of behavioral science mechanisms in the context of energy efficiency. Strategies for encouraging energy efficiency through behavior change are identified.
5. *Case Study Selection & Evaluation* documents the criteria for selecting and evaluating the case

studies used to encourage energy efficiency through behavior change.

6. *In-Depth Case Study Analysis & Evaluation* examines four international case studies that were selected for an in-depth evaluation: aWattgarde, Austria; Block by Block Program, The Netherlands; Community Energy Diet, Canada; National Smart Meter Plan, Ireland.
7. *Cursory Case Study Review* examines the behavior change strategies of six international case studies: 10% Energy Challenge, Singapore; Community Energy Saving Programme, United Kingdom; Eco-Points Program, Japan; Energymark, Australia; Free CFL Program, United States; Warm Up New Zealand: Heat Smart, New Zealand.
8. *Recommendations* provides recommendations for potential Sonoma County implementation of energy efficiency programs that utilize behavior change strategies based on evaluation of the case studies above.
9. *Appendix* contains supporting tables and documentation.

2. SONOMA COUNTY DEMOGRAPHIC & ENERGY PROFILE

Located on the northern coast of California, Sonoma County is the largest of the nine San Francisco Bay Area counties. Agriculture and tourism are two major drivers of Sonoma County's economy.

There are approximately 493,000 residents now in the County, and the population has steadily increased over the last 10 years, growing 7.6 percent between 2000 and 2010. The City of Santa Rosa, the largest city in the County, has led this growth, increasing 10.7 percent in that time period. **Table 2.1** displays the population breakdown for the nine cities within the County, and the unincorporated areas. The total county population is projected to be 519,042 residents in 2015,[1] and is expected to grow 23 percent through 2040.[2]

Table 2.1: Sonoma County Population by City (2013)

City	Population
Cloverdale	8,669
Cotati*	7,310
Healdsburg	11,509
Petaluma	58,804
Rohnert Park	41,034
Santa Rosa*	170,093
Sebastopol*	7,445
Sonoma*	10,731
Windsor*	27,132
Unincorporated Areas*	147,696
Total - Countywide	490,423
Total in SCP Service Areas	370,407

* = denotes SCP participation.

Source: CA Department of Finance, Table E-5, 2013.

Household income growth follows the population trend. The median household income grew by 16.9 percent between 2000 and 2011 to $64,031. Median income is expected to continue to increase at a similar rate and is projected to reach $76,440 by 2016.[3]

Despite the population and income growth, like other counties in California the energy consumption in Sonoma County has remained steady with relatively slight fluctuations in the last few years. The total usage of gas and electricity has increased by about 1.5 percent during 2006-2012. **Figure 2.1** and **Figure 2.2** display annual electricity usage and natural gas usage, respectively, in the County in terms of mega-watt hours (MWh) and millions of therms. Non-residential electricity consumption saw an 11 percent decrease in 2009 and has remained fairly stable since then. There was a seven percent and three

[1] Accessed online: http://www.dof.ca.gov/research/demographic/reports/projections/view.php
[2] *Plan Bay Area Draft Forecast of Jobs, Population and Housing,* Metropolitan Transportation Commission, Association of Bay Area Governments, March 2013
[3] *2012-13 County of Sonoma: Local Economic Report,* Sonoma County Economic Development Board

percent increase in non-residential and residential natural gas consumption between 2010 and 2011, yielding the highest rate of natural gas consumption since 2006.

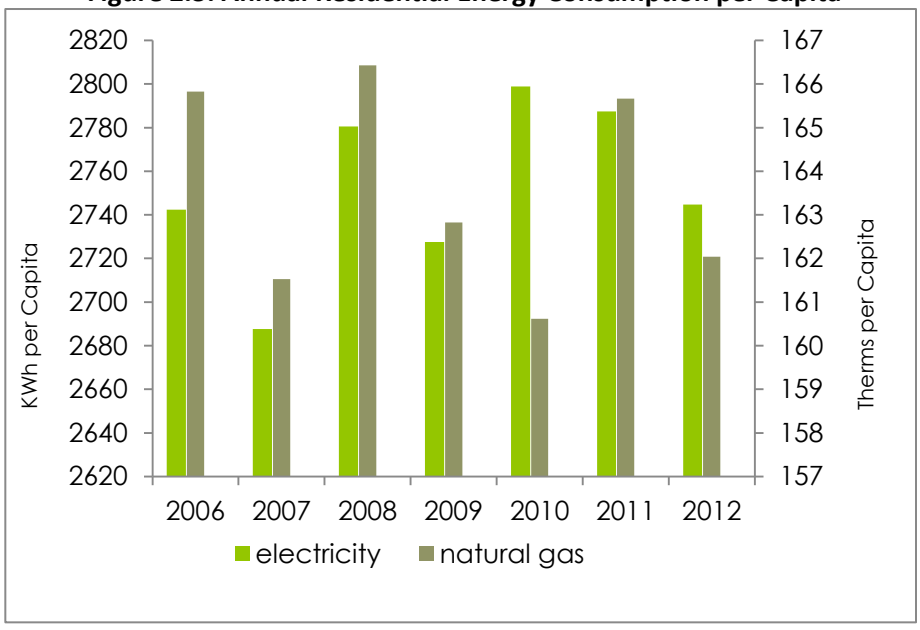
Figure 2.1. Gas Usage 2006-2012

Figure 2.2. Electricity Usage 2006-2012

Source: California Energy Consumption Data Management System (ECDMS) http://www.ecdms.energy.ca.gov/gasbycounty.aspx

Given the population and energy trends, the residential energy consumption per capita fluctuated from 2006 to 2012, as displayed in **Figure 2.3**. **Table 2.2** calculates the annual usage of electricity and natural gas per household in Sonoma County in 2012 using average household size. Compared to other counties in California, the average consumption per capita in Sonoma County has ranked among the lowest. Additionally, non-residential consumption per capita ranks in Sonoma County third lowest among counties of similar population size in California.[4]

Figure 2.3. Annual Residential Energy Consumption per Capita



[4] Accessed online: http://sonomacounty.ca.gov/About-Sonoma-County/The-Environment/

Table 2.2: Sonoma County Energy Profile - 2012

	Sonoma County
Electricity	
Total Residential Electricity Usage (millions of kWh)[1]	1,338.505
Sonoma County Population (2012)[2]	487,672
Average Annual Usage per Capita (millions of kWh)	0.002745
Average Annual Usage per Capita (kWh)	2,745
Average Persons per Household[2]	2.56
Average Annual Usage per Household (kWh)	7,018
Natural Gas	
Total Natural Gas Usage (millions of therms)[1]	79.022
Sonoma County Population (2012)[2]	487,672
Average Annual Usage per Capita (millions of therms)	0.000162
Average Annual Usage per Capita (therms)	162
Persons per Household[2]	2.56
Average Annual Usage per Household (therms)	414

[1] California Energy Commission energy consumption database at

[2] California Department of Finance, Table E-5, 2012.

Sources: California Energy Commission; California Department of Finance.

It is important to note that this sample set covers a relatively short duration. Additional factors such as annual temperature changes and economic slow down due to the recession in 2008 also play a role in energy consumption and may help explain the fairly stable energy consumption in the county. As the median household income rose, the percentage of low-income households decreased significantly. The percentage of households earning less than $50,000 was reduced by 12.7 percent from 2000 to 2010.[5] Both economic literature and empirical evidence have shown that increases in total income and improvement of income distribution can lead to increased energy consumption. Therefore, Sonoma County should pursue sustainable and innovative pathways towards energy efficiency in order to maintain its place as a national leader in energy efficiency.

[5] As defined in 2014 State Income Limits Regulations by California Department of Housing and Community Development (HCD), the area median income for 3-person family in Sonoma County is $74,350, and threshold for low income family is $58,500.

3. Current State of Energy Efficiency

California

The State of California has firmly established itself as a leader in promoting energy efficient policies over the past several decades. The American Council for an Energy-Efficient Economy (ACEEE), a non-profit organization that promotes energy efficiency policies, annually ranks each of the 50 states based on the measures that each state have taken to promote energy efficiency. The ranking examines utility policies, transportation policies, building codes, government led initiatives and appliance standards in developing its *State Energy Scorecard*. In 2013, California ranked second among all states, only behind Massachusetts.[6]

California's high ranking on the *State Energy Scorecard* is bolstered in part by the several statewide programs currently in place to encourage energy efficiency. To get a sense of the programs offered throughout the state, this analysis examined the energy efficiency programs implemented by the five largest utilities (public and private) in California. These utilities are:

- Pacific Gas & Electric (PG&E)
- Southern California Edison
- San Diego Gas & Electric
- Los Angeles Department of Water and Power (LADWP)
- Sacramento Municipal Utility District (Sacramento MUD)

Notably, the Energy Upgrade California program has been implemented by all of the utilities that were examined. The program takes the "whole house approach" towards energy efficiency by identifying financing, incentives, and rebates to consumers in order to help them make their homes as energy efficient as possible. Based on a point system, consumers can earn between $1,000 and $2,500 in incentives per project or up to $4,500 in rebates.

Many of the utilities offer an energy savings assistance program. This type of program targets low-income qualified renters and homeowners with free solutions for managing energy use, and saving money on their monthly energy bills. Each of the utilities surveyed offers rebates for the purchase of energy efficient products.

A detailed description of the energy efficiency programs in the five largest utilities in California can be found in **Appendix Table A.1.**

Sonoma County

Sonoma County offers a number of energy efficiency programs targeting residential, commercial, and government energy users. These programs are offered mostly through partnerships with regional utilities, local or statewide government agencies, and/or energy efficiency-focused nonprofits. Most of the programs offered to Sonoma County residents and commercial businesses come in the form of free energy audits, advice, and information, followed by direct installation and upgrade services carried out by a network of contractors and/or favored technical firms. Financial

[6] Accessed online: http://www.aceee.org/sector/state-policy/california

incentives in the form of energy savings, rebates, and incentives are offered to encourage participation in these energy efficiency programs.

Overseen and administered by the Sonoma County's Energy and Sustainability Division, the Sonoma County Energy Independence Program (SCEIP) is a one-stop shop for information for county residents and businesses about energy efficiency, water conservation and renewable energy generation. It connects homeowners, business property owners, local governments, and local contractors. Since its launch in 2008, SCEIP has funded 1,665 residential and 57 commercial projects, resulting in 56.7 million dollars invested locally in Sonoma County properties, while creating or retaining over 73 local jobs and 698 American Recovery and Reinvestment Act (ARRA) jobs. Through a partnership with the California Energy Commission (CEC), the Sonoma County Energy Independence Program expanded its resources in 2011-2012.

An important and relevant development in Sonoma County has been the formation of Sonoma Clean Power (SCP), a community choice aggregation (CCA) electricity provider, which locally sources power from environmentally friendly sources and even includes a 100 percent local renewable power option known as EverGreen. Modeled after another CCA in Marin County that was established in May 2010 (Marin Clean Energy), SCP was created with support from local residents and businesses that called for renewable energy sources. The program maintains the billing, metering, and grid maintenance services provided by PG&E. More importantly, SCP is expected to play a major role in administering and managing energy efficiency programs.

SCP recently went into service on May 1, 2014 for the first group of 23,070 customers (73 percent commercial and 27 percent residential) in participating cities including Windsor, Cotati, Sebastopol, Santa Rosa, Sonoma and all of the County's unincorporated areas, where residents and businesses will receive electricity from SCP unless they choose to opt out of the service. Thus far, approximately 5 percent of eligible customers have opted out of SCP service. SCP projects up to 18 percent of eligible customers could ultimately opt out of the service, however the final numbers will depend on exogenous factors such as temperature and economic growth as well.[7]

A detailed description of the energy efficiency programs in Sonoma County can be found in **Appendix Table A.2.** Notably, Sonoma County currently does not administer any energy efficiency programs that are explicitly designed to utilize behavioral science strategies.

[7] Gneckow, Eric. "Sonoma Clean Power flips switch for first customers." *North Bay Business Journal*, 1 May 2014.

4. BEHAVIORAL SCIENCE APPLIED TO ENERGY EFFICIENCY

Increasingly, social scientists and policy makers are recognizing that human behavior is perhaps one of the most critical and capricious elements of energy savings. One recent study reported that by simply making people believe they were under observation, those people reduced energy usage by 2.7 percent.[8] Consequently, there is a growing body of literature on the effectiveness of resource conservation programs focused on achieving results through behavior change.

Richard Thaler and Cass Sunstein, whose seminal book *Nudge* helped raise the profile of policies designed to prompt behavior change, explain that small and apparently insignificant details can make dramatic impacts on human behavior and decision-making. Thaler and Sunstein suggest that by presenting choices in a more appealing way, people will make wiser decisions on their own, without need for government to force change. Instead of rigid mandates, the authors argue that policies designed to "nudge" behavior change can be much more effective at achieving larger social goals in a complex, modern world.[9]

STRATEGIES

A recent study by Susan Mazur-Stommen and Kate Farley of the American Council for an Energy-Efficient Economy (ACEEE) collected data from a sample of 238 behavior-based programs in order to create a useful taxonomy to aid utilities in understanding major program categories.[10] Mazur-Stommen and Farley settled upon three large categories of demand-side energy efficiency-program strategies.

1. **Cognition strategies:** these focus on providing information for consumers and hinge upon intrinsic psychological processes. The major sub-strategies in this category are:
    a. General communication efforts such as campaigns using all traditional mass market channels (e.g., broadcast television, cable television, print, and billboard);
    b. Targeted communication efforts such as enhanced billing, direct mail, bill inserts, and bill redesigns for consumer comprehension and usability;
    c. Social media such as Facebook, Twitter, Tumblr, and blogs;
    d. Classroom-based education such as teaching and learning in K-12 classrooms and in higher education;
    e. Training such as commercial, industrial, and other institutional educational efforts.
2. **Calculus strategies:** these focus on the economic decision-making of consumers and hinge upon processing of external information, specially related to financial gains. The major sub-strategies in this category are:
    a. Feedback, both in real-time and asynchronous;

[8] Schwartz D., B. Fischhoff, T. Krishnamurti, and F. Sowell. 2013. "The Hawthorne Effect and Energy Awareness." Proceedings National Academies of Science 17; 110 (38):15242-6.
[9] Thaler, Richard H., and Cass R. Sunstein. *Nudge: improving decisions about health, wealth, and happiness*. New Haven, Conn.: Yale University Press, 2008. Print.
[10] Mazur-Stommen, Susan and Farley, Kate. 2013. *ACEEE Field Guide to Utility-Run Behavior Programs.* American Council for an Energy Efficiency Economy; Research Report B13.

b. Games, including competitions, challenges, and lotteries;

c. Incentives, such as cash, rebates, and subsidies;

d. Home energy audits, both free and market-rate, as well as do-it-yourself (DIY) or direct install.

