

2010

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Working Paper Number 10-24



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**ENERGY AND CLIMATE CHANGE:
KEY LESSONS FOR IMPLEMENTING THE
BEHAVIORAL WEDGE**

1 J. Energy & Envtl. L. (forthcoming 2010)

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Abstract

The individual and household sector accounts for roughly 40 percent of United States energy use and carbon dioxide emissions, yet the laws and policies directed at reductions from this sector often reflect a remarkably simplistic model of behavior. This Essay addresses one of the obstacles to achieving a “behavioral wedge” of individual and household emissions reductions: the lack of an accessible, brief summary for policymakers of the key findings of behavioral and social science studies on household energy behavior. The Essay does not provide a comprehensive overview of the field, but it discusses many of the leading studies that demonstrate the extent and limits of rational action. These studies can inform lawyers and policymakers who are developing measures to reduce energy use and carbon emissions and can serve as an entry point for more detailed studies of the literature.

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An effective response to the climate change problem will require substantial reductions in energy demand in addition to new developments in low-carbon energy supplies.¹ The individual and household sector presents a major opportunity: the sector accounts for roughly 40% of U.S. carbon emissions and a comparable percentage of total U.S. energy production,² and it is one of the most promising areas for reducing emissions.³ A recent analysis estimates that behavioral measures directed at this sector could reasonably be expected to reduce total US emissions by over 7% by 2020, an amount larger than the combined emissions from several of the largest-emitting industrial sectors and larger than the total emissions of France.⁴ In many cases, these emissions reductions can be achieved at less cost than the leading alternatives.⁵

Despite this opportunity, recent regulatory and policy efforts are only beginning to direct substantial attention to the individual and household sector. Findings from the social sciences provide valuable insights into how to capitalize on this opportunity, yet policymakers often have little time to develop new policies and are confronted with a barrage of often-conflicting approaches and theories. This Essay addresses the policymaking challenge

¹ See Nathan S. Lewis, *Powering the Planet*, 2 ENG. & SCI. 12, 19 (2007). See also Steven Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCIENCE 968, 969 (2004).

² Compare Shui Bin & Hadi Dowlatabadi, *Consumer Lifestyle Approach to U.S. Energy Use and the Related CO₂ Emissions*, 33 ENERGY POL'Y 197, 205 (2005)(estimating 28% and 41% share of U.S. energy and CO₂ emissions due to direct behavior) with Shui Bin, *Re-estimation and Reflection: The Role of Consumer Demand in US Energy Use and CO₂ Emissions*, paper presented at the 2004 ACEEE Summer Study on Energy Efficiency in Buildings, Panel 7, retrieved April 16, 2010 from

http://www.eceee.org/conference_proceedings/ACEEE_buildings/2004/Panel_7/p7_4/ (estimating 38% and 42% share of energy use and emissions). See also Gerald T. Gardner & Paul C. Stern, *The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change*, 50 ENVIRON 12, 16 (2008) [hereinafter Gardner & Stern, *The Short List*](estimating 38% share of energy use); Michael P. Vandenbergh & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673, 1694 (2007)(estimating 32% share of US CO₂ emissions in 2000).

³ See, e.g., Thomas Dietz et al., *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions*, 106 PROC. NAT'L ACAD. SCI. 18452 (2009)(concluding that 123 million metric tons of carbon emissions reductions could be achieved in ten years); HANNAH CHOI GRANADE ET AL., MCKINSEY & CO., UNLOCKING ENERGY EFFICIENCY IN THE US ECONOMY 10 (2009)(noting the magnitude of the efficiency opportunities in the residential sector).

⁴ Thomas Dietz et al., *supra* note 3, at 18453-454.

⁵ See, e.g., Hunt Allcott & Sendhil Mullainathan, *Behavior and Energy Policy*, 327 SCIENCE 1204, 1204-05 (2010)(concluding that a behavioral intervention of the type recently implemented by OPOWER "scaled across the United States would net \$2.2 billion per year over the program's life"); FLORIAN BRESSAND ET AL., MCKINSEY GLOBAL INST., CURBING GLOBAL ENERGY DEMAND GROWTH: THE ENERGY PRODUCTIVITY OPPORTUNITY 57 (2007)(noting that the residential sector may be one of the top two global opportunities for low-cost CO₂ emissions reductions); Michael P. Vandenbergh, Jack Barkenbus & Jonathan Gilligan, *Climate Change: The Low-Hanging Fruit*, 55 UCLA L. REV. 1701, 1758 (2008).

