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Paying for Good Deeds: Using Financial Incentives to Achieve Energy Efficiency

Proposal Submitted to the Precourt Energy Efficiency Institute

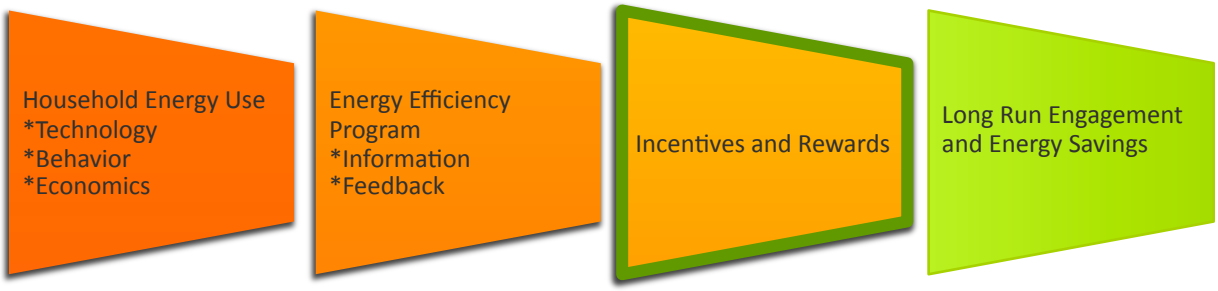
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Summary



The aim of this project is to understand how we can motivate individuals to achieve sustainable long run energy efficiency. In particular it asks whether we should pay individuals for achieving energy efficiency targets. Household energy use depends on the complex interaction between the available technology (such as the installed appliances), the individual behavioral constraints (such as the discount rate of future events) and economic factors (such as the price of electricity). While recent advances in technology have made it feasible to provide households with feedback and feedback on real time usage and pricing, very little is know about how to engage households in the long run. Existing evidence appears to show that households fail to engage with the existing feedback technology on a continuous basis in order to save energy in the long run. This project takes a behaviorally driven, economic approach to this problem, by considering the optimal design of rewards schemes aimed to encourage long run compliance with energy efficiency schemes. We propose a series of large-scale randomized field trials in order to measure the precise effect of such schemes and provide a quantitative guide to policy and real world implementation.

Literature Background and Motivation

As utilities, regulators and other market actors face increasing pressure to dramatically ratchet up energy efficiency and demand response programs, a new buzzword, *behavior*, is fundamentally changing the approach to energy efficiency. Behavior strategies, often grouped with close cousins marketing, education, outreach, conservation and market transformation, offer the promise of dramatically increasing the reach, cost-effectiveness and verifiability of energy efficiency investments. By combining the insights of behavioral science and consumer marketing with advanced technologies, changes in household energy use patterns and purchases of energy efficiency products and services can be strongly affected. A detailed recent overview of the opportunities provided by behavioral economics to addressing challenges in energy efficiency, is provided by Alcott and Mullainathan (2010). As the following literature review shows this area of economics is relatively well developed and provides a promising new approach to energy efficiency.

This research project builds on the recent interest in behavioral approaches to energy efficiency but is also closely related to several other strands in the economics literature. First, there is a large amount of literature focusing on providing financial incentives for individuals to carry out actions for their own benefit. In addition, this research relates to papers analyzing the provision of financial incentives to individuals carrying out actions for the benefit of society.