3. **Social interaction strategies:** these rely on social norms and contact between and among people and hinge upon sociability and belonging. The major sub-strategies in this category are:

    a. Human scale, including community-based social marketing, person-to-person efforts, eco- teams, and peer champions;

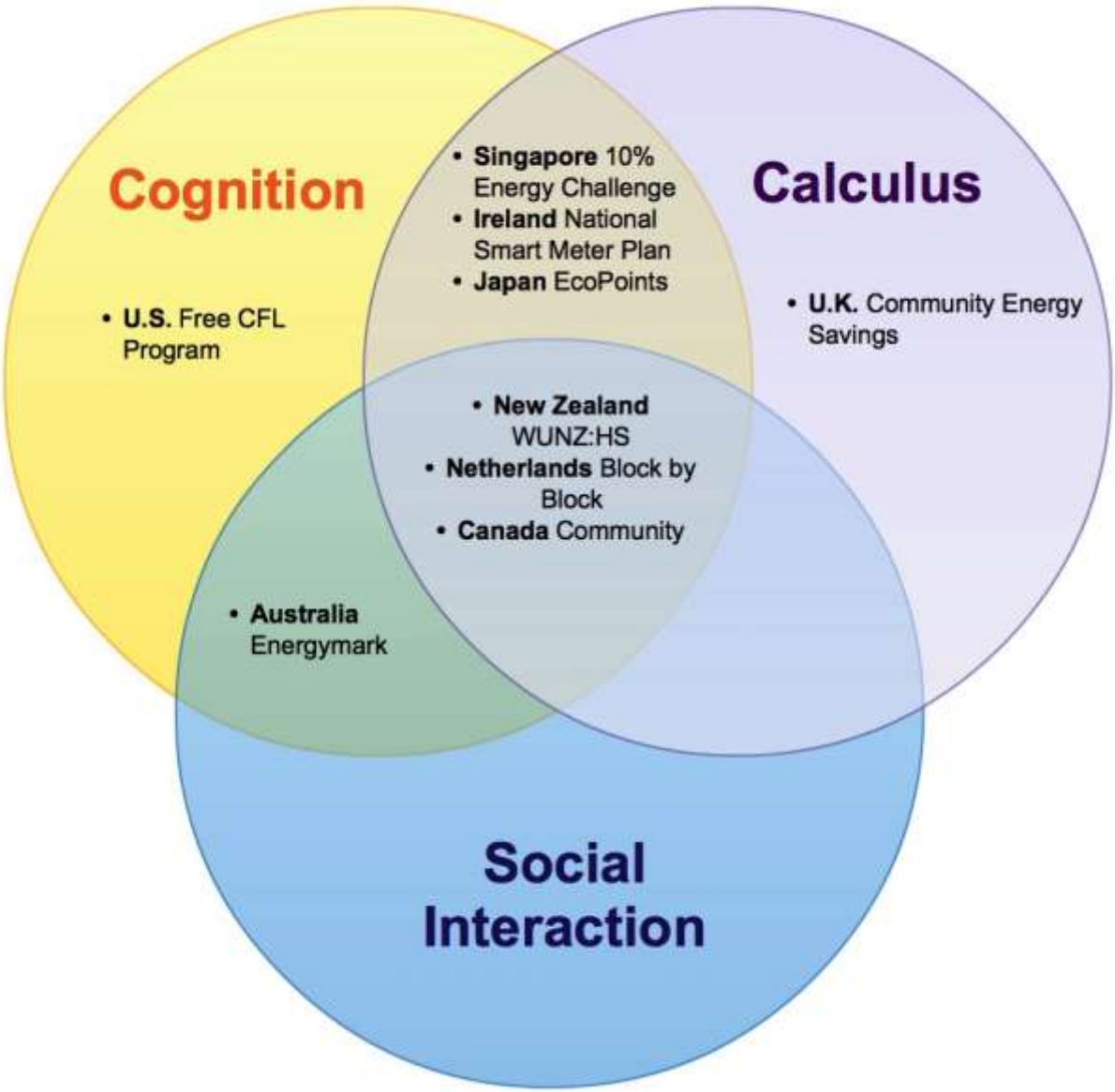
    b. Online forums, including any forum that is based around community-based or peer-to-peer communications;

    c. Gifts/incentives that are non-monetary, upfront and invoke a sense of reciprocity among customers.

It is important to note that these strategies need not operate in a silo. Researchers have found that combining or "stacking" strategies from the three major categories can be effective at engaging multiple stakeholders, thereby compounding behavior change and action, and achieving the greatest impact in energy savings. This report evaluates and identifies the behavior change strategies exemplified by ten case studies in order to deepen the understanding of what mechanisms are at play in residential and commercial energy efficiency.

Figure 4.1 on the following page is a diagram illustrating the crossover in strategies utilized by the ten case studies in this report, which can be used as a guide for a policymaker searching for an example of a specific strategy in action. The following chapter will present these cases as individual studies, keeping in mind that larger lessons can be derived about behavior change strategies by perusing the entire set of cases.

Figure 4.1


Cognition
• U.S. Free CFL Program
Calculus
• U.K. Community Energy Savings
Social Interaction
• Singapore 10% Energy Challenge
• Ireland National Smart Meter Plan
• Japan EcoPoints
• New Zealand WUNZ:HS
• Netherlands Block by Block
• Canada Community
• Australia Energymark

5. Case Study Selection & Evaluation

Once familiar with the types of behavior change strategies used to encourage energy efficiency detailed above, the Goldman team searched for international case studies that utilized those strategies. This chapter details both the criteria used to select the case studies included in this report, and the criteria used to evaluate the case studies for potential application in Sonoma County. Both the selection criteria and evaluation criteria were informed by SCWA's priorities.

Selection Criteria

The Sonoma County Water Agency (SCWA) requested ten international case studies for a detailed overview of the design and implementation of innovative energy efficiency programs. The ten cases were selected based on use of behavioral science, data availability, and specific interest expressed by the client. Collectively, the ten cases were selected to represent a diverse range of program designs, climates, and geographic regions. Subsequently, in consultation with the SCWA, four of the ten international case studies were selected for in-depth review.

Evaluation Criteria

Each of the ten international case studies were researched and analyzed for the following information:

- Description of the program design and implementation
- Description and motivation of the implementing agency or organization
- Behavior change theories, principles, and strategies employed in the program
- Public perception and receptivity to the program
- Key lessons learned for Sonoma County

The four cases selected for in-depth review were evaluated against the following criteria:

Uptake: Each case was evaluated based on the rate of signup to the program and the rate of continuing participation (within a certain timeframe, when possible).

Savings achieved: Each case was evaluated based on amount of energy (in kilowatt hours) saved, greenhouse gas emissions reduced (in tons equivalent carbon dioxide), and monetary savings to each household.

Feasibility: Each case was evaluated on implementation feasibility based on whether it is a program that would fit within the geographic and demographic characteristics of Sonoma County.

Cost effectiveness: Each case was evaluated on the savings in both energy and money per dollar spent to carry out the program, from the perspective of the implementing agency.

6. In-Depth Case Study Analysis & Evaluation

The four cases selected for an in-depth analysis and evaluation provide examples of innovative energy efficiency programs that can potentially be implemented in Sonoma County. Similar to the cursory case studies above, this chapter provides an overview of the program, details behavior change strategies employed, and lists the key takeaways from the case study. Unlike the cursory case studies, the in-depth case studies in this chapter provide additional analysis, and explore the potential effects of implementation in Sonoma County.

A. aWattgarde | Austria

Key Lessons Learned

- Rewarding users upon first and continued use of the gaming platform ensures initial uptake and lock-in to the gaming platform, while rewarding users immediately after completing a desired action is critical to linking the reward to the desired behavior change.

Summary
Agency/Org: Illwerke VKW AG **Years in Operation:** 2011-present **Program Type:** Gaming, Mobile app, Infotainment **Behavior Change Strategy:** Cognition and Calculus **Uptake:** 6,919 (within first 6 months—10% of eligible population) **Selected as:** Best Practice

- When rewarding behavior change, users prefer immediate, lower value, and guaranteed gifts and prizes over long-term, high value, and lottery style gifts and prizes.

- Infotainment such as quizzes and daily challenges that are playful and interactive are an effective means to deliver information on energy consumption levels of home equipment.

- Establishment of small, but achievable goals for energy savings are important because unattained goals can demotivate or discourage consumers to participate in future programs. Medium-level default goals lead to more energy savings than low or high default goals or self-set goals.

Program Overview

A team of European researchers from ETH Zurich partnered with Illwerke VKW AG, an Austrian utility company, to pilot an interactive web portal and mobile application called aWattgarde. By providing customers with information and insights on their home electricity consumption through a gaming and infotainment structure, aWattgarde incentivizes customers to read their electricity meters and enter their readings online every week. Illwerke VKW AG decided to experiment with this new app because traditional methods to promote energy efficiency, such as energy audits and energy saving tips, were costly, had low customer penetration, and generated low interest levels from customers.

The app was designed after studies of other well-known apps,[11] such as EcoIsland and StepGreen.org. The challenge in each of those apps had been in sustaining the interest of the users

[11] Other well-known apps that SCWA could explore include EcoIsland, StepGreen.org, UbiGreen and Energy Life.

in the application.[12] [13] Based on their studies of these existing apps, the research team created an interactive gaming and information delivery platform that incorporated a multi-layered point system that rewards users for entering electricity meter readings and adopting energy conservation behaviors. The researchers then divided the users into groups facing a variety of motivational elements to determine the effectiveness and popularity of different behavior change strategies. These layers of points provide piqued both interest and commitment. In particular, the researchers found that the bonus points were most effective in achieving energy efficiency goals because they rewarded desirable action immediately. Meanwhile, the regular point structure kept the user base aware of their day-to-day consumption levels, which were found to be more effective than motivating people toward large, end-goal savings.

The different elements of engagement with aWattgarde are as follows:

- **Initial uptake:** A professional marketing agency was hired by ETH Zurich researchers to publicize the program and to customize the look and feel of aWattgarde. Immediate welcome gifts, such as an iTunes reward card, a voucher for tourism activities, or a donation to the charity of the user's choice, were then offered to prospective users to attract their attention. The pilot study signed up 6,919 participants within six months.

Examples of the customizable web portal (top) and mobile app (bottom) from BEN Energy are shown in the images above.

- **Retention:** Once signed up, incentives were used to ensure that users would remain engaged with aWattgarde. ETH Zurich researchers experimented with two different types of rewards to continually attract users back into the system. In one group, users were guaranteed welcome gifts upon entry of at least one electricity meter reading over a certain span of time. In the other group, for completion of the same task, users were entered into a lottery of their choice, with high-value gifts such as a MacBook, electrical bike, and coffee dispenser. Lotteries of energy efficient products (up to €4,000 or approximately $5,550 in value) were also held once a month. In addition, users were able to sign up for email and SMS reminders to input electricity meter readings.

[12] Makoff et al. "StepGreen.org: Increasing Energy Saving Behaviors Via Social Networks." Association for the Advancement of Artificial Intelligence, 2009.
[13] Takayama et al. "ECOISLAND: A System for Persuading Users to Reduce CO2 Emissions." Software Technologies for Future Dependable Distributed Systems, 2009.

Overall, the only 8 percent of users stopped participating after receiving their welcome gift and the pilot study was successful in getting 100,547 meter readings, or approximately 14 readings per user on average.[14]

- **Habit forming:** Regular redeemable points were given for routine activities that save energy. These points were often rewarded immediately following a desirable action. Overall, the points system was used to reward participation instead of energy saving, which helped to attract a larger user base.
- **Infotainment:** In addition to rewarding desired behavior, this platform was used to deliver energy saving tips in a playful and interactive way in order to improve the initial interest, consumption, and retention. Rather than simply transmitting information to the user, ETH Zurich researchers used quizzes to prompt consumer thinking. Another popular infotainment activity was the "sleep task meter," which required a user to turn off all electronic devices within his or her home before going to bed. Some energy saving tasks included reducing standby consumption of coffee machines, eliminating standby at working desks, and putting a cover on cooking pots.
- **User data analytics:** While improving energy efficiency results for the utility (Illwerke), this platform also provided an avenue for utilities to gather user data and information on energy consumption behavior and consumer preferences that help to improve its energy efficiency products and offerings. Redeemable bonus points are offered for "extra" activities conducted by the user, such as filling out user information surveys. Additional user information was also deduced from their choice of gifts.

These layers of rewards were successful in piquing interest and sustaining commitment. In particular, the researchers found that points that rewarded desirable actions *immediately* were the most effective in changing behavior and in achieving energy efficiency goals. Meanwhile, the regular point structure kept the user base aware of their day-to-day consumption levels, which were found to be more effective than motivating people toward large, end-goal savings. Another important finding from this experiment was that infotainment was the most effective means to transmit energy efficiency information. The quizzes presented information in an engaging way as a challenge and tapped into a social media trend where people can share how much they know. Meanwhile, the "task meter" activity was an entertaining way to present energy saving tasks and information and helped users identify previously unknown energy guzzlers.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

ETH Zurich researchers utilized behavior change strategies in recognition that energy conservation is a low-interest, low-priority topic to consumers and the fact that majority of consumers do not view saving money as the primary motivation to save energy. According to a user survey, participants joined aWattgarde because they were motivated by sustainability (81.1 percent), knowing their consumption levels (47.8 percent), social comparison (14.9 percent), saving money (16.9 percent). Other motivators included being a role model and having fun. As a result, this pilot project combined multiple aforementioned behavior change strategies to induce behavior change.

