ENVIRONMENTAL REVIEWS AND CASE STUDIES

Beyond the Information Campaign: Community-Based Energy Behavioral Change at the University of Toronto

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For three decades, many environmental practitioners have used the information campaign as their tool of choice. Yet most simple information appeals remain ineffective and are rooted in an outdated understanding of human behavior. In this article, we report on policy lessons from the Rewire program, an innovative energy conservation campaign at the University of Toronto that has grown to reach over 12,000 community members in Canada's largest university. Drawing from the Rewire experience, which evaluated the program by using a mix of psychological, electricity, and qualitative metrics, we suggest cost-effective methods for delivering policy interventions in a complex institutional setting and explore effective methods to generate widespread changes in energy behaviors through a community-based social marketing approach. Campaign designers should move away from single-tool policy interventions to employ a coordinated set of tools and techniques that address a wide range of determinants of human behavior. By training community-based coordinators, campaign designers should also move away from hierarchical policy implementation and toward decentralized deployment of modular and locally adaptive campaigns. For behavioral change to make a meaningful contribution to energy policy, we emphasize the need for more regular dialogue between social science research and the community of energy conservation practitioners.

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With the looming threat of climate change, global policy makers are struggling to reduce global energy demand while transitioning electricity infrastructure onto a more sustainable trajectory (Caldeira, Jain, and Hoffert, 2003; Dietz, 2010; Hoffert et al., 1998; Lackner and Sachs, 2005). Efforts to deliver on the promise of energy efficiency have often concentrated on technological advances, yet technological fixes have struggled to respond to accelerating environmental pressures either because technological innovation has not kept pace with increasingly complex policy problems (Homer-Dixon, 2000) or because many efforts fail to appreciate the "human factor" underlying the use and deployment of technology (Vicente, 2004). By contrast, a growing set of public and private stakeholders have highlighted the importance of behavioral change for sustainable energy policy (Allcott and Mullainathan, 2010; Dietz et al., 2009; Ehrlich and Kennedy, 2005; Gardner and Stern, 2002).

To date, many demand-side energy conservation efforts have focused unsuccessfully on either financial incentives or public information campaigns. Financial tools, framed as either ex-ante incentives or ex-post rewards, have had some success in shifting behaviors (Abrahamse et al., 2005; Hassett and Metcalf, 1995). However, the cost-effectiveness of subsidies is difficult to evaluate; many subsidies fail to discriminate between individuals who would or would not have otherwise participated in a behavior—the problem of additionality—or become captured by nontarget populations—the problem of deadweight (Mceldowney, 1997). Further, when subsidies motivate behavioral change through financial reward, these changes can be fragile and externally motivated, often weakening when incentives are removed (e.g., McClelland and Belsten, 1979;

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Newsom and Makranczy, 1977) and can be expensive to scale. Isolated financial incentives also cannot leverage the multidimensional behavioral change that is possible when target populations are internally motivated by a broader proenvironmental orientation. Internally motivated change secures the persistence of the behavioral change over time and promotes behavioral change in related behaviors (Bachman and Katzev, 1982).

The traditional educational tool—the public information campaign—is also outdated. Conventional wisdom holds that the provision of information can change public behaviors; however, the psychological and communication literature has shown this common assumption to be deeply misguided (Abrahamse et al., 2005; Costanzo et al., 1986; Gardner and Stern, 2002). In the public sector, insufficient attention has been paid to the effect of advances in the psychological and sociological disciplines related to behavioral change (Dennis et al., 1990). Most prominently through community-based social marketing workshops and literature, these ideas have begun to permeate the practitioner community in the past decade (e.g., McKenzie-Mohr, 2011). However, few energy conservation programs informed by this new wave of behavioral change thinking have been carefully assessed in a field setting.