by distilling the findings from a broad range of fields into several key principles for those developing energy and climate laws and policies. The principles we outline here are a starting point for policymakers working in this area. We attempt to provide insight into which principles are most relevant to law and policy, but instructions as to how to incorporate these principles are beyond the scope of this essay. The principles include only a subset of the insights from the behavioral and social science literature. In many cases, adherence to multiple principles will be necessary to develop the most effective policy design. Policymakers should consult the body of work referenced here, as well as experts in the social sciences to further their understanding of these and other principles. More extensive reviews of this literature and its relevance to energy and climate policy are also available.⁶

KEY BEHAVIORAL PRINCIPLES

1. Price Plays an Important but Limited Role. Price clearly affects behavior; however, the impact is easily overstated. Often price accounts for less variance in behavior than other factors such as personal commitment or social norms.⁷ Policymakers often gravitate towards price-based mechanisms when attempting to influence product purchase decisions, using rebates or other incentives. Although price offsets are often effective at inducing purchases of efficient products, studies find that when the monetary value of price incentives is held constant participation rates can vary by a factor of ten as a result of other variables.⁸ This variance is largely explained by non-financial variables such as program marketing and management or the ease of participating in the program.⁹ These data also

⁶ See, e.g., Paul C. Stern, *Environmentally Significant Behavior in the Home*, in THE CAMBRIDGE HANDBOOK OF PSYCHOLOGY AND ECONOMIC BEHAVIOUR, 363-382 (A. LEWIS ED. 2008); Paul C. Stern, *Blind Spots in Policy Analysis: What Economics Doesn't Say about Energy Use*, 5 J. POLICY ANAL. MANAG. 200 (1986) [hereinafter Stern, *Blind Spots*]; Paul C. Stern, *What Psychology Knows about Energy Conservation*, 47 AM. PSYCHOL. 1224 (1992) [hereinafter Stern, *What Psychology Knows*], Charles Wilson & Hadi Dowlatabadi, *Models of Decision Making and Residential Energy Use*, 32 ANNU. REV. ENVIRON. RESOUR. 169 (2007), Wokje Abrahamse, et al., *A Review of Intervention Studies Aimed at Household Energy Conservation*, 25 J ENVIRON PSYCHOL 273 (2005); GERALD T. GARDNER & PAUL C. STERN, ENVIRONMENTAL PROBLEMS AND HUMAN BEHAVIOR, 2ND ED. (2002) [hereinafter Gardner & Stern, ENVIRONMENTAL PROBLEMS], Paul C. Stern, Gerald T. Gardner, Michael P. Vandenbergh, Thomas Dietz, Jonathan M. Gilligan, *Design Principles for Carbon Emissions Reduction Programs*, ENVIRON SCI TECHNOL (forthcoming).

⁷ See Thomas A. Heberlein & G. Keith Warriner, *The Influence of Price and Attitude on Shifting Residential Electricity Consumption From On- to Off-Peak Periods*, 4 J. ECON. PSYCHOL. 107, 125 (1983). Jessica M. Nolan et al., *Normative Social Influence is Underdetected*, 34 PERS. SOC. PSYCHOL. BULL. 913, 921 (2008).

⁸ Stern, *Blind Spots*, *supra* note 6 at 210 - 211.

⁹ *Id.*

suggest that the stronger the financial incentives, the more critical non-financial factors are in inducing participation.¹⁰ Additional data show that individuals can be induced to change their behavior even when they are not financially responsible for their energy costs.¹¹ Interventions such as real-time feedback or comparative energy reports can reduce consumption within the range of 5 to 15% even without changes in price.¹² Policymakers should not assume that home metering or other demand-side management programs are only valuable if they are linked to variable pricing. If the political will does not exist to raise price, or if fears about pricing create public resistance, then the price assumption could undermine what would otherwise be a quite viable means of making important reductions in energy use and carbon emissions.