Calculus strategies leveraged feedback loops and rewards to increase motivation, facilitate the learning process, and ultimately induce the desired behavior change. Financial incentives in the form

[14] Loock et al. "How to Motivate Energy Efficiency Online." 20th International Conference on Management of Technology, 2011.

of redeemable points within a gaming structure were used to arouse attention and foster initial participation, while reinforcing positive behavior. The researchers also learned that the timing of rewards were important in inducing behavior change. Specifically, an immediate reward following the desirable event was important to connecting the two to each other and provided higher value to users than rewards given out over a longer time horizon. Furthermore, behavior change depended on the value of points earned and the type of gift. In this case, welcome gifts provided with certainty but valued at a fraction of lottery gifts were more popular than lottery gifts.

In addition, following the findings from goal-setting theory, concrete and realistic goals for energy savings were set for users in order to achieve better results. These default goals—i.e., the option presented because the user has not specified a goal—acted as a reference point for a future desirable state and directed attention, desire, and persistence toward this goal. Medium-level default goals were established that made the energy-saving goals achievable—which is important because unattained goals can demotivate or discourage consumers to participate in future similar programs—but at the same time significant. Past studies on goal-setting theory have shown that medium default goals lead to more energy savings than low or high default goals or self-set goals.[15]

Cognition strategies were also utilized in this pilot project in the form of infotainment, which added motivational and interactive elements to information delivery. In contrast to traditional approaches that delivered energy saving tips and information that increased knowledge levels but did not induce behavior change, ETH Zurich researchers presented information in the form of challenges, games, and quizzes. In addition to employing cognition and calculus strategies, Illwerke is also experimenting with adding more **social interaction strategies**. Recognizing that most people do not necessarily want to be "good" but rather "better than others," this pilot project explored the possibility of social competition through rankings on energy savings levels, and social recognition in the form of rotating testimonials featured on the web portal.

POTENTIAL APPLICATION TO SONOMA COUNTY

Today, the pilot project with aWattgarde has been scaled to a sustainable energy efficiency platform that is still active, while the ETH Zurich researchers from the pilot study have spun off a new company called BEN Energy AG to build on the successes of aWattgarde. Founded in 2011, the Zurich-based company offers a multi-platform (web portal, mobile app, and Opower-style reports), customizable energy efficiency tool that engages individuals in changing their energy consumption behaviors and provides utilities with a sales and communication platform to reach its customers. To date, the spinoff company has grown to attract over 20 utility clients serving nearly 25 percent of Swiss households, while generating around €665,000 ($922,000) in annual revenues for 2012 from just €175,000 ($242,600) in 2011. It also continues to work with ETH Zurich to incorporate the latest insights from behavior change research into its product.

Given the success of aWattgarde and BEN Energy, a similar energy efficiency platform could be applied to Sonoma County. The findings from this pilot study, however, may be limited from the fact that scaling is easier to achieve than acquiring the initial user base and from the fact that most smart meter installations in central Europe are still in the pilot stage, while all Sonoma residents have smart meter installations. The pilot project and many of BEN's work in Switzerland deal with utility customers that do not have smart meters, which is due to the lack of smart meter uptake in large parts of Europe. Currently, BEN Energy only has one utility customer that has rolled out smart

[15] Loock et al. "Motivating Energy-Efficient Behavior with Green IS: An Investigation of Goal Setting and the Role of Defaults." MIS Quarterly 37.4, 2013. pp.1313-1332.

meters to all of its 14,000 customers, which has led to a much higher uptake rate. On the other hand, by 2020, due to regulatory requirements, 80 percent of all households in Europe will be equipped with smart meters.

Uptake: The pilot project was successful in getting 10 percent of Illwerke's customers to sign up for its platform. To get this level of signup, ETH Zurich researchers hired a professional marketing firm. Similarly, BEN Energy has been able to reach a 10-percent uptake level on average with its new utility customers in Switzerland. According to Claire-Michelle Loock from BEN Energy, the uptake rate depends on the level of investment in marketing, which could reach up to 15 percent using an aggressive and creative marketing campaign that goes beyond magazine or billboard ads.

Saving achieved: On average, each household among BEN's client base generally saves about 2.5 percent each year. For those who are more engaged, the energy savings could be up to 5 percent, according to Loock.

Feasibility: The aWattgarde gaming platform has been successfully piloted and scaled across Austria and Switzerland via BEN Energy. Given that these initial projects used a manual input platform, there is a strong likelihood that the uptake and energy savings figures could be much higher with a platform that relied on automatic smart meter readings. Every home in Sonoma County already has a smart meter as part of PG&E's rollout, which would lower the costs and barriers for these residents to sign up for and continue participation in a gaming platform.

Cost effectiveness: The cost of acquiring customers to sign up for the program may be higher than hiring software firms to develop a web and mobile app. According to PV Solar Report, this could amount to about $0.69 per watt, or $1,000 per customer for rooftop solar PV systems.[16] Lower per-customer cost numbers should be expected for products like aWattgarde since the barrier to adopting energy efficiency products is lower than that for rooftop PV systems.

Based on the baseline energy profile for Sonoma County in 2012 (shown earlier in Chapter 2, Table 2.2)**. Table 6.A.1** estimates potential energy savings to the SCP service area under two scenarios: low success and high success to provide a range of possible outcomes if implemented in the SCP service area. **Appendix Table A.3** compares the analysis in Table 6.A.1 to the other in-depth case studies included in this report.

[16] Francescato, Rosana. "How Can We Reduce Solar Soft Costs? Part 3: Lowering Customer Acquisition Costs." 30 Oct 2013.

Table 6.A.1: Case Study - aWattgarde | Austria

	Scenarios	
	Low	High
Electricity		
Service Population (2012)	368,426	368,426
(Less 20% assumed opt-out)	(73,685)	(73,685)
Adjusted Service Population	294,741	294,741
Assumed Uptake[1]	10%	15%
Potential Reach	29,474	44,211
Baseline Usage per Capita (2012)	2,745	2,745
Energy Savings[2]	2.5%	5%
Potential Usage per Capita	2,676	2,608
Persons per Household	2.56	2.56
Cost per kWh[3]	$ 0.186	$ 0.186
Average Annual Electricity Cost per Household	$ 1,274	$ 1,242
Annual Savings per Household	$ 33	$ 65
SCP Area Estimated Usage - Before (million kWh)	1,011.2	1,011.2
SCP Area Estimated Usage - After (million kWh)	1,009.2	1,005.2
Overall Reduction in Usage	-0.2%	-0.6%

[1] BEN Energy achieved 10% uptake levels on average and can be considered the minimum uptake level considering Sonoma's county-wide smart meter rollout. The 15% figure was achieved by BEN Energy if it pursued a more aggressive marketing campaign.
[2] The 2.5% is the average and 5% is the high end energy savings for BEN Energy customers.
[3] The electricity rate is the yearly average residential rate in 2012 according to the rate schedule from Pacific Gas & Electric.

Source: Table 2.2; BEN Energy.

B. Block by Block Program | The Netherlands

Key Lessons Learned

- Knowledge and information are the major tools used to increase participation. Passing information to target customers in an appropriate way is a critical component to any program's marketing strategy.

Summary
Agency/Org: Netherlands Enterprise Agency **Years in Operation:** 2 years **Program Type:** Home Retrofitting and Re-insulation **Behavior Change Strategy:** Cognition, Calculus, and Social Interaction **Uptake:** 1,500-10,000 homes **Selected as:** Best Practice

- Cooperation among different stakeholders can significantly enhance the efficiency of program implementation, especially when the collaboration is combined with a financial subsidy.

Program Overview

The Block by Block program was launched in November 2012 by the Netherlands Enterprise Agency, which encourages entrepreneurs to delve into sustainable, agrarian, innovative and international businesses.[17] The program is intended to spur a movement to save energy on a large scale across the country by retrofitting and re-insulating old, drafty homes. These projects encourage businesses, local government agencies, and corporations to form "blocks" and create joint plans that will impact 1,500-2,000 homes at one time. All homes should be improved with a minimum of two labeling steps or placed on "Level B" of the energy labeling system.[18]

This program was designed to run from 2012 to 2014. The phasing of the program design is as follows:

- 1st year: preparation (2012)
- 2nd year: realization of first 1,000 homes and preparation of second 1,000 homes (2013)
- 3rd year: realization of second 1,000 homes (2014)[19]

Each Block must include at least three stakeholders working together in a consortium. They share their knowledge and experience on platforms like LinkedIn in an attempt to find win-win solutions. The project leaders are encouraged to share lessons learned with other neighboring projects so that they get stronger over time. The projects are funded by institutional investors complemented by some aid from the Netherlands Enterprise Agency that was intended only to contribute to additional costs during the pilot phase.

Fourteen projects have been launched to date throughout Netherlands, and the targets of homes reached out to vary from 1,500 to 4,000 among different projects, where diverse approaches have been used to achieve the goals. For example, in Amersfoort (a medium-sized city in The Netherlands) the approach begins with setting several homes as models within a neighborhood, which will receive comprehensive advice about energy savings from experts. During a briefing in the district, neighbors see from those models what they can do with their own homes. In Den Bosch, the city government worked together with a consulting firm called Enexis BuildDesk, a marketing and communication company called 5plus1, as well as the housing association, to develop a website

[17] Accessed online:https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok?wssl=1
[18] All residential property offered for sale in the Netherlands since January 1, 2008 are mandated to have an energy label. By means of a rating (from A to G), the label provides an indication of the home's energy efficiency.
[19] The exact target numbers vary among different projects.

called Smart Portal, which leads the residents to an online energy calculation tool, technical information, packages of energy-saving tips, photos and testimonials from neighbors. [20]

The aim of the Block by Block project is to see what market-based options there are for the existing housing stock to achieve large-scale energy conservation. The energy saving opportunities are identified based on the particular consumers living in a certain city. Some municipalities also offered low interest loans for further energy-savings investment. For example, the Tilburg government gave private homeowners a five-year guarantee on the savings from reducing heat consumption. [21]

Ordered by the Ministry of the Interior and Kingdom Relations (BZK), the program tracks how to approach residents to participate, their satisfaction in the programs, and the reason for their participation (or lack thereof). The results will be used to tailor follow-up projects.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

The Block by Block programs do not focus primarily on technology, but on the "wishes and needs of the residents,"[22] which is the application of targeted communication through **cognition strategies**. The study on this program reveals that environmental commitment is a relevant factor in the willingness to engage in energy-saving programs and projects, but it has also found that people often do not know where to find reliable information.[23] Therefore this program is focused on passing information about practical environmental effects, energy costs, and monetary benefits and costs to the consumers through both conventional methods and new social media such as LinkedIn and web portal. The Eindhoven case set their prioritized goal as "delivering clear and unambiguous information,"[24] and the Groningen case defined the primary problem as "the lack of knowledge about technical possibilities."[25] The program also utilized customer segmentation, which targeted specific customers and enhanced the efficiency of communication. Additionally, the program involved **calculus strategies,** using government funding and low-interest loans as subsidies to incentivize customer behavior. In some cases the energy feedback system is also developed using energy monitoring via smart meters, such as Haarlem case.[26]

The major strategy employed by this program is **social interaction**. In the Block by Block case in Amsterdam, the homeowners associations promote the idea that "you can achieve more together," encouraging joint effort to achieve savings goals. Housing corporations, contractors, installers, and cities work as a consortium, exchanging knowledge and experience to achieve their common goal of saving energy at an affordable cost. Through interaction with different stakeholders, homeowners become better informed and make decisions influenced by the community that has been built up. In the Overijssel case the province helped construction and installation companies with support for finding energy saving markets with access to private homeowners, and also helped share knowledge between two sides, which created opportunities for savings and efficiencies.

[20] Accessed online: http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok/projecten
[21] Ibid.
[22] Ibid.
[23] "Doelgroepsegmentatie energiebesparingsprojecten", Ministerie van Economische Zaken, Lanbouw en Innovatie
[24] Accessed online: http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok/projecten
[25] Ibid.
[26] Ibid.

Potential Application to Sonoma County

Uptake: The initial program design is aimed at reaching 1,500 to 2,000 homes per project. However, different cities have designed their own goals, which vary from 2,000 in most cases to up to 5,000 households in Hardenberg case,[27] and even 10,000 homes in the Province of Overijssel.[28] There is potential for the program to expand to the national scale. Though the real uptake is still not clear, it provides an example of how flexibility can be allowed in a pilot program, which can help tailor future intervention to a specific neighborhood or targeted group, thus facilitating a larger scale roll-out in the future.

Saving achieved: The energy savings may vary among different projects, and some projects have declared their explicit energy saving goals. Ymere is aiming at a 45 percent savings within a period of four months.[29] The Utrecht case is aiming at a 30-40 percent energy saving.[30]

Feasibility: This program is administered on the national level, with significant financial support from the government. From the perspective of financial assistance, therefore, it might not be a model that would easily fit within the bounds of the County. However, there are a few design features of the program that could be useful for the County. First, the use of evaluation throughout the program to receive consistent feedback about a variety of strategies could potentially work in a county like Sonoma with diverse stakeholder groups. For example, energy saving measures that might appeal to households in urban centers like Santa Rosa might not be the same as those that would appeal to more rural areas like Graton and Occidental. Second, the use of social norming through neighborhood-wide programming could work for Sonoma County. In some projects such as Breda, the organizers developed "personal and intimate" contact with the residents, which was well-received. Sonoma County can apply these methods in some small-scale cities, such as Cotati and Sebastopol.

Cost-effectiveness: The costs of the project for the government include the fees for the formation of the consortium, developing a marketing strategy and communication activities, the establishment of energy-saving and financial concepts, developing innovative procurement models, and the knowledge and learning process. The benefit of the program is measured primarily in cost savings. The financial savings is aimed at 35 percent in the Tilburg case.[31]

The Netherlands Enterprise Agency is currently working with IVAM, a research and consulting institute, on an in-depth program evaluation, thus the data related to cost-effectiveness is not publicized yet till this summer.

Table 6.B.1 below demonstrates potential savings from low and high uptake and energy savings scenarios. In terms of population and uptake, we are using the targeting population range in the 14 projects and assume 100-percent uptake rate if the program is run as a pilot.

[27] Accessed online: http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok/projecten
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Ibid.