The University of Toronto, which is one of the largest public teaching and research universities in North America, encompasses a diverse set of academic and residential communities. Across three campuses, it enrolls 65,000 students while employing 6,000 faculty and 10,000 staff. In 2004, the university launched an ambitious Sustainability Office to coordinate reductions in the university's carbon and energy footprints. Office initiatives have included building retrofits, changes in operation policies, and an extensive educational and research mandate. Since 2004, the University of Toronto Sustainability Office has implemented a major energy conservation project—Rewire. Part of the program's aim was evaluation, and it sought to understand whether an energy conservation campaign designed with a richer set of behavioral determinants in mind could prove effective. This article, which draws policy lessons from the Rewire campaign, begins by outlining community-based social marketing and the associated psychological theories that informed the Rewire campaign's design, a review that should prove informative to many energy practitioners. After a discussion of the project's monitoring and assessment experience, effective design practices for energy conservation campaigns are discussed.

Theoretical Approaches to Environmental Behavioral Change

Research has demonstrated a number of social psychology techniques to promote environmentally responsible behaviors broadly and energy conservation specifically. Douglas McKenzie-Mohr and colleagues synthesized many of these techniques into the community-based social marketing (CBSM) framework (McKenzie-Mohr, 2000, 2011).[1] CBSM begins with a detailed analysis of the barriers blocking target behaviors within a site-specific context and then identifies a diverse set of psychological techniques to mitigate these barriers.

McKenzie-Mohr's work describes best practices for the design of behavioral change campaigns First, campaign *commitments* are most effective when voluntary, written, and public. Second, *prompts* can mitigate the effect of forgetfulness, but should be noticeable, self-explanatory, and situated close to the target behavior. Third, community *norms* should be nurtured by ensuring that the execution of campaign target behaviors is public and visible to as large a portion of the target community as possible. Personal contact between community members should be promoted to reinforce the behaviors and values fostered by a campaign. Fourth, effective *communication* involves attention to message framing and the credibility of the person delivering the information. Threatening messages have often been a dominant paradigm in the environmental movement, but negative framing should rarely, if ever, be used. Finally, behavioral *incentives* should be visible and tightly linked to the target behavior; however, caution is necessary because target behaviors can become linked to the prompt and may rebound when the incentive is removed.

Other psychological models of behavior also speak to the creation of effective behavioral change campaigns. The Rewire program brought three additional literatures to bear on its program design: the theory of planned behavior, self-determination theory, and psychological models of persuasion.

The Theory of Planned Behavior

The *theory of planned behavior* proposes that three main factors create the conditions for a behavioral intention: attitudes, subjective norms, and perceived behavioral control (Ajzen, 1985, 1991; Ajzen and Madden, 1986). *Attitudes* concern the individual's opinion or orientation towards a given behavior, such as how important one believes energy conservation to be. *Social norms* are the set of common

beliefs and behaviors operating within a community; for example, how an individual perceives their peers' or community's attitudes towards energy conservation. Finally, *perceived control* is a measure of an individual's belief that they have control over their behavior and is similar to *self-efficacy*.

Conventional wisdom often assumes that attitudinal shifts are the primary factor underlying behavioral change. The theory of planned behavior identifies the limits to this assumption. Although individuals may strongly endorse proenvironmental items on a questionnaire, this will translate into action only if the behavior is directly linked to the relevant attitude, if social norms support the behavior, and/or if people believe they have the necessary skills and resources to behave differently.

Self-Determination Theory

Self-determination theory models how motivations and their conditions affect people's behavior (Deci and Ryan, 1985, 1991; Ryan and Deci, 2000). The theory proposes that internal motivation—as opposed to external motivation—will increase the likelihood of behavioral action (Osbaldiston and Sheldon, 2003). In other words, the most reliable change occurs when a behavior is motivated by enjoyment of the behavior itself or values rather than conditioned on the presence of some external incentive or prompt.

Persuasion

Finally, the Rewire program drew on persuasion techniques well documented in the psychological literature (in particular, see Cialdini, 2007), including reciprocity, liking, authority, and consistency. *Reciprocity* refers to the fact that people do not like to feel that they are in an unequal situation or relationship; they feel the need to return favors, thus keeping social interactions balanced. *Liking* captures the idea that people are more likely to comply with others who they believe like them and who they like and know. A behavioral change program will be most effective when it involves positive, amicable members of resident communities. *Authority* or *source credibility* draws on the idea that people are more likely to listen to a person who they believe to be a credible, expert source of information and who is judged trustworthy (Cialdini, 2007; Hovland and Weiss, 1951). *Consistency* is the idea that people like to see themselves as consistent in their beliefs and behaviors. Encouraging participants to make a small commitment to the project means it is more likely they will change their behaviors. This can also lead to a positive feedback loop in

which small behavioral change as one component of the project can feed into broader aspects of the person's life. Ideally, this will make the person more open to other proenvironmental behaviors and messages.