2. Both Technology Adoption and Use are Important.

Policymakers should target both product purchase decisions (i.e., efficiency) as well as product use (i.e., curtailment) to maximize the potential for emissions reductions within the individual and household sector. Efficiency improvements generally offer greater long-term potential for reducing energy use and emissions.¹³ Once upgraded, savings can be achieved without relying on consumers to develop and maintain energy-saving habits, and may reduce actual or perceived sacrifices in lifestyle and comfort sometimes associated with curtailment. However, these actions also involve a greater up-front cost to the consumer and may be slower to realize due to the rate at which appliances are retired and replaced. Furthermore, studies suggest that behavior is sometimes as important as the physical properties of a product. The Twin Rivers project demonstrated that energy use in identically constructed homes with similar appliances and demographic characteristics varied by as much as 300% due to behavior.¹⁴ Efficiency gains through technological innovation can also be weakened by “take-back” effects, in which a portion of the technologically achievable

¹⁰ *Id.*

¹¹ For example, interventions have successfully reduced energy use among office employees, dormitory residents, and individuals living on military bases. For a workplace example, see Amanda R. Carrico & Manuel Riemer, *Motivating Pro-Environmental Behavior in an Organizational Setting: The Use of Feedback and Peer Education to Reduce Energy Use*. Abstract presented at the Behavior Energy and Climate Change Conference, Washington D.C. (2009). For a dormitory example, see John E. Petersen, et al., *Dormitory Residents Reduce Electricity Consumption When Exposed to Real-Time Visual Feedback and Incentives*, 8 INT. J. SUST. HIGH. EDUC. 16, 29 (2007). For military base example, see Andrea H. McMakin et al., *Motivating Residents to Conserve Energy Without Financial Incentives*, 34 ENVIRON. BEHAV. 848, 856 (2002).

¹² See Wokje Abrahamse, et al., *supra* note 6, at 278 - 280.

¹³ For example, purchasing a fuel efficient vehicle offers greater potential energy savings than the combined savings of carpooling, trip-chaining, reducing highways speeds, and avoiding sudden acceleration and stops. Gardner & Stern, *The Short List*, *supra* note 2, at 17.

¹⁴ See Loren Lutzenhiser, *Social and Behavioral Aspects of Energy Use*, 18 Ann. Rev. Energy Environ. 247, 289 (1993).

savings is offset by an increase in the use of energy.¹⁵ For these reasons, policymakers should select a balance of behavioral targets based on their potential impact as well as the rate at which reductions can be realized and the level at which they can be expected to be maintained. Simultaneously targeting decisions regarding the purchase of efficient products as well as how those products are used can increase the potential of both near- and long-term emissions reductions while reducing the magnitude of take-back effects.

3. Economic Incentives Can Be Counterproductive. Relying solely on economic incentives or disincentives to change behavior can lead to motivational crowding, which occurs when external rewards undermine intrinsic motivation resulting in a reduction in the desired behavior.¹⁶ For example, in an effort to reduce the number of parents who arrive late to pick up their children, a group of day cares in Israel imposed a fine per child for any parent who arrived 10 minutes late or more. Rather than noticing a reduction in late pick-ups, these instances nearly doubled during the weeks after the fine was introduced and remained at that level even after the fine was removed.¹⁷ Introducing external rewards or punishments in situations that are otherwise governed by moral norms has been shown to grant individuals a license to behave in self-interested ways.¹⁸ This principle is most relevant to behaviors that are performed frequently and when the financial incentives/disincentives are perceived to be relatively trivial. Policymakers should be careful to avoid introducing economic incentives or penalties to change behaviors that may already be governed by moral norms. When economic incentives or disincentives are deemed appropriate, policymakers should also consider reinforcing moral norms using other avenues such as public education. There is some evidence that pairing economic disincentives with public outreach or moral persuasion can have synergistic effects.¹⁹

¹⁵ For example, studies suggest that households tend to increase their thermostat settings during the winter after weatherizing their homes, resulting in a decrease in the potential energy saving based on the technologically achievable potential of the changes, See Eric Hirst et al., *Indoor Temperature Changes in Retrofit Homes*, 10 ENERGY 861, 870 (1985). See also H. Herring, *Energy Efficiency—A Critical View*, 31 ENERGY 10, 12 (2006); M. Binswanger, *Technological Progress and Sustainable Development: What About Rebound Effects*, 36 ECOLOGICAL ECON. 119, 130 (2001).

¹⁶ See B.S. Frey, *Motivation as a Limit to Pricing*, 14 J. ECON. PSYCH. 635, 658 (1993). See also E.L. Deci et al., *Meta-Analytic Review of Experiments Examining the Effect of Extrinsic Rewards on Intrinsic Motivation*, 125 PSYCHOL. BULL. 627, 658-659 (1999).

¹⁷ U. Gneezy & A. Rustichini, *A Fine is a Price*, 22 J. OF LEGAL STUD. 1, 8 (2000).