Table 6.B.1: Case Study - Block by Block | The Netherlands

	Scenarios	
	Low	High
Electricity		
Assumed Block Service Population[1]	3,835	25,568
(Less 20% assumed opt-out)	(767)	(5,114)
Adjusted Service Population	3,068	20,454
Assumed Uptake[1]	100%	100%
Potential Reach	3,068	20,454
Baseline Usage per Capita (2012)	2,745	2,745
Energy Savings[2]	30%	45%
Potential Usage per Capita	1,922	1,510
Persons per Household	2.56	2.56
Cost per kWh[3]	$ 0.186	$ 0.186
Average Annual Electricity Cost per Household	$ 915	$ 719
Annual Savings per Household	$ 392	$ 588
SCP Area Estimated Usage - Before (million kWh)	10.5	70.2
SCP Area Estimated Usage - After (million kWh)	8.0	44.9
Overall Reduction in Usage	-31.6%	-56.2%

[1] Since this project has clear target of absolute number of households reached, we used the targeted population in each project and assume 100% uptake rate, instead of using Sonoma County's population. The low scenario assumes that 1,500 housholds participate in the program and the high scenario assumes 10,000 households participate in the program, which are the range of households numbers targeted in all current Block by Block projects.

[2] The low and high scenarios of energy savings rates are based on the trageted energy rates from the cities of Ymere and Utrecht.

[3] The electricity rate is the yearly average residential rate in 2012 according to the rate schedule from Pacific Gas & Electric.

Source: Table 2.2; http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok/projecten

C. Community Energy Diet | Canada

Key Lessons Learned

- Step-by-step instructions about the program's goals are important to reduce confusion and encourage uptake. In this case, residents felt a strong urge to take action but they were confused over what the "right thing" to do was. The program administrators responded to this by streamlining program elements so that they are presented as a step-by-step process in order to get residents more involved.[32]

Summary
Agency/Org: Sustainability Commission Energy Task Force & partners
Years in Operation: 7 months
Program Type: Energy Audits and Subsidies for Home Retrofits
Behavior Change Strategy: Calculus, Cognition, and Social Interaction
Uptake: 11%
Selected as: Best Practice

- The Community Energy Diet has been well documented from the very beginning, with high quality images and videos of community meetings and program participants. This has allowed program administrators to successfully market the program using social interaction strategies by showing testimonials of local community members participating in the program and getting positive results.

- The city recognized the need to identify a community ambassador for this program and to help clarify and answer questions about the program. Having a dedicated person staffed to this program has enabled the city to seek additional funding and support for the program and consolidate important information in one place.

Program Overview

Rossland, British Colombia is a small, alpine town in the Monashee Mountains. It has a population of 3,556 and is been known as the "Mountain Bike Capital of Canada."[33] The Rossland Energy Diet took shape in 2012 when the community's Sustainability Commission identified that the average Rossland home, comprised of many early twentieth century heritage homes, consumed 36 percent more electricity than other homes across the province. Therefore, they worked together with FortisBC, the local electricity and natural gas provider, to develop the first ever community-level "energy diet"—a concerted effort to get all citizens in the town to reduce their energy consumption. This program ran for seven months and was implemented by a partnership between the City of Rossland, the Sustainability Commission Energy Task Force, Nelson and District Credit Union, Columbia Basin Trust and FortisBC.

Program participants received a free initial energy assessment, assistance in connecting with local qualified contractors to do the retrofit work, and guidance in capitalizing on the LiveSmart BC Efficiency Incentive Program and the former Federal ecoENERGY incentive programs. Program administrators sought to make the process of getting involved with the program as easy as possible by providing information sessions, hiring a dedicated coordinator for the program, arranging for low

[32] Rossland on an Energy Diet. (n.d.). *V2A: Vision to Action*. Retrieved April 29, 2014, from http://visionstoaction.ca/rossland-energy-diet
[33] About Rossland. (2010). *City of Rossland website*. Retrieved April 29, 2014, from http://www.rossland.ca/about-rossland

cost loans through the local credit union, and providing opportunities to meet with contractors qualified to install energy efficiency upgrades.[34]

The program structure is as follows:

1. Homeowners attend a public presentation/meeting and can sign up for an on-site audit at the meeting.

2. The audits are free to the consumers ($300 value) who can start to receive them as early as one week after the community presentation.

3. The homeowner receives a sheet of priorities from the auditor and then is free to implement the recommended changes or not. The program helps the client and contractors find rebates and subsidies for this work as well as access low cost loans through local credit unions.

4. Once the energy efficiency upgrades are completed, the homeowner must pay for a post audit to determine the overall energy savings achieved.

While the original program target was to reach 100 homes, more than double signed up for an energy assessment (257 in total). Fully 22 percent of the homeowners registered for an energy assessment *and* qualified for a rebate, and 35 businesses received complete lighting retrofits. Compared to the uptake rate achieved by most public programs in Rossland (1-2 percent), this is significant progress. By the end of the program, 11 percent of Rossland's homeowners and 35 small businesses had invested $1.6 million in energy efficiency improvements. They reduced their annual consumption of natural gas by 2220 GJ, their electricity by 1,478,000 kilowatt hours, and their greenhouse gas emissions by 338 tons.[35]

BEHAVIOR CHANGE STRATEGIES EMPLOYED

On face, Rossland's program operated like a traditional energy efficiency program. However, the program administrators carefully designed features of the program that linked to behavior change strategies. First, it is a **calculus** program in that it offers free assessments and rebates in order to incentivize people to undertake energy efficiency upgrades. However, the program's success lies in its utilization of **cognition** and **social interaction strategies.** The program sought to increase awareness of the need for energy efficiency through a marketing campaign supported by the local energy provider and the city. This campaign included basic mass media techniques, including use of a logo, websites, email blasts, telephone banking, and dissemination of YouTube videos of program participants clearly explaining how the program works and how they are going to use it to save money.[36] FortisBC also has a webpage called "Residents Slim Down" with short profiles on citizens who have successfully participated in the program with positive results.[37] It appears as though

[34] Rossland Energy Diet. (2014). *FortisBC website*. Retrieved April 30, 2014, from http://www.fortisbc.com/Electricity/PowerSense/InYourCommunity/CommunityEnergyDiets/RosslandEnergyDiet/Pages/default.aspx

[35] BCSEA Webinar: The Rossland Energy Diet. (2013, December 25). *YouTube*. Retrieved April 30, 2014, from http://www.youtube.com/watch?v=EFs_I1y6amo.
Rossland, B.C. now skinnier thanks to energy diet. (n.d.). *FortisBC website*. Retrieved April 30, 2014, from http://www.fortisbc.com/MediaCentre/NewsReleases/2012/Pages/Rossland-BC-now-skinnier-thanks-to-energy-diet.aspx

[36] Rossland Energy Diet. (2013, June 4). *FortisBC YouTube*. Retrieved April 30, 2014, from https://www.youtube.com/watch?feature=player_embedded&v=9OUwtEutp30

[37] Residents slim down. (2014). *FortisBC website*. Retrieved April 30, 2014, from http://www.fortisbc.com/Electricity/PowerSense/InYourCommunity/CommunityEnergyDiets/RosslandEnergyDiet/Pages/Residents-slim-down.aspx

FortisBC will continue to update this page with success stories as more citizens take action on the information obtained through their free energy assessments.

Perhaps the most important piece of the program, and what makes it unique, is that its marketing strategy was designed to facilitate social interaction. Even the name itself, "community energy diet," alludes to an initiative that everyone is working on together. This strategy helped to create social pressure on citizens to participate, and in focus group conducted by the Sustainability Commission, the majority of participants expressed that "doing the right thing" was of high concern. Additionally, offering free assessments at the beginning of the program likely invoked a sense of reciprocity among participants so that they were more likely to take action on their own to implement energy efficiency upgrades. Finally, the program administrators have arranged for residents to be able to share information on Rossland's local online news portal.[38]

The image to the left is a banner used on the FortisBC website to promote the community energy diet. This imagery works to illicit a feeling of community involvement. Also the logo helped brand the program.

POTENTIAL APPLICATION TO SONOMA COUNTY

Uptake: This program has enjoyed high uptake levels. 11 percent of the homeowners targeted by the pilot have already invested in energy efficiency upgrades in their homes. This is much higher than the normal uptake rate (1-2 percent) for previous energy efficiency programs in Rossland. However, the baseline for this community was quite low compared to Sonoma. Essentially, the community did not have any programming to encourage energy efficiency before the advent of this program. In fact, the program was initiated when the town learned that they consumed 40 percent more energy on average than the typical home in British Colombia.

Savings achieved: The energy diet audits marketed 20-50 percent potential energy savings in participating houses. Within the first six months of the program, 135 participants reduced their annual consumption of natural gas by 2220 GJ, their electricity by 1,478,000 kilowatt hours, and their greenhouse gas emissions by 338 tons. The lion's share of this savings came from technology upgrades in the home, which are likely to have lasting impact on energy use, but may not change or improve upon daily use habits among citizens.

Feasibility: The Community Energy Diet concept is feasible in that it follows along the lines of programs already in place in Sonoma, such as rebate and subsidy measures offered by PG&E. The major distinguishing factor is the marketing angle of calling the program a "Community Energy Diet." Based on the 'small-town feel' of certain towns in the county, it is possible that a program that worked in the small alpine village in Canada could work in Sonoma as well. For example, the towns of Sebastopol and Cotati have small enough populations that they could serve as potential pilots.

[38] Rossland Energy Diet. (2014). *FortisBC website*. Retrieved April 30, 2014, from http://www.fortisbc.com/Electricity/PowerSense/InYourCommunity/CommunityEnergyDiets/RosslandEnergyDiet/Pages/default.aspx

The biggest obstacle is the cooperation of the local energy provider. It is not likely that PG&E will play as large a role as FortisBC did in Rossland. However, there is potential for Sonoma Clean Power to step in and take the role of FortisBC. Additionally, the partnership with local credit unions made a big impact in uptake because residents were able to take out low-cost loans to implement energy upgrades. This is something that Sonoma CleanPower could investigate further as there are a number of local credit unions, including Redwood Credit Union, Summit State Bank, and First Community Bank (all located in Santa Rosa).

Cost effectiveness: This program could be cost effective if it is designed to work in conjunction with existing rebates and subsidy programs.

Table 6.C.1 below demonstrates potential savings from low and high uptake and energy savings scenarios. Note that the service population in this table is not the entire population of the service area, but rather the population of the town of Sebastopol in order to demonstrate the potential impact of a community energy diet program if run as a pilot. **Appendix Table A.3** compares the analysis in Table 6.C.1 to the other in-depth case studies included in this report.

Table 6.C.1: Case Study - Community Energy Diet | Canada

	Scenarios	
	Low	**High**
Electricity		
Sebastopol Service Population (2012)	7,415	7,415
(Less 20% assumed opt-out)	(1,483)	(1,483)
Adjusted Service Population	5,932	5,932
Assumed Uptake[1]	11%	15%
Potential Reach	653	890
Baseline Usage per Capita (2012)	2,745	2,745
Energy Savings[2]	20%	50%
Potential Usage per Capita	2,196	1,373
Persons per Household	2.56	2.56
Cost per kWh[3]	$ 0.186	$ 0.186
Average Annual Electricity Cost per Household	$ 1,046	$ 654
Annual Savings per Household	$ 261	$ 653
Estimated Usage - Before (million kWh)	20.4	20.4
Estimated Usage - After (million kWh)	20.0	19.1
Overall Reduction in Usage	-1.8%	-6.4%

[1] The low scenario is based on the rate achieved after the first six months of the pilot in Rossland. The high scenario is what Rossland expects upon completion of the program.
[2] The estimated savings are based on the rates marketed to homeowners through the program, not actual metrics taken from the participating homes.
[3] The electricity rate is the yearly average residential rate in 2012 according to the rate schedule from Pacific Gas & Electric.

Sources: Table 2.2; Dehnel, Patricia and Suhan, Carol. "Rossland Energy Diet: Secrets to Success." Webinar. December 2013. <http://www.bcsea.org/sites/bcsea.org/files/2013-12-17-webinar-rossland-energy-diet.pdf>.

D. National Smart Meter Plan | Ireland

Key Lessons Learned

Summary
Agency/Org: Commission for Energy Regulation **Years in Operation:** 2007-present **Program Type:** Advertising, Smart Meter, IHD **Behavior Change Strategy:** Calculus, cognition **Uptake:** 100% (Federal Mandate) **Selected as:** Best Practice

- When paired with an in-home metering display (IHD), the real-time feedback provided by smart meters can be utilized to significantly change consumer energy consumption patterns.
- Peak hour time of use pricing, paired with an IHD, can also be utilized to significantly change consumer energy consumption patterns.
- Careful and comprehensive data collection can enable a detailed statistical evaluation of a proposed behavior change program.

Program Overview

Since 2006, Ireland has pursued a comprehensive advertising campaign, known as the Power of One campaign, aimed at encouraging energy efficient behavior. The campaign has targeted various forms of energy efficiency including natural gas, electricity and transportation fuel costs.

In late 2007, the Commission for Energy Regulation (CER) established the National Smart Metering Project as a measure to further the energy efficiency goals of the Power of One program. Specifically, the goal of the smart metering project was to comprehensively analyze the costs and benefits of a smart metering program, and to examine the feasibility of implementing smart meters throughout Ireland. CER partnered with several industry members, namely Electric Ireland and Bord Gáis, to test the smart metering potential.

CRE conducted customer behavior trials (CBT) focused on residential and small-to-medium enterprise (SME) gas and electricity consumers in order to answer three main questions regarding smart meters and energy efficiency:

- Do smart meters effect a measurable change in the consumer's behavior?
- Do smart meters reduce peak electricity demand?
- Do smart meters reduce overall (gas and electric) energy consumption?

Based on the results of the analysis, on July 4, 2012 CER approved the decision to mandate the rollout of meters to all customers in Ireland between 2014 and 2019.

Behavior Change Strategies Employed

The electricity CBT used a sample size of 4,300 to test the effectiveness of pricing and behavioral stimuli on reducing overall and peak time consumption, the effectiveness of demand side management initiates with time-of-use pricing and to determine the price tipping point that causes a change in consumer behavior.

The participants were split into several groups to test whether peak hour tariff schemes and demand side management stimuli affected usage patterns in electric and natural gas consumption.

The stimuli tested in the CBT are as follows:

- Stimulus 1: Bi-monthly bill and energy use statement;
- Stimulus 2: Monthly bill and energy use statement;
- Stimulus 3: Bi-monthly bill, energy use statement and in-home display; and,
- Stimulus 4: Bi-monthly bill, energy use statement and OLR incentive.