The Rewire Experience

Building from this broad literature on the determinants of behavioral change, the Rewire program targeted user-mediated energy behaviors in a university campus setting. In the winter of 2006, a pilot program was delivered to one medium-sized residence at the University of Toronto. In an expansion phase, running from September 2006 until April 2007, seven residences across the University of Toronto tested the program. Since 2007, the Rewire program has been implemented in 16 residences and expanded to an office setting.

The Rewire program was organized as a series of themed behavioral change modules, each leveraging the tools of community-based social marketing to promote specific energy behaviors and respond to site-specific energy barriers (for full details, see Chan et al., 2012). On-site coordinators, who were identified via existing social structures, were primarily elected student representatives of each wing of the building, as well as academic dons. Modules were delivered sequentially, week by week, with each focused on a specific environmental behavior. For example, during the 2006 pilot program, individual modules targeted energy use from personal lighting, idle electronics, lighting in common rooms, and personal computers. Each module included a diverse set of prompts, posters, website animations, discussion forums, stickers, and social activities to shape energy conservation behaviors. Providing the coordinators within each residential community with training and supportive materials, including information, communication tips, signs, and a process to address problems, enabled them to become effective change agents. While the focus of the Rewire program continues to be centered on energy conservation behaviors, a number of other proenvironmental behaviors have since been targeted in the program's expansion, including water and paper use.

Crucially, student residents within each target community delivered the program's content. In its later stages, each residence was assigned a lead coordinator, who acted as the person in charge of supporting the program in that residence. Local Rewire "reps" were in charge of implementing the program on residential floors. This network structure enabled the program to be community-based while still

allowing for simple management and accountability. Ensuring the program is manageable is a key challenge as an energy conservation program increases in scale. Training is also crucial. In the program's pilot year, student leaders were trained to implement the program in a short, two-hour session, and later debriefed. All Rewire coordinators and reps were then trained in two-hour sessions each term, which involved more in-depth explanations and explicit training on behavioral change techniques.

At the individual level, the program also included securing a small, public pledge from all willing community members to reduce their energy use. This initial buy-in, often called the foot-in-the-door technique, has proven to be of critical importance across a wide range of policy environments in reorienting people's perception of self and in conditioning a community to be receptive to major change (Katzev and Johnson, 1983; Pallak, Cook, and Sullivan, 1980).

During the pilot, the program's design and implementation were monitored by using a number of metrics: direct quantitative metering in the buildings, detailed psychological surveys of the target population both before and after the program, and regular qualitative assessment of the program through informant interviews and focus groups.

Psychological Surveys

The surveys used to monitor and improve the program were administered before and after the program and included six components. The first section collected information about student energy behaviors in residences. The second section used self-determination theory to try to establish the motivation behind particular behaviors; this was measured using the internal perceived locus of causality (I-PLOC) scale, which uses the difference between internalized and noninternalized factors to establish the motivation behind a particular behavior (Ryan and Connell, 1989). For example, externalized motivations were judged as a behavior that must or should be done. In contrast, internalized motivations were judged as a behavior the respondent valued as important or interesting. A third section included questions that surveyed all three components of the theory of planned behavior (Ajzen, 1985) for target behaviors. Fourth, respondents completed the New Environmental Paradigm (NEP) scale, a standard psychological framework used to establish environmental orientation (Dunlap et al., 2000). Fifth, barriers were assessed using ten open-ended questions that asked students to assess hypothetically why someone might not engage in a target proenvironmental behavior. Finally, a wide range of

demographic data were collected from student respondents, including their floor, their gender, whether they had a roommate, their level of involvement in extracurricular activities, and their degree type.