¹⁸ S. Bowles, *Policies Designed for Self-Interested Citizens May Undermine "The Moral Sentiments": Evidence from Economic Experiments*, 320 SCIENCE 1605, 1609 (2008); Ann E. Tenbrunsel & David M. Messick, *Sanctioning Systems, Decision Frames, and Cooperation*, 44 ADMIN. SCI. QUART. 684, 704 (1999).

¹⁹ For example, a tax on plastic grocery bags in Ireland paired with an aggressive media campaign led to a 94% drop in the use of plastic bags. Elisabeth Rosenthal, *Motivated by a*

4. Decision Making is Limited by Incorrect or Incomplete Information. Traditional rational actor models of human behavior often assume that individuals have full and accurate information about their set of options. Policymakers should not assume this to be the case. Individuals often act in ways they perceive to be in their own self-interest, or to benefit the common good, when in fact their actions are counterproductive to these ends. For example, the average individual in the United States believes it is both economically and environmentally beneficial to idle one's vehicle for three minutes or more before turning it off.²⁰ In fact, the Environmental Protection Agency recommends idling for no more than 30 seconds to save gas, reduce emissions, and prevent vehicle wear and tear. In this case, it is estimated that inaccurate beliefs are associated with over 8 million metric tons of carbon dioxide emissions annually. Additional surveys find large knowledge deficits, in general, among consumers regarding how to save energy, often leading them to over-emphasize the impact of curtailment behaviors and under-emphasize the impact of efficiency upgrades.²¹ Although simply providing information to consumers is rarely sufficient to change behavior,²² accurate and actionable information is often a necessary component to achieving this end.

5. Decision Making is Limited by Our Ability to Process Information. A growing body of literature within psychology and behavioral economics reveals that individuals often fail to make decisions on the basis of a calculation of the expected utility of a set of options.²³ Most relevant to the discussion of energy and climate change is the tendency for individuals to act as if they are applying steep discount rates when making product purchase decisions. For instance, relative to the up-front cost of purchasing a more efficient appliance, consumers tend to devalue savings achieved through lower operating costs at a rate that is well above

Tax, Irish Spurn Plastic Bags, N.Y. TIMES, Feb. 2, 2008. Retrieved February 7, 2010 from <http://www.nytimes.com/2008/02/02/world/europe/02bags.html?pagewanted=1&r=1>.

Combining public education with regulatory measures has also been successfully used to reduce vehicle idling in a number of Canadian communities, *See* Lura Consulting, *The Carrot, The Stick, and the Combo: A Recipe for Reducing Vehicle Idling in Canadian Communities*, Report prepared for Natural Resources Canada, Clean Air Partnership (2005). <http://oee.nrcan.gc.ca/communities-government/transportation/municipal-communities/reports/carrot-stick-combo/carrot-stick-combo.pdf>

²⁰ Amanda R. Carrico et al., *Costly Myths: An Analysis of Idling Beliefs and Behavior in Personal Motor Vehicles*, 37 ENERGY POL'Y 2881, 2885 (2009).

²¹ Shahzeen Z. Attari et al., *Perceptions of Energy Consumption and Savings*, working paper (2010); Willett Kempton et al., *Do Consumers Know "What Works" in Energy Conservation*, 9 MARRIAGE FAM. REV. 115 (1985).

²² *See* Wokje Abrahamse et al., *supra* note 11, at 278.

²³ *See* Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCIENCE 1124 (1974); DAN ARIELY, *PREDICTABLY IRRATIONAL: THE HIDDEN FORCES THAT SHAPE OUR DECISIONS* (2008).

market value.²⁴ This may be partially due to uncertainties about potential savings or future energy costs;²⁵ however, additional data suggest that individuals may simply miscalculate potential savings associated with operating costs²⁶ or may fail to consider operating costs altogether so that what appears to be a steep discount rate in an expected utility calculation may well be a decision made on a different calculus altogether.²⁷ As such, consumers often make product purchase and use decisions that are economically disadvantageous to the consumer when the lifecycle costs of operating a product are considered. Well-designed labels and educated salespersons can provide information regarding lifecycle costs at the point of sale that consumers often fail to properly consider.