Time of Use Tariff Pricing

The backbone of the smart meter test program was the concept that consumers will react to pricing signals, in the form of peak use tariffs, and will alter their energy usage if they are aware of the increased cost of energy during peak hours. The CBT tested four different tariff schemes. Each scheme had three different increasing rates for weeknights (11 pm to 8 am), weekdays (8 am to 5 pm, 7p to 11pm) and peak hours (5 pm to 7pm, Monday through Friday, excluding holidays). See **Appendix Table A.4** for a detailed breakdown of the time-of-use tariffs tested by the CBT.

Enhanced Energy Statements & Awareness

The next stimulus tested was the effect of an enhanced energy statement. The energy bills were redesigned based on input from focus groups in order to further provide information to the consumer with the goal of creating changes in consumer energy consumption behavior. Enhanced energy statements included facts about energy awareness, hints and tips for usage reduction, a comparison of actual use with peers, historical usage and additional pertinent information. To emphasize the tariff scheme being tested among the participants, stickers and refrigerator magnets that illustrated the peak hour pricing scheme were distributed to the appropriate customers participating in the test. **Figure 6.1** shows a sample of the peak hour pricing guides that were distributed as part of the trial.

In Home Displays (IHD)

As noted above under Stimulus 3, the trial examined the effects of the usage of in-home display (IHD) along with the tariff pricing schemes in reducing energy consumption. IHDs are a vital link between the data provided by the smart meter, and the consumer who can utilize that data to alter their energy consumption, particularly during peak usage hours. CER designed the IHD using feedback from the smart metering industry, and feedback from potential users. A key element of the program was the establishment of a daily budget. The IHDs were configured to display daily usage as a percentage of the daily budget. The daily budget was personalized to each consumer

based on their energy goals, and past energy consumption patterns, and was calculated prior to deployment of the smart meters and IHD.

Also, the IHDs displayed colors corresponding with the pricing tariff schemes highlighted above. During peak hours IHDs displayed a prominent red bar; meaning that customers were being charged the highest, peak hour rates. Weekday usage was indicated by an orange bar; and week night usage (charged at the lowest tariff) was identified by a green bar.

OVERALL LOAD REDUCTION (OLR) INCENTIVES

As noted above under Stimulus 4, the CBTs also examined the effects of an ORL incentive program. The program asked participants to reduce their energy consumption by 10 percent compared to their actual previous energy usage. In addition to any savings caused by the reduction in consumption, if participants reached the 10 percent goal, they were rewarded with €20 (~$30). The enhanced energy statements then tracked progress towards the goal, and provided an estimate of the amount of energy (or less) that the consumer had to use in order to reach the goal.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

The behavior change strategies used in this program can be characterized as **cognition** and **calculus** strategies. The enhanced energy statements provide the cognitive tools for consumers to adjust their behavior. The time-of-use pricing, load reduction incentives, and constant feedback provided by the smart meters and IHD comprise the program's calculus strategy for encouraging behavior change.

RESULTS

Compared to the control group, across all test groups overall electricity usage decreased by 2.52 percent and peak usage decreased by 8.81 percent. The results were statistically significant to a 90 percent confidence level. **Table 6.D.1** displays the overall changes in usage as a result of the CBT for electricity.[39]

Note that while daytime and peak hour usage decrease, night usage increase, but not by a statistically significant amount. Surveys indicate that 91 percent of program participants rated the IHD as an important tool for achieving peak usage reduction.[40] Using the IHDs feedback, customers shifted their usage to the night period to take advantage of the lower tariffs offered at that time.

[39] See **Appendix Table A.5** for a breakdown of electricity usage reductions, by tariff scheme.
[40] Final Results of Ireland's Smart Meter Rollout Trial Presentation: The Customer Behavioural Response, November 7th, 2011, SEAI.

Table 6.D.1: Overall Changes in Electricity Usage

	Change
Overall[1]	-2.52%
Peak Usage[1]	-8.81%
Day Usage[1]	-2.57%
Night Usage	0.12%

[1] Results are statistically significantly different from control group using a 90% confidence level.
Source: Electricity Smart Metering Customer Behaviour
Trials (CBT) Findings Report (CER11080a), The Commission for Energy Regulation, Ireland.

The CER's recommendation that IHDs be mandated nationwide was a result of the cost benefit analysis findings that showed that IHDs contributed to appreciable energy usage savings. **Table 6.D.2** examines the effects of the four stimulus scenarios noted above on electricity usage. For both overall and peak hour reductions, Stimulus 3 (Bi-monthly Bill, energy use statement and electricity monitor) consistently caused the greatest reductions in usage (3.2 percent and 11.3 percent, respectively) for electricity.

Table 6.D.2: Electricity Usage Reductions, by Stimulus

Usage Period	All Tariff Groups and DSM Stimuli	Bi-monthly Bill and energy use statement (Stimulus 1)	Monthly Bill and energy use statement (Stimulus 2)	Bi-monthly Bill, energy use statement and electricity monitor (Stimulus 3)	Bi-monthly Bill, energy use statement and OLR incentive (Stimulus 4)
Electricity					
Overall	-2.5%	-1.1%	-2.7%	-3.2%	-2.9%
Peak	-8.8%	-6.9%	-8.4%	-11.3%	-8.3%

Note: All results except overall/stimulus 1 are statistically significantly different from control group using a 90% confidence level. Peak hour usage reduction data was not available for gas.

Source: Electricity Smart Metering Customer Behaviour Trials (CBT) Findings Report (CER11080a), The Commission for Energy Regulation, Ireland, May 16, 2011.

POTENTIAL APPLICATION TO SONOMA COUNTY

Uptake: In Ireland, uptake will be 100 percent at the completion of the rollout. Given that Sonoma County has already started to roll out smart meters, a roll out of IHDs would complement the smart meter rollout.

Savings achieved: Given the results of the CBT, once implemented, SCP could see between a 1.1 and 3.3 percent reduction in electricity usage.

Feasibility: An IHD rollout in Sonoma County is feasible, given the existing smart meter infrastructure put in place by PG&E. The biggest obstacle to implementing an IHD rollout would be financing the purchase and installation of the devices. That said, costs could potentially be recovered through utility rates, and partially offset by the cost savings as a result of the behavior changes informed by the IHD.

Cost effectiveness: Given that the CBT trials indicated a net benefit from the smart meter/IHD trials, this alternative ranks high with regards to cost effectiveness. The Ireland case study proved that given the appropriate stimulus, IHDs and smart meters could be cost effective in the long term. In Ireland's current smart meter rollout, the estimated cost to roll out the infrastructure to the nation totals approximately €1 billion (~$1.39 billion), yielding net benefits of €229 million (~$318 million) net present value over a 20 year period.[41]

Based on the baseline energy profile for Sonoma County in 2012 (shown earlier in Chapter 2, Table 2.2). **Table 6.D.3** estimates potential energy savings to the SCP service area under two scenarios: low success and high success to provide a range of possible outcomes if implemented in the SCP service area. **Appendix Table A.3** compares the analysis in Table 6.D.3 to the other in-depth case studies included in this report.

[41] *Decision on the National Rollout of Electricity and Gas Smart Metering (CER12008)*, Commission for Energy Regulation, Ireland. July 4, 2012. pp.4.

Table 6.D.3: Case Study - National Smart Meter Rollout | Ireland

	Scenarios	
	Low	High
Electricity		
Service Population (2012)	368,426	368,426
(Less 20% assumed opt-out)	(73,685)	(73,685)
Adjusted Service Population	294,741	294,741
Assumed Uptake[1]	100%	100%
Potential Reach	294,741	294,741
Baseline Usage per Capita (2012)	2,745	2,745
Energy Savings[2]	1%	3%
Potential Usage per Capita	2,715	2,657
Persons per Household	2.56	2.56
Cost per kWh[3]	$ 0.186	$ 0.186
Average Annual Electricity Cost per Household	$ 1,293	$ 1,265
Annual Savings per Household	$ 14	$ 42
SCP Area Estimated Usage - Before (million kWh)	1,011.2	1,011.2
SCP Area Estimated Usage - After (million kWh)	1,002.4	985.3
Overall Reduction in Usage	-0.9%	-2.6%

[1] Based on resuts of CBA, Ireland will implement gas and electric smart meters and IHDs nationwide.
[2] Overall electricty use reductions ranged from -1.1% to -3.2% depending on DSM stimuli.
[3] The electricity rate is the yearly average residential rate according to the rate schedule from Pacific Gas &Electric.

Sources: Table 2.2; Electricity Smart Metering Cost-Benefit Analysis (CBA) Report – CER/11/080c - The Commission for Energy Regulation, 16th May 2011.

7. Cursory Case Study Review

This chapter examines the details of each of the six cursory case studies demonstrating energy efficiency through behavior change. For each case, there is an overview of the program, details about behavior change strategies employed, and key lessons learned. It is important to note that not all of the case studies can be seen as successes. For those case studies that were not resounding successes, key lessons learned can also provide valuable insight for policy makers.

A. 10% Energy Challenge | Singapore

Key Lessons Learned

- Competition and lotteries can be efficient ways of encouraging energy saving, and combining different types of games (both community level and school level) provide motivation to change behavior.

Summary
Agency/Org: National Environment Agency
Years in Operation: 3 years
Program Type: Energy Saving Competition
Behavior Change Strategies: Cognition, Calculus
Uptake: N/A
Selected as: Best Practice

- Information campaigns carried out in conjunction with relevant government agencies and producers can provide targeted and more efficient instruction on the consumer decision-making process.

Program Overview

Singapore's National Environment Agency (NEA) launched the "10% Energy Challenge" program in April 2008 to raise awareness among all 1.12 million households about simple energy saving measures and habits that can help households reduce their utility bills.[42] Residents who had proven successful in reducing their electricity consumption by 10 percent within a specific period of time were eligible to enter into a lottery for a chance to win attractive prizes like an energy-efficient refrigerator, or a fuel-efficient hybrid car.

To take part in the lottery, the difference in household electricity consumption in the first four months had to be at least 10 percent lower than the next four months. Eligible households were provided household electricity consumption data and visualizations for the aforementioned eight months on the reverse side of their utility bill, which made households aware of their consumption levels. Together with the lottery, NEA provided every household with an Energy Efficiency information kit, which contained useful tips on saving electricity and other interesting collateral materials to guide individuals in their energy conservation. For example, households were instructed to turn off appliances at the power socket to eliminate standby power, which can add up to 10 percent to the electricity bill, or were encouraged to look for Energy Star labels to buy energy-efficient appliances.

[42] *NEA to households: cut your energy bills by 10%*, Press Release 26 Apr 2008, accessed online: www.nea.gov.sg

In tandem with the national contest, NEA and the Singapore Environmental Council (SEC) have jointly enlisted school children to help promote energy efficient habits within their households through a similar competition to reduce their household electricity consumption by at least 10 percent over the same periods. Students vied for the intra-school award, which is given to the top three energy savers, and schools competed for the inter-school prize which was given to the top three schools with the highest percentage of participating students who have achieved 10 percent or more reduction. Participating students whose household electricity consumption achieves a 10 percent reduction received a separate individual prize.

As part of the program, NEA, the Housing and Development Board (HDB) and the Energy Market Authority (EMA) signed a Voluntary Agreement with 16 major retailers and suppliers to promote energy efficient appliances in September 2009. Signatories committed to supply or display more energy efficient (3-tick and 4-tick) air-conditioners, refrigerators and clothes dryers, and to promote them to consumers.[43] In return, the government agencies provide signatories with energy efficiency training, educational materials, and training on how to raise consumer awareness of energy efficiency. Additionally, NEA organized an Energy Challenge Month. Throughout the month, NEA regional offices worked with grassroots organizations to hold energy efficiency-focused community events all over Singapore.

The Energy Challenge Month culminated in an Energy Challenge Fair (ECF) for all community members. At the ECF 2010 Opening Ceremony, a Climate Change brochure was launched to inform the public and students on the key findings of Phase 1 of the Climate Change Study on the possible long-term impacts of climate change on Singapore. The brochure also included information about the science of climate change and the measures that will be taken in Singapore to adapt to the possible impacts of climate change. The brochure also outlined what Singaporeans can do to help mitigate Singapore's greenhouse gas emissions. The 10 signatories of the Voluntary Agreement on energy efficient appliances received awards for their efforts in promoting energy efficiency.

If achieved as planned, a 10 percent cut in energy consumption in Singapore could save more than 680 GWh (based on the consumption of electricity by the domestic sector in 2007) and this, if sustained, translates into over $162 million savings per year at current consumption levels.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

There are various applications of **cognition strategies** in this program, including a general information campaign such as providing information kits to all consumers, and classroom-based education such as training primary school students. The Energy Challenge Month included both mass marketing and education as both energy efficiency appliance providers and grassroots organizations offered free training to consumers. Targeting school children may be an efficient approach in the sense that it could have long-term influence on the future energy saving behavior of those children. The challenge and lottery design is an application of **calculus strategies** in that they were intended to motivate citizens to save energy based on financial and reward-based incentives.

[43] The National Environment Agency rates appliances based on the number of ticks. The higher the number of ticks, the more energy an appliance consumes.

B. COMMUNITY ENERGY SAVING PROGRAMME | UNITED KINGDOM

KEY LESSONS LEARNED

- The Whole House approach to energy efficiency improvements has been demonstrated successfully in Sonoma County and the United Kingdom and maximizes energy savings by accounting for the entire range of possible home upgrades.

Summary
Agency/Org: Office of Gas & Electricity Markets **Years in Operation:** 2009-present **Program Type:** Energy Audits **Behavior Change Strategy:** Calculus **Uptake:** Around 40,000 homes (less than 50%) **Selected as:** Replication

- Successful schemes built on existing healthy relationships between energy companies and delivery partners, possessed good housing stock data and "ready-to-go" projects, and leveraged opportunities for matching funding.