These psychological metrics provided a useful first-order evaluation of the pilot program's efficacy and impact (for survey results, see Chan et al., 2012). The survey provided evidence that the Rewire pilot program was able to affect key predictors of proenvironmental behaviors successfully. It was found that environmental concern, attitudes, perceptions of control, and perceptions of social norms all changed after the program, albeit in somewhat different ways. Of course, these findings cannot discriminate between programmatic impacts and confounding exogenous changes that may have simultaneously shaped student behavior during program delivery. Nonetheless, the evidence collected suggests that the Rewire pilot made people feel more concerned about the environment, more positive towards specific proenvironmental behaviors, more empowered to engage in some energy conservation behaviors, and more convinced that proenvironmental behaviors were regarded as socially normative and desirable.

The pilot survey also assessed the motivations for proenvironmental behaviors. Results suggested that Rewire might work through making people feel stronger social pressure regarding their environmental behaviors, shifting them away from internalized motivations. This is potentially concerning because the program aims to foster broadly cast proenvironmental behaviors, which are often associated with internalized motivation. More research into this area could prove useful.

Electrical Meters

Residential energy use was monitored through meters in the building in both the pilot and expansion phases by using electrical data loggers attached to current sensors that captured the total electrical current flowing through residential electrical circuits at 15-minute intervals. This metering was conducted for two months before the five-week test period as a control period and continued for one month following the test period to assess the short-term persistence of behavioral changes. Metering locations were chosen to isolate end-user-mediated energy consumption. Figure 1 charts the raw average user-mediated electricity consumption across all meters in the pilot residence on a daily basis, showing trendlines for consumption in the prepilot, pilot, and postpilot periods.
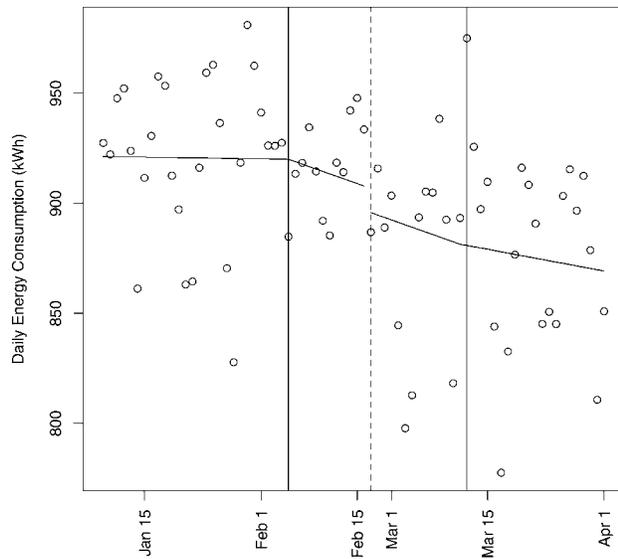
Figure 1. Daily energy consumption in the Rewire pilot residence (kWh). The *solid vertical lines* demarcate the beginning and end of the pilot intervention. The *dashed vertical line* demarcates the University's Reading Week (spring break); data from February 16 to February 25 during this vacation period are excised from the graph. *Trendlines* give the differential trends in energy consumption during the prepilot, pilot, and postpilot periods, respectively.
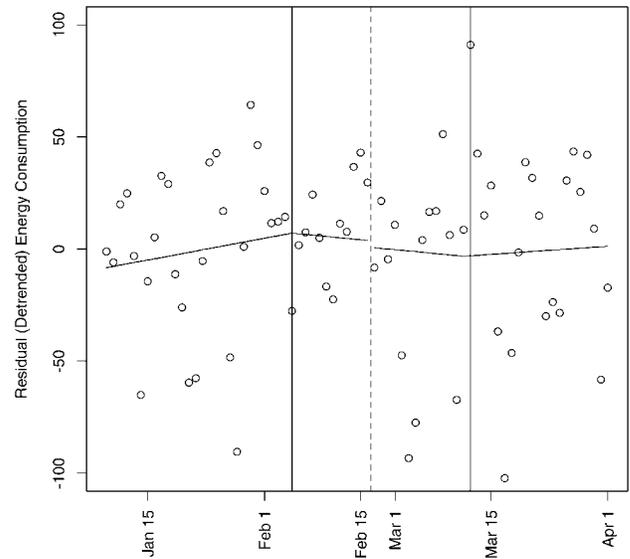
Figure 2. Detrended daily energy consumption in the Rewire pilot residence (kWh). The *solid vertical lines* demarcate the beginning and end of the pilot intervention. The *dashed vertical line* demarcates the University's Reading Week (spring break); data from February 16 to February 25 during this vacation period are excised from the graph. *Trendlines* give the differential trends in energy consumption during the prepilot, pilot, and postpilot periods, respectively.