6. Cognitive Costs Matter. Traditional rational actor models tend to underestimate the cognitive costs associated with seeking out, evaluating and acting on new information. Individuals often fall prey to a “status quo bias” in which they revert to the default option due to its convenience, even when that option may be less preferable to the individual.²⁸ Major reductions in carbon emissions could be achieved by policies that specify default settings in such a way as to “nudge” consumers towards the economically or socially optimal options.²⁹ In many cases default settings are unavoidable, and current policies (or the lack thereof) are, in effect, nudging consumers towards less than desirable choices. For example, a policy requiring new water heater installations to be set at the Department of Energy’s (DOE) recommended level of 120°F, rather than the more typical residential setting of 135°F could substantially reduce emissions and energy costs for the consumer with no impact on comfort.³⁰ Policies that take steps

²⁴ See Jerry A. Hausman, *Individual Discount Rates and the Purchase and Utilization of Energy Using Durables*, 10 BELL J. ECON. 33 (1979). See also Richard Howarth & Alan H. Sanstad, *Discount Rates and Energy Efficiency*, 13 CONTEMP. ECON. POLICY 101 (1995); Kenneth Gillingham et al., *Energy Efficiency Economics and Policy*, 1 ANN. REV. OF RESOURCE ECONOMICS 597 (2009).

²⁵ See A. Jaffe, R. Newell & R. Stavins, *The Energy-Efficiency Gap*, 22 ENERGY POLICY 804, 805 (1994).

²⁶ Willet Kempton & L. Montgomery, *Folk Quantification of Energy*, 7 ENERGY 817, 826 (1982).

²⁷ Daniel C. Feiler & Jack B. Soll, *A Blind Spot in Driving Decisions: How Neglecting Costs Puts Us in Overdrive*, 98 CLIMATIC CHANGE 285, 289 (2010).

²⁸ See Cass R. Sunstein & Richard H. Thaler, *Libertarian Paternalism Is Not an Oxymoron*, 70 U CHI. L. REV. 1159 (2003). For an example of the effect of the status quo bias in rates of organ donation, see also Eric J. Johnson & Daniel Goldstein, *Do Defaults Save Lives*, 302 SCIENCE 1338, 1339 (2003).

²⁹ See RICHARD THALER & CASS SUNSTEIN, NUDGE (2008);

³⁰ The DOE recommends 120°F as a level that provides a water temperature that meets the needs of most users. U.S. Department of Energy, *Energy Savers Tips on Saving Energy and Money at Home: Water Heating*. Accessed February 4 2010 at http://www1.eere.energy.gov/consumer/tips/water_heating.html The DOE assumes 135°F as the standard set point of a water heater in households when determining energy demand; U.S. Department of Energy, *Technical Support Document: Energy Efficiency Standards for*

to make efficiency and conservation more convenient also have greater prospects for success.³¹ Home efficiency programs that make it easy to find competent installers or that minimize the number of steps required to participate are more successful than those that require multiple stages. For example, programs that require a home energy audit to be eligible for home insulation rebates are less successful than those do not require this extra step.³² Governments and utilities tend to impose paperwork burdens on households to ensure accountability, but these are likely to substantially reduce participation. Successful programs may need to accept a certain level of misuse in order to achieve widespread adoption, but the benefits of widespread adoption may far outweigh the costs of the misuse. In a sense, too much attention to misuse can lead to policies that are suboptimal.

7. Choices Depend on the Way the Options Are Framed.

Individual choices are not always grounded in a stable set of preferences as many in law and economics have assumed. A large and growing body of literature suggests that even when the expected utility of a set of options is identical, individuals reliably prefer certain choices more than others as a function of how those choices are framed.³³ For example, individuals favor a hamburger that is 75% lean over one that is 25% fat.³⁴ Likewise, consumers are more willing to invest in a water heater blanket when it is framed as a way to avoid losing money, rather than a way to save money.³⁵ Many times frames invoke systematic deviations from what neoclassical economists would view as rational, such as the tendency for losses to loom larger than gains when outcomes are effectively equivalent (as evidenced in the water heater example used above). In other case, frames interact with an individual's previous experiences or ideological worldview to trigger

Consumer Products: Residential Water Heaters; Appendix D-2. Water Heater Analysis Model (WHAM), 2000.