Several empirical papers have analyzed individuals' responses to incentive schemes, which transfer financial rewards conditional on these individuals performing actions to their own benefit. The vast majority of these papers examine educational achievement outcomes, although additional outcomes, such as quitting smoking or going to the gym, are also looked into. The literature on financial incentives in exchange for educational achievement outcomes is quite diverse, covering students from elementary school through college and in developed as well as developing countries. Monetary awards vary from cash transfers to tuition or schooling

fee subsidization, and the recipients can be either the students themselves or their parents. Most papers find a positive effect of monetary rewards on school achievement outcomes. Angrist and Lavy (2009) study students in Israeli high schools characterized by low high school certification completion rates. In their experiment, students in the treatment high schools are rewarded cash payments for passing the required exams in order to attain the high school completion certification. Their findings reveal that female students on the margin, i.e. those with a relatively higher likelihood of attaining the certification prior to the experiment, increased their certification attainment rates by approximately one third. Barrera-Osorio et al. (2008) look into conditional cash transfers to boost education in Columbia and use variations in the treatment groups to assess differences in education outcomes. Kremer, Miguel and Thornton (2004) look into a scholarship program for adolescent girls in Kenya. Girls who scored well on exams were awarded school fees as well as a grant. The findings show that the program had a positive effect not only on high-performing girls' school performance, but also on low-performing girls, who were unlikely to win the scholarships, and even on boys' academic achievements, although they were ineligible for any rewards. Behrman, Sengupta and Todd (2005) evaluate the first two years of the social program PROGRESA, which transferred payments to rural low-income families in Mexico, contingent on their children regularly attending school. The analysis reveals that participation in the program is associated with higher enrollment rates, less grade repetition and better grade progression, lower dropout rates, and higher school reentry rates among dropouts. Bettinger (2008) looks into cash payments made to third through sixth graders in Ohio conditional on target test scores, and finds that the cash incentives improved math test scores, though there is also evidence that students were shifting away from "high stakes" assignments in response to the new incentive structure. Jackson (2009) examines the longer-run effects of the Advanced Placement Incentive Program (APIP), a program that targeted high-school students in low-income minority-dominated school districts, in Dallas. Because the program's main objective was to improve students' college preparedness, Jackson evaluates program participants' college outcomes, and finds significant improvements. Other evaluations of programs providing financial incentives for educational achievement include the Learning, Earning and Parenting (LEAP) project in Ohio for pregnant and parenting teenagers on welfare (Long et al. 1996) and the Quantum Opportunities Program in U.S. cities, a five-year program which targeted youth with low grades entering high schools with high dropout rates (Maxfield, Schirm and Rodriguez-Planas 2003).

Papers focusing on educational outcomes in exchange for financial incentives with less conclusive results include Fryer (2010), analyzing school achievement outcomes resulting from cash payments rewarded to students conditional on attaining certain goals or achieving specific test scores. The experiments involved 38,000 students from 261 state-run low-performing schools in New York City, Chicago, Dallas and Washington, D.C. The experiment divided the programs among the cities to "output" experiments in New York City and Chicago and "input" experiments in Dallas and Washington, D.C. "Output" experiments rewarded students for grades or test scores, and "input" experiments rewarded actions which could potentially enhance the student's school performance, such as reading books, attendance and behavior. The results show that students' school achievement increased significantly in response to incentives for input, but no significant impact is detected in response to incentives for output. Fryer interprets the results to suggest that students "do not understand the educational production function and, thus, lack the know-how to translate their excitement about the incentive structure into measurable output." In addition, Angrist, Lang and Oreopoulos (2006) examine Canadian students' college education outcomes when up to an equivalent of a full-year's tuition in cash awards was offered for students meeting a target GPA and find that the program had a small effect on educational outcomes, though the effect was larger for females. Lastly, Angrist et al. (2002) and Angrist, Bettinger and Kremer (2006) examine the effect of the provision of school vouchers in Columbia for private secondary school enrollment when receiving the vouchers was conditioned on maintaining satisfactory academic performance. The results show an increase in school performance for those randomized to receive the vouchers; however, the authors admit that they are unable to disentangle the effect of school choice on school performance from the effect of the conditional renewal of scholarships on school performance.