Clearly, overall electricity consumption declined over the entire sampling period, and the rate of decline seems pronounced during the Rewire pilot intervention. However, the total number of daylight hours was associated with total electrical consumption and can explain part of this decline. By contrast, during this period studied, neither daily precipitation nor daily mean temperature appear to be associated with daily electricity consumption. Figure 2 charts trends in daily electricity consumption after seasonal changes in total daylight hours have been controlled for. It plots the residuals from an ordinary least squares (OLS) regression of daily energy consumption on the logarithm of total daily daylight hours.[2]

Electricity consumption during the intervention period still appears to have declined relative to preintervention and postintervention periods, suggesting some programmatic impact. Of course, electricity metrics of this sort are at best an indirect measure of program success. Without the benefit of randomized experimental design, it is impossible to separate the effect of the program from the effects of climatic factors and exogenous social change. At the very least, the electrical metering data seem consistent with the survey results, revealing a similar program effect in reducing electricity consumption.

Qualitative Assessment

A series of focus groups and informant interviews were conducted throughout the project development, and feedback from coordinators and other project participants was continuously solicited on line, during training sessions, and through more casual contact. Across a number of outcome measures, Rewire increased attention to environmental issues in student housing and provided a structured forum to raise environmental issues within peer groups. Many residents leveraged their involvement with Rewire to organize their own events, activities, and projects (e.g., environmental movie screenings, organic brunches). In addition, inspired by student efforts, building management invested in new energy-efficient technologies such as compact fluorescent lightbulb retrofits.

Further attempts were made in the second year of the Rewire program (postpilot) to assess the efficacy of the Rewire campaign by using a more sophisticated research design.

However, significant implementation barriers undermined these attempts. Despite increasing demands for evidence-based campaign design (Steg, 2008), implementation barriers, reported in other field evaluations (e.g., Carrico and Riemer, 2011), remain a significant obstacle. In Rewire's case, implementation problems derived from the tension between attaching rigorous evaluation tools to advocacy processes (e.g., electrical meters and psychological surveys) and semiautonomous student groups that operate on their own schedules and rhythms. Nonetheless, even partial results provided valuable signals to shape and reshape the program's design during its early stages, refining and enhancing the program's structure as it was gradually deployed to broader institutional settings. The use of evaluation processes, even if they are imperfectly implemented, is still valuable in providing input for continuous learning and improvement during environmental and energy campaigns.

Designing Effective Energy Conservation Campaigns

Narrow, simplistic understandings of human behavior still permeate social activism and public policy. In the field of energy conservation, this failure can be partially attributed to the boom-bust nature of academic scholarship. Responding to the wave of public and government interest in energy issues during the late 1970s and early 1980s, a rich literature on energy behavioral change flourished, identifying a limited range of effective campaign tools (Katzev and Johnson, 1987). With renewed interest in energy conservation over the past decade, the policy community and advocacy groups are only just beginning to incorporate more recent advances in psychology, marketing, and communication into their campaign designs.

Critically, practitioners need to shed the intuitive but flawed assumption that attitudes are the major determinant of human behavior. In fact, multiple and complementary psychological factors influence environmentally responsible behaviors (Allen and Ferrand, 1999; De Young, 2000; McKenzie-Mohr et al., 1995). Without a careful study of barriers, any number of factors, by themselves or jointly, could prevent uptake of preferred behavioral outcomes (Stokes et al., 2012). Even mitigating the most important barrier in a given policy setting doesn't guarantee behavioral change if smaller complementary barriers have disproportionately large impacts that continue to stifle change. Such multiple, codependent determinants of environmental behavior remain insufficiently acknowledged within many energy conservation and environmental campaigns.