REPLICATING SONOMA'S SUCCESS IN ENERGY EFFICIENCY

One of the key local energy efficiency programs in Sonoma County is the Whole House Upgrade Program, which is administered under the statewide Energy Upgrade California (EUC) Program. The "whole house" approach to energy efficiency holds several advantages over a piecemeal approach to renovating and retrofitting an existing home. The piecemeal approach delivers energy efficiency improvements without considering the home as an energy system with interdependent parts. By contrast, the whole house approach considers all the potential improvements at the same time rather than looking at the cheapest measure first. For example, improved insulation reduces the heating needs of a home and thus could be used to reduce other parts of the home, such as energy-inefficient furnaces and heating systems. In the piecemeal approach, the potential changes in other parts of the home resulting from improved insulation would represent a missed opportunity to achieve even greater energy savings. Furthermore, the whole house approach accounts for the occupants, site characteristics, and local climate when renovating and retrofitting homes.[44]

While the whole house approach reduces the number of times home improvements must be made and maximizes savings in energy costs, there are a few downsides to this approach as well. The quality of data from energy audits has sometimes been substandard to support a fully integrated approach. In addition, retrofits at the whole-house scale can be disruptive to residents' lives. While some parts like boilers can be upgraded without much disruption, properties with solid walls and external insulation require residents to temporarily vacate their homes.[45] At the same time, whole-house retrofit programs may also be undervalued in terms of its added non-energy benefits, such as improved comfort and noise insulation, aesthetic enhancements, improved home durability and safety, and better indoor air quality.[46]

The EUC Whole House Upgrade Program has helped residents secure financing, incentives, and rebates, prepare applications, and connect participants with approved contractors. Using the whole house approach for building science, pre- and post-project testing, and energy performance analysis, the program provides between $1,000-$2,500 in incentives per project (Home Upgrades) or

[44] "Whole-House Systems Approach." Department of Energy, 26 Apr 2012
[45] Potts, Dale. "Cutting Carbon: The 'Whole House' Approach." Faithful + Gould, 15 Apr 2010.
[46] Thorne Amann, Jennifer. "Valuation of Non-Energy Benefits to Determine Cost-Effectiveness of Whole-House Retrofit Programs: A Literature Review." ACEEE Report Number A061, May 2006.

up to $4,500 in rebates (Advanced Home Upgrades). According to the Sonoma County Energy Independence Program (SCEIP), the EUC Whole House Upgrade Program was mildly successful. In 2012, the program attracted 582 applicants, rewarded 625 rebates, improved 124 residential properties, and produced 31 percent overall energy savings per home on average. However, the three-year-old EUC program has fallen short of its initial 100,000 homes statewide goal.[47]

PROGRAM OVERVIEW

The United Kingdom has adopted a number of energy efficiency policies and programs similar to that of Sonoma County and California and has passed several laws to generate greater energy savings and carbon emission reductions. To achieve its legally binding reduced GHG emissions targets under the Kyoto Protocol (12.5 percent below 1990 levels by 2008-2012) and under the Climate Change Act 2008 (80 percent below 1990 levels by 2050), the UK government established the Carbon Emissions Reduction Target (CERT) in 2008, which required domestic energy providers serving at least 50,000 customers to help their customers reduce carbon dioxide emissions. As a result, these suppliers have assisted their customers in reducing their carbon footprints by promoting the uptake of low-carbon and energy efficient home solutions.

CERT ended in 2012, however, in favor of the Green Deal, which was a provision in the Energy Act of 2011 that created a financing mechanism similar to Property Assessed Clean Energy (PACE) financing[48] in California but for energy efficiency. Subsequently, the United Kingdom adopted a whole-house approach to its energy efficiency programs similar to Sonoma County's Energy Upgrade California (EUC) Whole Upgrade Program. Established in conjunction with CERT in 2009, the Community Energy Saving Programme (CESP) promoted whole house energy efficiency measures to reduce energy use and carbon emissions for its 4,500 eligible areas, with a particular focus on low-income households. CESP was designed with a scoring system that encouraged energy companies to choose the measures they wanted to install and to favor a small number of the 15 eligible energy efficiency measures, namely solid wall insulation (81 percent of scheme submissions), heat controls (65 percent), and boiler replacements (62 percent).

Funded by an obligation from October 2009 to December 2012 on energy suppliers and electricity generators CESP was administered by the Office of Gas and Electricity Markets (Ofgem) and delivered through community-based partnerships between Local Authorities (LAs), community groups, and energy companies. The local partnership model allowed energy providers in different areas to implement CESP as it fit their individual area, while allowing Ofgem to coordinate each of the local initiatives at the national level. The energy efficiency schemes that were established under CESP could be split into three broad categories for scheme delivery: energy company managed, client managed (local authority or housing authority), or third party managed.

By the end of June 2011, only 201 schemes were submitted to Ofgem when up to 400 schemes were expected, which was targeted to benefit 90,000 homes, save nearly 2.9 million tons of carbon dioxide emissions, and deliver per-household annual average electricity bill savings of up to £300 ($500). The June 2011 figure, however, equated to around half of the total CESP target. Much of the delay in submitting scheme proposals to Ofgem was attributed to the resource-intensive negotiations process between energy companies and their potential delivery partners. There was

[47] Baker, David R. "California energy-rebate program draws few takers." SFGate, 27 Dec 2013.
[48] According to the Database of State Incentives for Renewables & Efficiency (DSIRE), PACE financing "allows property owners to borrow money from a local government to pay for renewable-energy systems and/or energy-efficiency improvements [where] the amount borrowed is typically repaid via a special assessment on property taxes, or another locally-collected tax or bill, such as a utility bill."

some lack of awareness and understanding of CESP by local delivery authorities, cost of gathering housing stock data to judge the viability of energy efficiency schemes, and disagreement between energy companies and delivery partners over supply chain decisions and payment issues (e.g., whether local and housing authorities would be paid in advance of the measures being installed). On the other hand, successful schemes were able to overcome these challenges and were generally built on existing healthy relationships between energy companies and delivery partners. Partner housing authorities offered credibility and expertise to energy companies in engaging their tenants. In addition, the success cases benefited from the availability of good housing stock data, existence of "ready-to-go" projects from previous energy efficiency schemes, and leverage of external match-funding.

Among successful schemes, there was some variation in the degree of uptake among different households within a CESP area. Overall, in every scheme, there was near-universal uptake with social housing units, which was in part due to the fact that only 31 percent of participating households felt like they had a choice on whether to participate in CESP. This sense of forced change, however, was mitigated and reported satisfaction levels were higher when low-income households were consulted on schemes before implementation and were give choice over non-trivial things like the color of external wall insulation, which led to increased buy-in and interest.

On the other hand, there was less than 65 percent uptake for private housing units, which has been attributed to the lack of match funding or cost sharing from private homeowners and higher transaction costs of dealing with multiple homeowners as compared to a single large stock owner of social housing. However, uptake levels among private householders were higher when low-interest loans were available and when they were able to see completed housing authority-owned properties and hear about the benefits received from these measures by their social tenant neighbors.

Households were engaged through letters, open events, in-person interviews, press releases, newsletters, and websites, with letters being the most popular and successful communication method. The most successful communication methods were understandable and non-technical, particularly in regards to the whole house approach. Schemes with poor levels of uptake did a poor job of communicating how implementing one energy efficiency measure was more expensive than a collection of measures, for example.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

CESP is an example of a relatively successful case study that leveraged **calculus strategies** to encourage low-income households to adopt whole house upgrades to their homes. Participation in the program was completely dependent on the cost and energy savings that it intended to generate. This case also demonstrates the importance of **cognition strategies** in that lack of awareness of the program impeded its widespread uptake.

C. ECO-POINTS PROGRAM | JAPAN

KEY LESSONS LEARNED

- Incentive programs work well for generating economic activity, but are not a "silver bullet" for reducing energy consumption. "Never mistake activity for achievement" – John Wooden.
- LED use increases dramatically when incentivized financially.
- Energy efficiency program design must be carefully crafted to avoid unintended consequences. Incentives provided must be calibrated to meet realistic goals.

Summary
Agency/Org: Ministry of Environment, Ministry of Economy, Trade and Industry (METI), Ministry of Internal Affairs and Communications.
Years in Operation: 2 years
Program Type: Rebate
Behavior Change Strategies: Calculus, Cognition
Uptake: N/A
Selected as: Best Practice

PROGRAM OVERVIEW

Faced with self-imposed conservation goals, and a sagging economy, Japan implemented the Eco-Points program in April 2009 with hopes of spurring economic growth and reducing energy usage. The Prime Minister at the time, Yukio Hatoyama, made a bold declaration at the 2009 United Nations Climate Change Conference that Japan intended to reduce greenhouse gases (GHG) emissions by 25 percent by 2020 when compared to the nation's GHG emissions in 1990. The 25 percent GHG emissions reduction was a particularly aggressive target, and many criticized the goal as unrealistic. In particular, despite the government's optimism, the Japanese business community feared that continued efforts to reduce GHG emissions would hamper economic growth.

At the same time, the nation was beginning to move away from nuclear power generation, as concerns regarding earthquakes and other natural disasters in the region have prompted a movement away from the technology. Unfortunately, as Japan continues to use oil-fired thermal technology to backfill the reductions in nuclear power generation, the business community is further deterred by the increased cost of thermal power generation, compared to nuclear. In 2010, the Institute of Energy Economics, Japan (IEEJ), estimated that the cost per kilowatt-hour of power generation is estimated at ¥7.2 and ¥10.2, for nuclear versus thermal technology ($0.07 to $0.10).

The "Program to Promote the Spread of Green Home Appliances" referred to colloquially as the Eco-Points program was implemented as an attempt to both meet the nation's GHG reduction goals, and to bolster the economy, given the uncertainties regarding a stable, low-cost energy supply. The program was the outcome of a combined effort from three national agencies: the Ministry of Environment**,** the Ministry of Economy, Trade and Industry (METI), and the Ministry of Internal Affairs and Communications**.** Each agency involved had a particular objective. The Ministry of the Environment was concerned with reducing GHG emissions. METI wanted to promote economic activity, and the Ministry of Internal Affairs and Communications was responsible for promotion of the program.

The Eco-Points program was structured as follows: After purchasing selected products (typically energy-efficient air conditioners, refrigerators and televisions), consumers were awarded a pre-determined amount of Eco-Points worth between 5 percent and 10 percent of the value of the product. Each Eco-Point was worth ¥1 ($0.01). Once accumulated, the Eco-Points could be

redeemed from a government catalog of goods and services. The rewards ranged from gift cards for food at local eateries, to travel.

In December of 2009, the government refocused the program to incentivize redemption of Eco-Points for LED light bulbs. This was accomplished by allowing consumers to exchange "their eco-points for LED lamps at twice their value."[49] The inclusion of a discount for LED devices had a significant effect on the LED market. By May 2011, a total of 450,000 applications had been processed to redeem Eco-Points for LED devices, totaling $46 million.[50]

Despite the popularity of the LED program, the Eco-Points program was generally seen as a failure, as it mainly subsidized the purchase of flat-screen televisions, which did not result in appreciable energy savings. Program design can be faulted for the failure of the program. First, while the program was aimed at encouraging the purchase of a variety of energy efficient appliances, "roughly 82 percent had been issued for purchases of energy-efficient televisions."[51] While the new televisions were more energy efficient than the models they replaced, the energy usage reductions that were achieved were far less than anticipated. The Ministry of the Environment hoped for a 50 percent reduction in annual power consumption from 250kWh to 125kWh per television, yet researchers estimate that annual power consumption per television was actually reduced by only about 16 percent.[52]

A more carefully designed program would have done the following:

- Set realistic goals: While energy usage reductions are possible through a rewards-based points program, the amount of energy usage reductions hoped for were not achievable given the business and consumer climate. The necessary level of public awareness and buy-in was not present at the outset of the program and mechanisms were not in place to generate that support.
- Considered strategies for lasting change: The Eco-Points program generated economic activity, and energy savings in the short term, but once the program concluded in 2010, the economic activity returned to pre-2009 levels. This is very similar to American "Cash-for-Clunkers" program, where the societal benefits of the program ended as soon as the incentives expired. Energy efficiency programs, and the accompanying cognitive messaging, work best through repeated communications. Focusing a program to operate for less than two years will not spur consistent behavior change.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

The Eco-Points program sought to reduce energy consumption through **cognition** and **calculus** behavior change strategies. The program hinged on consumers making rational decisions to purchase goods that used less energy, in exchange for Eco-Points incentives. The Ministry of Internal Affairs and Communications played a key role in disseminating information, as part of the cognition strategies of the program.

[49] Accessed online: http://www.ledsmagazine.com/articles/2011/07/japan-s-eco-point-program-transforms-market-for-led-lamps-magazine.html
[50] Ibid.
[51] Aoshima, Yaichi, "Pitfall of Environmental Policy: An analysis of "Eco-point Program" in Japan and its application to the renewable energy policy." *Institute of Innovation Research, Hitotsubashi University,* p.9.
[52] Ibid.

D. ENERGYMARK | AUSTRALIA

KEY LESSONS LEARNED

- Peer-to-peer learning is more trustworthy and personable and is therefore more likely to induce behavior change than norms set by a governing agency.
- The network of participants has a high potential of exponentially expanding as participants recruit and inform others.
- "Volunteer conveners" can create an avenue for utilities and energy agencies to gather, measure, and track knowledge, attitudes, behaviors, and preferences of its participants.

Summary
Agency/Org: Commonwealth Scientific & Industrial Research Organisation (CSIRO) **Years in Operation:** 8-12 months **Program Type:** Peer Champions, Community Building **Behavior Change Strategy:** Cognition and Social Interaction **Uptake:** Over 2,000 households **Selected as:** Best Practice

PROGRAM OVERVIEW

Energymark is a behavior change-based household energy efficiency program developed by Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science and research agency, and modeled after book clubs. This grassroots program originated from Watermark, a program developed by the Victorian Women's Trust that utilized pre-existing social networks to generate social change and public engagement on water use. The Energymark process begins with "volunteer conveners" who gather around 10-12 of their friends, colleagues, relatives, and neighbors for regular, self-paced monthly meetings and discussions in informal, comfortable, and local settings—often referred to as the "kitchen table approach." During these meetings, conveners lead critical discussions (e.g., pros and cons debates) about CSIRO-compiled fact sheets and materials on household energy efficiency, climate change, and energy technologies, and are responsible for setting and monitoring personal goals for behavior change. Conveners are broadly recruited through media advertisements and word of mouth, but potential conveners are also recruited in a more targeted way at existing sustainability groups, university clubs, and retirement communities. Meanwhile, regularly group members were recruited through the conveners' existing social networks (e.g., church groups, university clubs, book clubs, and mom groups).

