Behavioral Science is the New Green

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Large reductions in energy use are required to avert climate change and strengthen national security. Behavior change — getting households and businesses to reduce energy use through behaviors such as insulating, replacing cars and light bulbs with energy efficient models, and turning off idle equipment — is a source of reductions that can be deployed relatively quickly and at low cost compared to technology solutions, such as wind and solar power generation. The current energy crisis may represent the single largest opportunity for behavioral sciences to make an impact on real world events.

In a significant departure from traditional economic models, behavioral economics suggests that people sometimes exhibit biases, which means that they can be motivated (or de-motivated) by small psychological "nudges." These small nudges are often easy to implement, low cost, and can amount to a huge source of emissions reductions. Behavioral scientists have identified many of the biases that affect people's energy behaviors: people procrastinate, they don't like paying more money to purchase an efficient product even if it saves them money in the long run (time inconsistency), they forget things, they can't easily calculate net present valuations (bounded rationality), the small amount of money people save by remembering to turn off the lights is not motivating, people care what everyone else is doing (social preferences), and any individual effort to reduce energy use contributes such a tiny amount to the total effort that there is low personal motivation (the public good problem). Knowledge of these biases can be used to reduce energy use: We can diminish the behavioral biases that are currently working against energy savings, and we can take advantage of other behavioral biases in order to work in favor of energy savings.

The potential for behavioral sciences to reduce energy use is huge: Estimates place the reductions achievable through behavior change programs at 20 to 35 percent. However, understanding behavioral biases is not enough to bring about large scale energy reductions. Behavioral scientists must collaborate with policymakers, program implementers, and utilities in order to apply the knowledge from their research to the real world. Forums such as the Behavior, Energy & Climate Change (BECC)

conference* are an ideal place to facilitate such collaboration and foster the adoption of behavioral programs in the real world.

I am lucky to be part of a team of around 20 Stanford researchers who received a $6 million Advanced Research Projects Agency – Energy (ARPA-E) grant from the Department of Energy to explore behavior change as a source of energy use reductions. The goal of our ARPA-E projects is to use an energy sensor technology platform to create programs that leverage behavioral science techniques in order to motivate energy savings. We are currently working with program implementers, policy makers, and utilities to develop these programs. Once proof of concept is established, we will continue to work with them to diffuse the programs on a wide scale. In addition to bringing about large scale energy reductions, we believe that these behavioral based projects can achieve energy savings more cost-effectively than traditional technology solutions.

Broadly speaking, we are implementing three types of projects: first, we will build a smart technology platform and an extensible energy communications network that can be used by the entire Stanford initiative, which will allow delivery and evaluation of experiments quickly, cheaply, easily, and at scale and will enable future innovation in home area networks. Second, we will create and rigorously field-test behavioral programs that can be packaged and deployed wide-scale by utilities or policy makers. Third, we will create behavioral models in order to make more precise predictions about energy demand, which will allow utilities or policy makers to deliver targeted, dynamically updated programs to specific customer segments and will allow specific programs to be linked to objective, quantifiable energy reductions.

Our behavioral interventions use insights from behavioral science research and energy consumption information (e.g., from smart meters and wireless sensors) to develop programs that are appealing to consumers, highly salient, and highly motivating for consumer energy reduction. We adopted a model from public health to describe how combining multiple types of complementary interventions (such as media, policy, community, and analytics) can be particularly effective. For example, one of our projects is an energy game that will link energy sensors in homes to a multiplayer online game, so when you turn off your lights, you get points in the game. Another project uses novel incentive mechanisms that have been found to be very motivating, such as lotteries, in-kind gifts, and competitive prizes to reward households that shift and reduce their energy use. Three projects leverage social networks and social norms: one takes advantage of mobile networking tools such as Facebook, Amazon, and Twitter; one uses community goals to display energy information on online interfaces; and one relies on the more old fashioned way to network, using schools, communities, and word of mouth as diffusion channels for retrofit programs. Another project examines the potential of different types of frames to motivate appliance and rebate decisions, and another uses machine learning algorithms to predict household behavior patterns and eliminate wasted energy.

We hope that our ARPA-E project will serve as a call to action. Small changes to energy programs can have huge impacts if they leverage the correct behavioral bias. Behavioral scientists should think about how to practically apply their research to energy use, and program implementers should collaborate with researchers to create low cost, high impact energy programs. And everyone should go to the 2010 BECC conference (full disclosure: I am a co-chair) to interact with leaders in energy policy, behavioral sciences, program implementation, and media. ?