As a result, there is great need for flexible, adaptive policy tools that recognize the limits of one-size-fits-all and information-dominant behavioral change campaigns. The University of Toronto's Rewire program responded successfully to this charge through three design principles. First, as already outlined, the program incorporated evaluation techniques to ensure continuous learning and improvement. Second, the campaign moved away from single-tool behavioral change campaigns to employ a coordinated set of techniques that addressed a wide range of barriers to and determinants of human behavior. The program accomplished this by targeting one behavior after another in successive weeks by using a variety of tools: commitment, prompts, social norms, and improving people's perceived control. Using the results from the barriers survey, the program identified key reasons why individuals were not engaging in a behavior already and then designed materials accordingly (for more detail, see Stokes et al., 2012). Third, the program moved away from hierarchical policy implementation to the decentralized deployment of locally adaptive but centrally designed messages and tools. Training and empowering a network of coordinators enabled individuals to take effective action and get support when they needed it. These individuals will likely continue to carry this training and behavior with them into other settings, increasing the program's potential scope.

Developing Complementary Suites of Policy Tools

Recognizing that there are diverse barriers to energy conservation, the Rewire program created a suite of linked tools to address multiple determinants of human behavior. These were derived from a review of the literature, an assessment of potential energy saving, and the recommendations of community-based social marketing experts, as well as from careful psychological surveys of the target community.

Each of Rewire's modules was designed to expand the knowledge base of the target community and to deliver sophisticated messages aimed at shaping motivations, attitudes, perceived control, and social norms. To highlight a single concrete example, one of our early surveys found that students largely held favorable attitudes towards energy-conserving behaviors but that they significantly underestimated the proportion of their peers who shared these attitudes. Rather than simply convincing residents that energy conservation was important (a belief many already possessed), a supplementary framing made students aware of their peers' beliefs. This message attempted to calibrate the group's social norms with reality rather than focusing on isolated individual attitudes. Rather than being

redundant, multiply framed messages can simultaneously mitigate the diverse barriers present in a residence setting. Barriers can vary at the individual level and by the target behavior.

Decentralizing Centralized Design

Properly situating a centrally designed energy conservation campaign within a local community is a major challenge. While locally tailored messages that respond to site-specific barriers are most effective, most organizations do not have the resources or information to customize their campaigns to the community scale. For this reason, scaling up community-based program has proven very difficult.

Social networks may provide a partial remedy to this tension. Individuals are most likely to change when confronted by their peers, either in the workplace, residential, or family settings. The university residence context is also of particular interest because its close-knit social dynamic creates particular salience for social norms (McClelland and Belsten, 1979; Perkins, 2002) and because individuals are not metered directly for their own electricity consumption. The Rewire program leveraged residential social networks to deliver locally adaptive content. Individuals from each residence community were trained in the theory behind the campaign and social marketing techniques, and were then supplied with the tools and expertise to deliver Rewire within their own communities.

As expected, students had a differentiated response to the campaign. Several organized complementary modules and activities, and most successfully embedded the Rewire messaging within the unique social structures of their residences. The central Sustainability Office still played an important role, supplying a set of resources and supporting the deployment of those resources. Community members who were recruited to the program could then integrate those materials into their communities by using their local knowledge and seek help when needed. They could also provide feedback when an approach was not working. The successful uptake of the Rewire tools can also be attributed to the central involvement of students in the research design and planning process, an approach in line with community-based research principles (Minkler and Wallerstein, 2011).

An Adaptive Approach to Campaign Design

Rewire's encouraging experience confirms the potential for sophisticated energy conservation campaigns to meld recent psychological advances with energy conservation practices. However, development costs can limit the uptake of such campaigns. These costs are moderated when academic institutions such as the University of Toronto create programs like Rewire that are easily transferred out of the university context. Capital-intensive development of community programs in an academic setting can easily leverage their initial investment many times over and create major efficiencies in transferring a project to municipal and regional settings.