In addition to the convener, the other key roles in the Energymark process are the expert panel and the secretariat. The expert panel consists of CSIRO scientists and external experts that develop and supply the factsheets and technical information on the meeting topics, while the secretariat interfaces with the convener to ensure completion and standardization of session questionnaires and summary reports. The secretariat is also responsible for liaising between conveners and the expert panel on technical questions, for evaluating reports and surveys, and for developing marketing materials to recruit conveners.

The first Energymark trial was run in 2008 on a small scale with the Newcastle City Council. Building off this initial success, another round of trials were run in New South Wales (NSW)[53] and in the Brisbane[54] and Redlands City Council areas with more than 2,000 households. Approximately two-thirds of participants in NSW and Brisbane Energymark were female and only 19.8 percent of

[53] "NSW Energymark Program Outcomes." CSIRO, Sep 2012.
[54] "Brisbane Energymark Program Outcomes." CSIRO, Sep 2012.

participants lived in rental properties. Meanwhile, participants tended to be highly educated and either on the very young end (18-29 years) or near retirement age (60-69 years), which may have been attributable to greater availability of these populations and to the fact that CSIRO recruited heavily at universities and retirement communities for conveners. According to a CSIRO survey, participants stated that their main reason for engaging in Energymark was to learn about new ways to live sustainably and reduce carbon emissions.

At the end of the 8-12 month program, participants recorded between 12-23 percent energy savings (about $150-$160 per year per household) and 20 percent individual emissions reduction levels on average—calculations that were based on self-reported answers and verified by quarterly billing information. Participant surveys and tests also revealed 24-36 percent increases in knowledge of sustainability, energy technologies, and household energy efficiency and 2-4 percent increases in environmentally friendly attitudes toward energy conservation and climate change mitigation, even as participants started off with positive attitudes and high levels of knowledge.[55] Furthermore, Energymark's success has had multiplier effects as graduating participants reported to have spoken to 10-34 other people on average about the project and their education.[56] Despite concerns about the durability of this behavior change, CSIRO argues that the high-level of engagement and deep social networks formed by these groups make it likely that the behavior change is permanent in nature.

Due to these early successes, which CSIRO attributes to a more effective means of communicating information and developing a sense of social responsibility, CSIRO plans to extend Energymark into a four-year program that expands across Australia, serving up to 86,000 households. Based on trial data, CSIRO predicts that the expansion of the program has the potential to reduce home energy use by 250 GWh, generate $50 million in electricity bill savings, and reduce carbon emissions by 210,000 tons of carbon dioxide equivalent (CO2e) – all at a relatively low program cost of A$10 million (US$9.27 million). In addition, CSIRO estimates that an additional 690,000 tons of CO2e per year could be avoided because of spillover effects of behavior change into other areas like transportation, consumables, and waste.[57]

Despite the overall success, CSIRO researchers discovered several challenges and barriers to behavior change, such as cultural and political resistance to changing energy consumption behavior, barriers due to individual living situations, the high economic costs of changing behavior, and structural barriers outside the control of households.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

Energymark leveraged **cognition** and **social interaction strategies** to induce household behavior change and reduce community-wide energy consumption. Informed by social and psychological theories, CSIRO recognized the importance of voluntary individual behavior change and the heightened level of trust in peer-to-peer networks. For example, because behavior is a deliberate act based on individual beliefs and societal norms, according to the theory of reasoned action, CSIRO designed Energymark to foster positive attitudes (through CSIRO-compiled materials) and demonstrate perceived support (by setting individual goals within the group and watching other group members) for energy efficient and saving behavior to ensure action on that behavior.

[55] Dowd, Anne-Maree and Peta Ashworth. "Investigating the Effectiveness of Energymark: Changing Public Perceptions and Behaviours Using a Longitudinal Kitchen Table Appraoch." *Managing Climate Change: Papers from the Greenhouse 2009 Conference*, 2009.
[56] Dowd et al. "Energymark: Empowering individual Australians to reduce their energy consumption." Energy Policy, 2012.
[57] Dowd (2012).

Accordingly, Energymark trained and developed energy efficiency and environmental champions (conveners) who would facilitate social learning. The most common behavior changes reported by participants were installing energy efficient lights, turning off lights, reducing standby power, fixing or buying new energy efficient appliances, and monitoring energy use.

An unexpected finding from evaluations of the pilot programs was that participants with high relative levels of home electricity consumption produced the highest levels of energy savings. While the relatively larger reduction may be in part due to a higher baseline, Anne-Maree Dowd disaggregated the determinants of energy savings among Energymark participants to show that normative pressures was a major reason for this change in behavior. According to Dowd, the small, intimate, and open group setting where conveners facilitate the establishment and pursuit of energy-saving goals created an accountability structure that high energy users felt pressure to reduce their levels. Notably, in NSW Energymark, homeowners and people over 40 years of age used more electricity than renters and younger participants prior to joining Energymark, yet experienced greater levels of electricity use reduction after participating in Energymark.

E. Free CFL Program | United States

Key Lessons Learned

- Social media advocacy can have a substantial impact on consumer behavior, and the Internet has accelerated its influence.
- Collecting adequate information is essential before real implementation of the program, which justifies some social scientific methodology such as focus groups.

Summary
Agency/Org: First Energy Corp at Ohio
Years in Operation: 3 days
Program Type: Low-Energy Light Bulbs
Behavior Change Strategy: Cognition
Uptake: 0%
Selected as: Failure

Program Overview

FirstEnergy is an energy company in Ohio. The State of Ohio mandated FirstEnergy to increase energy efficiency and reduce energy use by 22.2 percent by the end of 2025 and reduce peak demand by 7.75 percent by the end of 2018.[58] To help meet those goals, FirstEnergy bought $6 million worth of compact fluorescent lamps (CFL), prepared packets with two bulbs plus literature on the program, and organized a massive effort to hand-deliver the bulbs to its residential energy users.

Formally launched on October 5, 2009, the FirstEnergy program was initially cast in a positive light by the local media. *The (Cleveland) Plain Dealer* ran a story on launch day headlined "FirstEnergy to Give Away 3.75 Million Low-Energy Light Bulbs."[59] Before long, however, the "bloom was off the rose" as the media exposed that the true cost of the bulbs was many times more than the standard retail cost. The extra cost was attributed to a move by the Public Utilities Commission of Ohio to help FirstEnergy recoup the cost of lost revenue as consumers switched to the more-efficient bulbs.

It was the Internet-based media—specifically, consumer advocacy web sites and bloggers—that broke the story within two days that the CFLs were not free at all, but were vastly overpriced. Because of heightened scrutiny of the program's "fine print" and increasing public outrage, Ohio Governor Ted Strickland called for the plan to be postponed. In addition to the Ohio governor's involvement, U.S. Congressman Dennis Kucinich (D-Ohio), State Senator Tim Grendell (R-18), and other elected officials weighed in on the matter and expressed strong concerns about the validity of the program. On October 8, 2009, just four short days after its launch, FirstEnergy issued a terse press release announcing that the program would be put on hold. On October 29, FirstEnergy took a different tack and announced a $7.4 million grant program to spur energy efficiency.

The failure of FirstEnergy and the result of bad press and damage to customer trust probably could have been avoided by implementing a simple, pre-launch focus group. It did not help that the FirstEnergy CFL program was forced onto the utility's customers. In contrast, Michigan's Bay City Electric rolled out a similar program with much more success. Bay City Electric also gave away two free CFLs per household, but the program was voluntary and was warmly regarded by citizens.

[58] Accessed online: http://www.cleveland.com/business/index.ssf/2009/10/firstenergy_light_bulbs.html
[59] Ibid.

BEHAVIOR CHANGE STRATEGIES EMPLOYED

This program provides an example of how a lack of **cognition strategies** can have a negative impact on the implementation and curtail the life of the program. The major lesson is how much influence the Internet and social media can make and how fast these forms of media can seal the fate of a program. Given the power of social media, utilities should conduct a review process before developing a strategy that incorporates the needs of the customer care, marketing, and legal departments, and then determine the social media policies about what will be said and how, and in what way the strategy will support the energy efficiency program.

F. NEW ZEALAND: HEAT SMART | NEW ZEALAND

KEY LESSONS LEARNED

Summary
Agency/Org: Energy Efficiency & Conservation Authority **Years in Operation:** 4 years **Program Type:** Subsidies for insulation upgrades **Behavior Change Strategies:** Cognition, Calculus, and Social Interaction **Uptake:** 200,000 homes (100%) **Selected as:** Best Practice

- Energy efficiency can be paired with other goals, such as improving public health, in order to draw more financial and political support for the program. Including other goals in the program design also allows for broader engagement, for example, by attracting people who might not be interested in energy issues but do care about health concerns. This also often allows for more "participation and flexibility, which is quintessential to ensure tailoring to end-user needs and demands and providing multiple benefits for all involved."[60]

- Calculus strategies alone may not be enough to push people to take action. In this case, the government paired the subsidy program with a public information campaign *and* social interaction strategies like building a network of well-informed industry service-providers.

- Cooperation with multiple agencies can broaden the program's scope and impact. In this case, the government partnered with insulation service providers, landlords, public health officials, and other community groups and nonprofits in order to offer a greater economic incentive for low-income households and get the word out about the program to more people.

PROGRAM OVERVIEW

More than a decade of academic and public health research precipitated the New Zealand national government's Warm Up New Zealand: Heat Smart (WUNZ:HS) program. The program ran from 2009-2013, with a budget of $340 million to promote insulation retrofits and installation of clean, efficient, heating systems throughout the country. The WUNZ:HS program was administered by the Energy Efficiency and Conservation Authority (EECA) and originally provided $230 million to fund retrofits for 200,000 houses over four years. The government expanded the funding due to the reported success of the program. Participating households could receive a 33 percent discount on installation of insulation in ceiling and floors. Low-income households could receive up to 60 percent off those costs. Some regional health boards and non-profit groups pledged additional funding to assist low-income households.

As a result of the program, there has been a 0.96 percent reduction in average annual household electricity and a 0.66 percent reduction in annual metered electricity and natural gas use. Despite the program's apparent focus on encouraging energy efficiency, research on the public health benefits of updated heating and insulation systems helped justify the passage of the program and continue to be included in evaluations of the program's impact. Researchers have found statistically significant evidence that there is a reduction in certain health-related costs for households that

[60] Mourik, Ruth and Rotmann, Sea. 2013. *Analysis of case studies IEA DSM Task 24 Closing the Loop - Behaviour Change in DSM: From Theory to Practice.* International Energy Agency Demand Side Management. Page 43.

participated in the program. When combining the health and energy results, the program is estimated to have a net benefit of $951 million dollars.[61]

Due to the success of the program, the national government renewed the program in 2013 under the name "Warm Up New Zealand: Healthy Homes." This revised program has a budget of $100 million over three years and intends to insulate 46,000 homes. The program is again targeted at low-income homeowners and renters and offers a 60 percent subsidy on installation of insulation. The program also estimates approximately $50million in matching grants from public trusts, healthcare organization, and other community groups in order to provide deeper discounts on insulation installation for low-income homes.[62]

BEHAVIOR CHANGE STRATEGIES EMPLOYED

The primary driver of this program is a **calculus strategy** of providing a financial incentive for people to insulate their homes. However, it appears that **cognition** *and* **social interaction strategies** were needed to improve and sustain the uptake of this program. The government identified cultural differences, financial and implementation difficulties, insufficient knowledge, and contradictory regulations as initial barriers to uptake.[63] In response, the government expanded the program to include new stakeholders (like landlords) and to provide grants to any house constructed before 2000, regardless of family income. Additionally, the government contracted with a range of service providers to offer the installations and has performed regular audits for quality assurance. The results of these audits have helped the insulation installation industry form stricter and more effective standards. The government also sought to raise awareness through TV, internet and radio campaigns and asking service providers to inform customers about the program.[64]

[61] Warm Up New Zealand: Healthy Homes. (n.d.). *EECA: Energy Efficiency and Conservation Authority*. Retrieved April 29, 2014, from http://www.eeca.govt.nz/eeca-programmes-and-funding/programmes/homes/insulation-programme
[62] Ibid.
[63] Mourik, Ruth and Rotmann, Sea. 2013. *Analysis of case studies IEA DSM Task 24 Closing the Loop - Behaviour Change in DSM: From Theory to Practice*. International Energy Agency Demand Side Management.
[64] Ibid.

8. RECOMMENDATIONS

Based on our analysis of the ten case studies in this report, we have developed a set of recommendations for Sonoma County to consider in the case that they proceed with design and implementation of a program to improve energy efficiency.

1. **Start small:** The most successful case studies we reviewed began as a pilot in a small service area (as in the Canada and Ireland examples). The benefit to this approach is that it reduces the initial investment, which minimizes potential losses in case the program is not as effective as planned, as in the Free CFL example from the United States. Another approach is to roll out a program on the county level, but deign it to be implemented incrementally, as in The Netherlands example. Additionally, beginning with a pilot allows the agency to build in feedback loops so that the program can adapt as it expands (as in the New Zealand example). Sonoma County has many small communities that could be excellent targets for a pilot program.

2. **Stack behavior change strategies:** The most successful programs stacked behavior change strategies; meaning, they did not rely solely on cognition, calculus, or social interaction *alone* to facilitate behavior change. As we saw in the failed U.S. example, use of one strategy can leave a program susceptible to criticism with no other avenue to correct it. Stacking strategies broadens program reach and provides more avenues for behavior modification. Two of the four most successful programs (Canada's Community Energy Diet and The Netherlands Block by Block) utilized all three strategies to achieve impact. One suggestion for Sonoma County would be to enhance an existing rebate or audit program to include social interaction and cognition strategies. In the Canada example, the Sustainability Committee rolled out a program that encouraged people to utilize existing subsidies for energy efficiency.

3. **Create lasting change through technology and accountability:** The programs that made the largest impact as far as energy savings were those that facilitated technological change. Upgrading appliances, for example, is a way to ensure that energy is saved on a daily basis and not susceptible to fade-out effects. The constant usage feedback provided by the smart meters and in-home devices in the Ireland example have proven to create lasting behavior change.