Papers evaluating experiments which provide financial incentives to individuals performing actions to their own benefit outside the realm of education include Charness and Gneezy (2009), who offered students in two U.S. universities cash payments for attending the gym a certain number of times within a certain time-frame. Comparing treated students' gym attendance with gym attendance for those not offered any cash payments, reveals that cash payments significantly increased gym attendance, in particular for those previously not attending the gym regularly. In addition, Gine, Karlan and Zinman (2008) conducted an experiment where smokers

voluntarily deposited funds in a savings account for six months, after which they were tested for nicotine and cotinine. If they were found positive, their savings would be forfeited to a charity of the bank's choosing. Otherwise, their money is returned to them. Their results show that this voluntary commitment device helped smokers quit smoking. In the medicine literature, Volpp et al. (2006) find a higher quit rate for smokers when offered financial bonuses in exchange for not smoking following a 30-day period, but the difference between the control and treatment group was no longer significant after 6 months.

Methods and Implementation

This research proposes to investigate the extent to which monetary rewards can incentivize households to engage in actions, which promote energy efficiency on an on-going sustainable basis. Rather than exploring this question in a laboratory, this project proposes to test this idea in the field. This is very important if we are to develop energy efficiency programs, which have a high degree of external validity and would be easily adopted by utility companies.

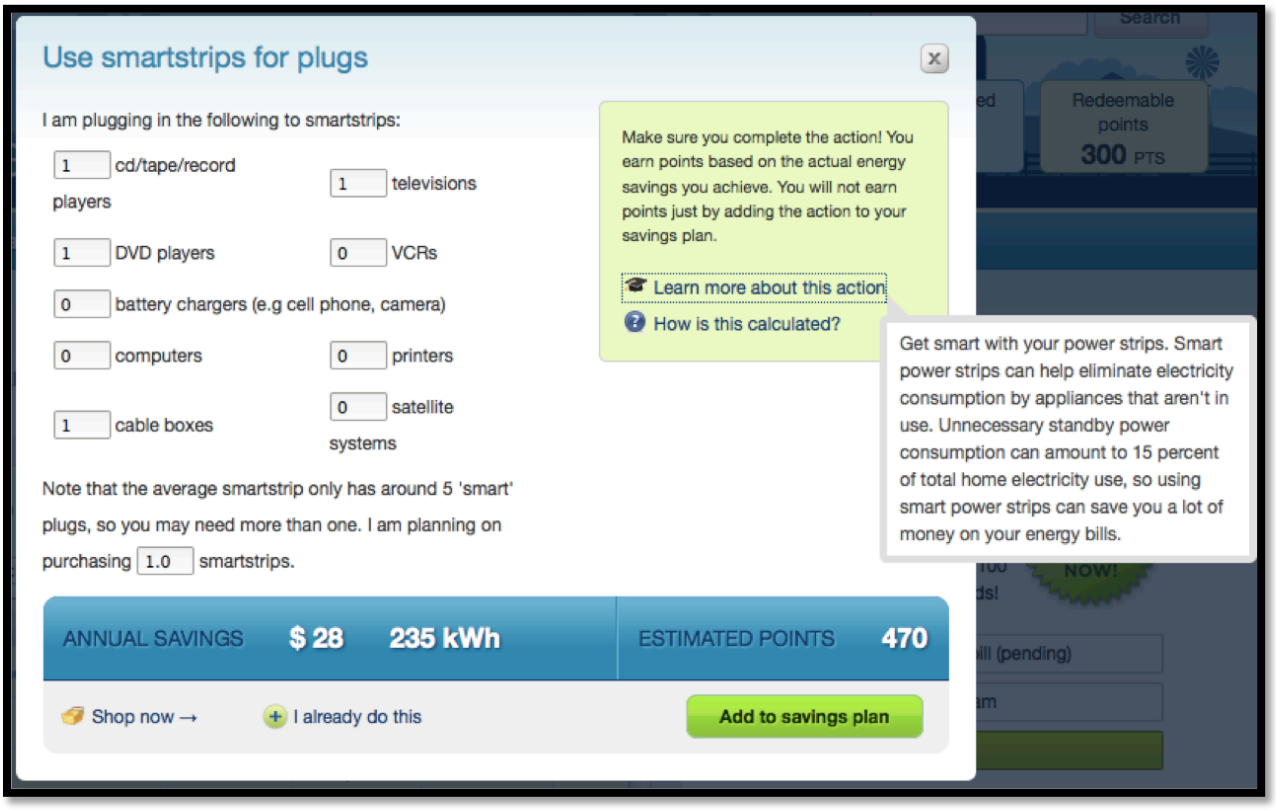
In order to fulfill this crucial implementation requirement I have secured the collaboration of **Efficiency 2.0** a premier energy efficiency and social software provider for utilities and other organizations seeking to engage residential and small business customers. Please find attached a letter of collaboration by the Chief Scientist at this company. Efficiency 2.0 works in collaboration with utilities to monitor energy use and provide households with informational tools required to manage their energy consumption and implement energy efficiency goals.