The Rewire project was designed explicitly with transferability in mind. The program's modular framework has been transferred to other building-user contexts outside of a university environment. For example, Toronto's University Health Network (UHN) adopted and modified the Rewire framework to encourage proenvironmental behavior in a teaching-hospital environment. While the program structure was retained (i.e., use of volunteers for peer-to-peer engagement, posters for prompts and education), the materials were developed anew specifically for the teaching-hospital context and targeted specific energy behaviors with high energy-savings potential for professional health-care providers. Measurement criteria were also adopted and modified from Rewire to address new energy conservation opportunities.

The Promise of University-Community Research Development

The Rewire program's success in creating a proven, transferable program addresses a critical gap in town-gown relationships. Academic advances are not always taken up by wider advocacy and policy communities. There have been increased efforts in recent decades to leverage technological and scientific advances through *commercialization* efforts, but this has not been paired with any efforts at the *socialization* of policy-relevant social science research. It is worth stressing, not for the first time, that universities have a critical public role to play in digesting academic work for consumption in the policy world. Institutions of learning such as the University of Toronto must act as living laboratories, testing applied academic ideas in a rigorous setting that can then be adapted and deployed outside of the ivory tower. There is a critical need for a richer, more sustained dialogue between social scientists and energy conservation practitioners.

Clearly, more resources dedicated to interdisciplinary and private-public policy partnerships would facilitate such efforts. However, stubborn institutional barriers also need to be tackled. Academics are discouraged from socially engaged efforts by a wide range of barriers to community-

based research (Savan et al., 2009). Through the publish-or-perish paradigm, there are uneven incentives for socially engaged academics in tenure-review practices. Although an growing number of universities do provide some recognition for high-profile applied work, more consistent internal university recognition is still necessary for community involvement. While many funders increasingly value applied research, time and money in grants are not yet generally apportioned on the basis of community outreach or the creation of transferable modules.

At the University of Toronto, an enlightened senior administration and a pool of dedicated undergraduate students guided the Rewire program's success. The program also helped the university reposition itself as a public environmental leader. The campaign helped leverage broad change across the university, from ambitious environmental design standards to a campuswide ban on incandescent lightbulbs. These examples demonstrate that complex policy interventions such as Rewire can themselves steer institutions towards more demanding policy and technological changes.

Conclusion

Combining insights from a number of theoretical frameworks in social psychology that bear on behavioral change, the Rewire campaign in University of Toronto residences has changed resource consumption behaviors in part of the university community. The pilot program revealed self-reported changes in behavior and behavioral motivations, and these data are consistent with the electrical monitoring data and qualitative metrics.

The success of the University of Toronto Rewire program has important implications for understanding factors influencing resource conservation behaviors, as well as obstacles to establishing similar campaigns and proliferating them both on and off campus. Combining tools from community-based social marketing with insights gained from psychology, including the theory of planned behavior, persuasion techniques, and self-determination theory, offers an integrated strategy. Through using a variety of approaches to change behavior, including targeted social norms and perceived control alongside information provision, individual changes in behavior are reinforced simultaneously.

Universities are an important test bed for resource conservation behavioral campaigns, and their potential should

not be underestimated. These interventions should be adapted to other public institutions and private corporations. Such efforts would more broadly accelerate the behavioral mitigations of climate change, and reduce costs and consumption on a large scale. In the face of meager international responses to the climate crisis, such behavioral campaigns offer grounds for optimism that, as was the case on the University of Toronto campus, such widespread changes in behavior can lead to subsequent changes in technology application, as well as deeper policy and regulatory change.

Notes

1. This summary draws primarily from McKenzie-Mohr (2011), which is an excellent, accessible introduction to community-based social marketing.

2. Total daylight hours varies according to a complex trigonometric function over the course of a year. However, between January and April, total daylight hours increases in an approximately exponential fashion in Toronto and can be reasonably treated as an exponential trend for the analysis here.

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