   Another way to encourage lasting change is to build in accountability through social interaction. People act alongside others much more often than they do on their own. Even if the program is not on-face a "social interaction" program, it should include some sort of social aspect. For example, marketing that includes testimonials and shows real community members participating in the program (as in the Canada example) can work to place heightened pressure on people. Note that social interaction strategies do not require understanding of new social media. Community meetings, public demonstrations or fairs, and education programs (as in The Netherlands and Singapore examples) are traditional methods that have proven to remain relevant even in the emerging world of digital and web-based technology.

4. **Carefully plan program roll out:** The best-laid plans breed the most successful energy efficiency programs. Program roll out should be carried out in a timely and efficient manner in order to maximize uptake. As we saw in both the Canada and Austria examples, program uptake was influenced by the program administrators' efforts to maintain interest and involvement through quick follow-up activities and opportunities to stay involved in the program or take further steps

to reduce energy use.

5. **Prioritize branding and marketing:** Hiring a professional marketing or PR firm and/or forming a special project team to focus on initial rollout is an important component of a successful behavior change program. In the Austria example, program administrators hired a professional firm to ensure that the program materials would be appealing, and to maximize messaging impact. In the Canada example, the city government utilized the marketing prowess of the local energy provider to publicize the program. Another benefit of outsourcing marketing is that the internal program team can focus on technical aspects of implementation. Alternatively, if there are insufficient resources or support for hiring an outside marketing firm, Sonoma County could adopt a grassroots outreach strategy as in the Australia example.

6. **Build in program feedback mechanisms**: The most successful programs did not necessarily start that way. Rather, programs like Austria's aWattgarde, Australia's Energymark, and New Zealand's WUNZ:HS collected feedback about community understanding and preferences, and adapted their approach to ensure greater success. In The Netherlands example, program administrators are collecting feedback from the early adopters of the citywide program and plan to utilize lessons learned to inform future expansion to the national level. Building in feedback can be as simple as user surveys, and should happen early and often throughout program implementation.

APPENDIX

APPENDIX TABLE A.1: ENERGY EFFICIENCY PROGRAMS IN THE FIVE LARGEST UTILITIES IN CALIFORNIA

Program Name	Sector	Ownership / Partnership	Program Details
Home and Business Area Network (HAN)	Residential & Commercial	▪ PG&E	▪ Home and Business Area Networking (HAN) is a wireless technology that allows customers to view their electricity consumption in near real-time, via their SmartMeter
SmartAC	Residential	▪ PG&E	▪ Installs SmartAC device to monitor and manage AC usage
SmartRate	Residential	▪ PG&E	▪ Summer pricing plan to encourage consumption at off-peak hours
Energy Upgrade California (Statewide)	Residential & Commercial	▪ State of California ▪ State's investor-owned utilities ▪ PG&E ▪ Southern Cal Edison	▪ Part of a statewide program that takes the "whole house approach" for building science, pre- and post-project testing, and energy performance analysis ▪ Helps secure financing, incentives, and rebates, prepare applications, and connect participants with approved contractors ▪ Based on a system of earned points, EUC provides between $1,000-$2,500 in incentives per project (Home Upgrades) or up to $4,500 in rebates (Advanced Home Upgrades)
Zero Net Energy Pilot Program	Residential & Commercial	▪ PG&E	▪ Program is focused on achieving maximal energy efficiency and load reduction by leveraging advanced design, construction and building operations before the addition of on-site renewable energy generation, such as solar PV ▪ A zero net energy building is one that produces as much clean, renewable, grid-tied energy on-site as it uses when measured over a calendar year
Energy Savings Assistance Program	Residential	▪ PG&E ▪ Southern Cal Edison ▪ San Diego Gas & Electric	▪ Provides income-qualified renters and homeowners with easy, free solutions to help manage their energy use and save money on their monthly energy bills
Rebate Programs	Residential	▪ PG&E ▪ Southern Cal Edison ▪ San Diego Gas & Electric ▪ LA DWP ▪ Sacramento MUD	▪ Provides rebates for making energy efficient upgrades
Lodging Energy Efficiency Program	Commercial	▪ San Diego Gas & Electric	▪ Audits lodging establishments for potential energy savings

Program Name	Sector	Ownership / Partnership	Program Details
Healthcare Energy Efficiency Program	Commercial	▪ San Diego Gas & Electric	▪ Audits healthcare establishments for potential energy savings
Home Performance Program	Residential	▪ Sacramento MUD	▪ Audits for energy efficiency
Greenergy	Residential & Commercial	▪ Sacramento MUD	▪ For just $3 (50% option) or $6 (100% option) more a month, SMUD will meet electricity needs with power made from renewable resources like wind, water, sun, and biomass

APPENDIX TABLE A.2: ENERGY EFFICIENCY PROGRAMS IN SONOMA COUNTY

Program Name	Sector	Ownership / Partnership	Program Details	Uptake / Success
Action Plan Tool	Residential	▪ SCEIP	▪ Provides self-energy analysis by having users submit information on location, square footage, year built, home layout, appliances, lighting, climate control equipment (heating, cooling, ducts), previous upgrades (windows, insulation, shower heads), solar equipment, and billing history ▪ Choose between home upgrade options, including maximizing savings and wealth, minimizing carbon footprint, and improving health and comfort ▪ Tool runs calculations that output lifetime monetary and carbon savings by undertaking certain behavior changes and/or installing certain equipment ▪ Connects users to contractors for action plans involving the installation of new equipment ▪ Each action item includes savings over time, upfront investment, qualifying rebates and incentives, product details, and demand reductions	▪ Unavailable
Property Assessed Clean Energy (PACE) Financing	Residential	▪ SCEIP	▪ PACE financing involves voluntary assessments of energy efficiency, water conservation and renewable energy generation improvements that are attached to the property (liens) ▪ Provides application documents, program guidelines, and calculator tools to help residents secure SCEIP PACE financing ▪ Repaid through property taxes over 10 or 20 years with a simple interest rate of 7% ▪ Minimum assessment amount is $2,500	▪ Number of properties: 229 residential, 15 commercial, 244 total ▪ 19 local and 237.3 ARRA jobs created ▪ 1,935 tons of eCO2 offsets ▪ Financing: $6.65M residential, $3M commercial, $9.6M total[65]

[65] SCEIP Annual Report 2012.

Program Name	Sector	Ownership / Partnership	Program Details	Uptake / Success
Windsor Efficiency PAYS	Residential	▪ SCEIP ▪ SCWA ▪ Sonoma County Regional Climate Protection ▪ Climate Protection Campaign	▪ Provides installation services of selected efficiency appliances and landscapes using a pay-as-you-save system (no loans or debt) ▪ Eligible for Windsor properties and residents	▪ Unavailable
Healdsburg Electric Department	Residential	▪ SCEIP ▪ City of Healdsburg	▪ Provides rebates for Energy Star appliances, heat pumps, AC replacements and tune-ups, conventional and LED lighting, weatherization (sealing and insulation), and pool pump replacement	▪ Unavailable
Energy Upgrade California in Sonoma County (Whole House Upgrade Program)	Residential & Commercial	▪ SCEIP ▪ State of California ▪ State's investor-owned utilities ▪ Funding from ARRA	▪ Part of a statewide program that takes the "whole house approach" for building science, pre- and post-project testing, and energy performance analysis ▪ Helps secure financing, incentives, and rebates, prepare applications, and connect participants with approved contractors ▪ Based on a system of earned points, EUC provides between $1,000-$2,500 in incentives per project (Home Upgrades) or up to $4,500 in rebates (Advanced Home Upgrades)	▪ 582 applicants ▪ 625 rebates rewarded ▪ 124 residential properties ▪ 1.44M kWh electricity and 173K therms natural gas saved ▪ 31% overall energy savings per home on average[66]
Contractors Directory	Residential & Commercial	▪ SCEIP	▪ Search by contractors that offer specific EUC packages (basic, advanced, flex) ▪ Filter by city, languages, and services offered ▪ Includes contractors that participate and SCEIP and are therefore certified according to their contractor standards	▪ Unavailable
Sonoma County Energy Watch	Commercial & Government	▪ County of Sonoma ▪ PG&E ▪ Energy Alliance Association	▪ Provides free energy and lighting audits ▪ Provides free technical consulting, financial consulting, and best practices advice on energy efficiency and conservation ▪ Provides direct install and upgrade services	▪ $700K in incentives ▪ 5.24M kWh electricity and 16.57K therms natural gas saved ▪ 1,265 metric tons of eCO2[67]

[66] SCEIP Annual Report 2012.
[67] SCEW data since 2010.

Program Name	Sector	Ownership / Partnership	Program Details	Uptake / Success
Healdsburg Commercial Energy Efficiency & Solar Rebate Program	Commercial	▪ City of Healdsburg Electric Utility	▪ Free, on-site energy analysis for commercial properties ▪ Provides rebates for up to a 20KW commercial solar PV system ▪ Provides energy efficiency rebates for commercial lighting, AC, and refrigeration	▪ Unavailable
California Green Business Program	Commercial	▪ SCWA ▪ Sonoma County Economic Development Board	▪ Green business certification for implementing high standards of pollution prevention and resource conservation ▪ Free on-site consultations and water/waste audits	▪ Unavailable
School Energy Efficiency Program	Commercial	▪ PG&E ▪ Resource Solutions Group	▪ Provides energy efficiency engineering services and incentives to public K-12 school districts and county offices of education	▪ Unavailable
Wine Industry Efficiency Solutions	Commercial	▪ PG&E ▪ Resource Solutions Group	▪ Provides energy efficiency engineering services and incentives to qualifying wineries ▪ Energy efficiency measures include refrigeration system controls, glycol tank and pipe insulation, barrel washing upgrades, compressed air system controls, heat reclaim measures, and boiler system retrofits	▪ Over 18M kWh and 312K therms of energy saved from 2006-2012 ▪ 13.7M pounds of CO2 removed from 2006-2012
Dairy Industry Resource Advantage	Commercial	▪ PG&E ▪ Resource Solutions Group	▪ Provides energy efficiency engineering services and incentives to qualifying dairies	▪ Enrolled 64 participating dairies, completed 22 energy audits, and committed 30 projects to implementation since 2006
Water Conservation Program	Commercial	▪ City of Santa Rosa Water Utility	▪ Rebates for turf removal, high efficiency urinals, water saving appliances, rain water harvesting, and graywater reuse	▪ Unavailable
Energy Upgrade California Employee Outreach Program	Commercial	▪ SCEIP ▪ State of California	▪ Provides employers community recognition and outreach tools to educate employees about EUC programs	▪ Unavailable
Lodging Savers	Commercial	▪ Ecology Action ▪ PG&E	▪ Free energy assessments and rebated energy efficiency retrofits to lodging properties	▪ Unavailable

Apendix Table A.3: Potential Energy Savings and Usage Reductions for In-Depth Case Studies

	aWattgarde		Block by Block		Community Energy Diet		National Smart Meter Plan	
	Low	High	Low	High	Low	High	Low	High
Electricity								
Service Population (2012)	368,426	368,426	3,835	25,568	7,415	7,415	368,426	368,426
(Less 20% assumed opt-out)	(73,685)	(73,685)	(767)	(5,114)	(1,483)	(1,483)	(73,685)	(73,685)
Adjusted Service Population	294,741	294,741	3,068	20,454	5,932	5,932	294,741	294,741
Assumed Uptake[1]	10%	15%	100%	100%	11%	15%	100%	100%
Potential Reach	29,474	44,211	3,068	20,454	653	890	294,741	294,741
Baseline Usage per Capita (2012)	2,745	2,745	2,745	2,745	2,745	2,745	2,745	2,745
Energy Savings[2]	2.5%	5%	30%	45%	20%	50%	1.10%	3.20%
Potential Usage per Capita	2,676	2,608	1,922	1,510	2,196	1,373	2,715	2,657
Persons per Household	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Cost per kWh[3]	$ 0.186	$ 0.186	$ 0.186	$ 0.186	$ 0.186	$ 0.186	$ 0.186	$ 0.186
Average Annual Electricity Cost per HH	$ 1,274	$ 1,242	$ 915	$ 719	$ 1,046	$ 654	$ 1,293	$ 1,265
Annual Savings per Household	$ 33	$ 65	$ 392	$ 588	$ 261	$ 653	$ 14	$ 42
Estimated Usage - Before (million kWh)	1,011.2	1,011.2	10.5	70.2	20.4	20.4	1,011.2	1,011.2
Estimated Usage - After (million kWh)	1,009.2	1,005.2	8.0	44.9	20.0	19.1	1,002.4	985.3
Overall Reduction in Usage	-0.2%	-0.6%	-31.6%	-56.2%	-1.8%	-6.4%	-0.9%	-2.6%

[1, 2] See Tables 6.A.1, 6.B.1, 6.C.1 and 6.D.3 for assumptions made for each uptake and energy savings calculation.

[3] The electricity rate is the yearly average residential rate according to the rate schedule from Pacific Gas &Electric.

Sources: Tables 6.A.1, 6.B.1, 6.C.1 and 6.D.3.

Table A.4: Domestic Time of Use Tariffs Examined in CBT for Electricity

	Weeknight (11pm to 8am)	Weekday (8am to 5pm, 7pm to 11pm)	Peak (5pm to 7pm, M-F, excluding Holidays)
Tariff A	€ 12.00	€ 14.00	€ 20.00
Tariff B	11.00	13.50	26.00
Tariff C	10.00	13.00	32.00
Tariff D	9.00	12.50	38.00

Note: Normal rate is 14.1 € cents/kWh.

Source: Final Results of Ireland's Smart Meter Rollout Trial Presentation: The Customer Behavioural Response, November 7th, 2011, SEAI.

Appendix Table A.5: Electricity Usage Reductions, by Tariff Scheme

Usage Period	All Tariff Groups and DSM Stimuli	Tariff A	Tariff B	Tariff C	Tariff D	Weekend Tariff
Overall	-2.5%	-2.7%	-3.4%	-1.9%	-2.4%	-3.7%
Peak	-8.8%	-7.2%	-9.8%	-9.0%	-10.9%	-11.6%

Note: All results are statistically significantly different from control group using a 90% confidence level.

Source: Final Results of Ireland's Smart Meter Rollout Trial Presentation: The Customer Behavioural Response, November 7th, 2011, SEAI.