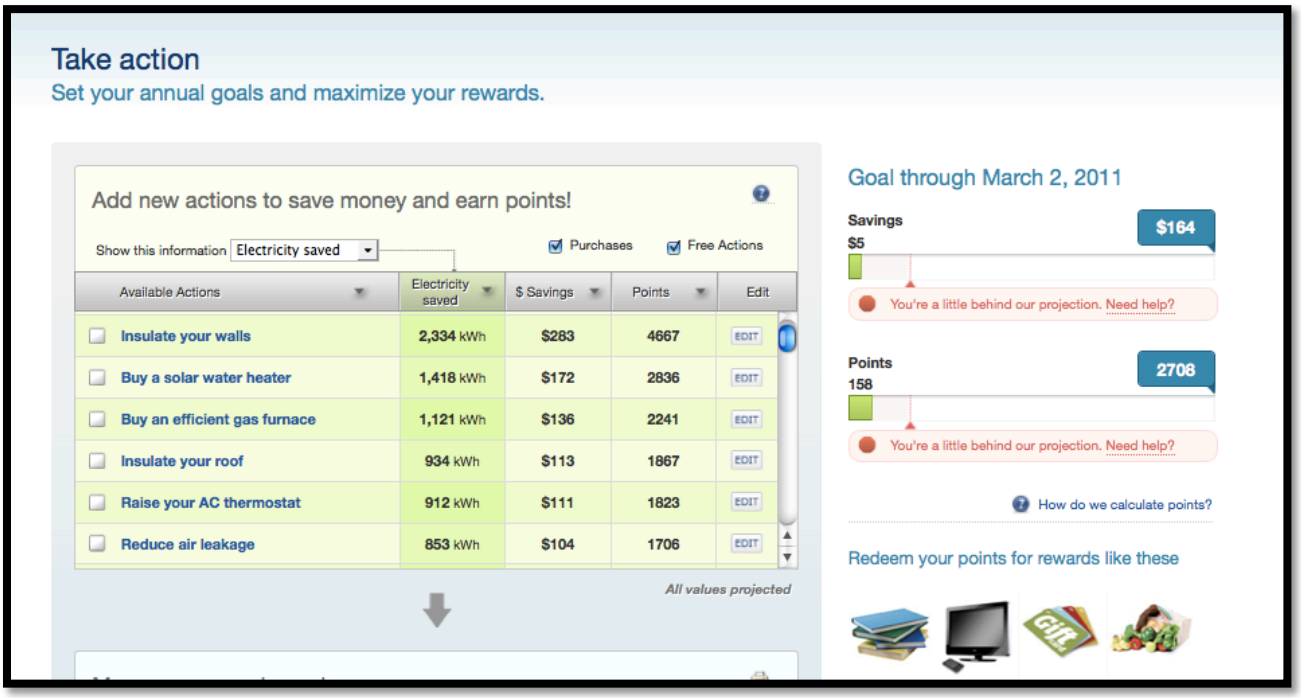
In particular I will engage a specific component of the services offered by Efficiency 2.0, the Personal Energy Efficiency Rewards (PEER) program, a residential energy efficiency information and *rewards program* that informs and engages customers through two components: a mail-in component, and a multi-channel information- and incentives-management component that is web-based. Below are two typical examples of the user interface, which display an advanced level of sophistication and flexibility, thus ensuring that this project can be feasibly implemented given the existing technology. In particular, it is important to note that the evaluation of reward points for achieving energy efficiency targets is already built into the software platform. Moreover, households will be able to directly redeem points for a number of products from major retailers (e.g. for electronics or household items).

Efficiency 2.0 has launched or is in the process of launching several pilot projects, in collaboration with major utilities across the country, which cover a large number of households. Additionally, I have secured the commitment of their scientific team to implement any project that results from this proposal using the highest scientific standards in a **randomized control treatment** framework using several thousand participants. I will design the allocation into treatment and control groups using appropriate statistical treatment rules methodology. Furthermore, given that no randomization is ever perfect in practice, I will be monitoring additional customer segments such those who request to opt-in or opt-out of a given program and use statistical methods to account for sample selection bias should this become an issue.
IRB- data recorded and analyzed.

Objectives

The primary objective of this research project is to assess the effectiveness of a system employing financial rewards for achieving energy efficiency goals. Note that the interest lies in evaluating the extent to which such reward systems act as a catalyst for enabling other traditional methods such as information provision. Since most large utilities have active energy efficiency programs it is no longer credible to think of the control group as consisting of uninformed individuals. Most consumers have already been treated with information. The real challenge lies in motivating individuals to act and utilize the information and tools available to them. It is important to realize that most individuals already have access to a rich set of technological approaches to save energy from smart strips to home energy monitors.


Use smartstrips for plugs
I am plugging in the following to smartstrips:
1 cd/tape/record players
1 televisions
1 DVD players
0 VCRs
0 battery chargers (e.g cell phone, camera)
0 computers
0 printers
1 cable boxes
0 satellite systems
Note that the average smartstrip only has around 5 'smart' plugs, so you may need more than one. I am planning on purchasing 1.0 smartstrips.
Make sure you complete the action! You earn points based on the actual energy savings you achieve. You will not earn points just by adding the action to your savings plan.
Learn more about this action
How is this calculated?
Get smart with your power strips. Smart power strips can help eliminate electricity consumption by appliances that aren't in use. Unnecessary standby power consumption can amount to 15 percent of total home electricity use, so using smart power strips can save you a lot of money on your energy bills.
ANNUAL SAVINGS $ 28 235 kWh
ESTIMATED POINTS 470
Shop now →
I already do this
Add to savings plan
Redeemable points
300 PTS


Take action
Set your annual goals and maximize your rewards.
Add new actions to save money and earn points!
Show this information Electricity saved
Purchases
Free Actions
Available Actions | Electricity saved | $ Savings | Points | Edit
Insulate your walls 2,334 kWh $283 4667 EDIT
Buy a solar water heater 1,418 kWh $172 2836 EDIT
Buy an efficient gas furnace 1,121 kWh $136 2241 EDIT
Insulate your roof 934 kWh $113 1867 EDIT
Raise your AC thermostat 912 kWh $111 1823 EDIT
Reduce air leakage 853 kWh $104 1706 EDIT
All values projected
Goal through March 2, 2011
Savings
$5
$164
You're a little behind our projection. Need help?
Points
158
2708
You're a little behind our projection. Need help?
How do we calculate points?
Redeem your points for rewards like these

The outcome of the research will be made available through one or more academic research papers for general interest and field journals within Economics. I expect to incorporate material from this project in my graduate level Environmental Economics class at Stanford. Additionally, undergraduate and graduate students at Stanford will be involved as research assistants. I expect to submit the conclusions of this research for presentation at major conferences such as the annual BECC meeting.

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