³¹ See Paul C. Stern, *Information, Incentives, and Proenvironmental Consumer Behavior*, 22 J. CONS. POL. 461, 468-469 (1986)[hereinafter Stern, *Consumer Behavior*]. See also Paul C. Stern, *What Psychology Knows*, *supra* note 6 at 1229]. Studies suggest that the convenience of an action stands out as a primary predictor of whether an individual chooses to adopt it. For example, the availability of curbside recycling bins is the strongest predictor of whether a household recycles. See G. Wall, *Barriers to Individual Environmental Action: The Influence of Attitudes and Social Experiences*, 32 CAN. REV. SOC. ANTHROP. 465, 477 (1995). Similarly, Ludwig et al. show that placing recycling bins in college classrooms where drinks are consumed rather than in the hallway decreased the number of cans thrown in the conventional trash by 50%. See Timothy D. Ludwig et al., *Increasing Recycling in Academic Buildings: A Systematic Replication*, 31 J. APPL. BEHAV. ANAL. 683, 685 - 686 (1998).

³² Stern, *Consumer Behavior*, *supra* note 33, at 468.

³³ See Daniel Kahneman & Amos Tversky, *Choices, Values and Frames*, 39 AM PSYCHOL 341 (1984). See also Tversky & Kahneman, *supra* note 25, at 453.

³⁴ I.P. Levin & G.J. Gaeth, *Framing of Attribute Information Before and After Consuming the Product*, 15 J. CONS. RES. 374, 376 (1988).

³⁵ S. Yates, *Using Prospect Theory to Create Persuasive Communications about Solar Water Heaters and Insulation*. Unpublished doctoral dissertation, University of California, Santa Cruz. See also Stern, *What Psychology Knows*, *supra* note 6, at 1227 – 1228.

certain responses. For example, the term “tax” triggers many negative associations among those who are ideologically conservative that the term “offset” does not. Consequentially, more Republicans (and Independents) are willing to purchase a more expensive product when its cost is inflated due to a “carbon offset” rather than a “carbon tax.”³⁶ In most cases, it is simply impossible to avoid framing information. Instead of attempting to avoid framing effects, policymakers should consult psychologists or behavioral economists when developing messages that frame choices. Policymakers should be careful to avoid frames that may be polarizing, or prevent audience members from fully considering an argument or policy proposal. Similarly, we should not assume from an initial negative reaction that the public is unwilling to accept certain policy measures. Re-framing an issue in a way that challenges the public’s preconceived beliefs may stimulate more thoughtful consideration of an issue.

8. People Do Not Always Act the Way They Feel. When designing public education campaigns, decisionmakers often gravitate toward an attitude-persuasion model for changing behavior. Although this approach may raise levels of awareness and concern, there are a host of other barriers—psychological and structural—that often prevent individuals from acting the way they feel. Individuals may hold strong values to protect the environment on an abstract level, but these values are often overcome by countervailing influences at the time when decisions are made, such as the desire for convenience or status.³⁷ Similarly, an individual may have good intentions to reduce driving, for example, yet these intentions may be complicated by a busy schedule or infrastructure barriers.³⁸ For these reasons, marketing a behavior is very different than marketing a product. Traditional marketing approaches, which tend to target attitudes, have had some success in raising levels of awareness and concern, but have a poor track record for success in promoting behavior change.³⁹ Successful social marketing efforts will take a systematic approach to understanding the

³⁶ David J. Hardisty, Eric J. Johnson & Elke U. Weber, *A Dirty Word or a Dirty World? Attribute Framing, Political Affiliation, and Query Theory*, 21 *PSYCHOL. SCIENCE* 86, 88 (2010).

³⁷ Gregory A. Guagnano, Paul C. Stern & Thomas Dietz, *Influences on Attitude-Behavior Relationships: A Natural Experiment with Curbside Recycling*, 27 *ENVIRONMENT AND BEHAVIOR* 699, 713 (1995)(noting that the impact of attitudes on behavior are bounded by contextual factors that may reduce their applicability).

³⁸ For example, in a survey among self-identified environmentalists, individuals cite poor community infrastructure as a common reason for not engaging in pro-environmental behaviors. C.C. Quimby & H. Angelique, *Barriers to Behavior Changes Related to Global Climate Change*. Poster presented at the 11th Biennial Conference for the Society for Community Research and Action 40, Pasadena, California (2007).

³⁹ See Wokje Abrahamse et al. *A Review of Intervention Studies Aimed at Household Energy Conservation*. 25 *J ENVIRON.. PSYCHOL.* 273, 291 (2005); M. Costanzo, et al., *Energy Conservation Behavior: The Difficult Path from Information to Action*, 41 *AM. PSYCHOL* 521 – 528 (1986).

barriers that may prevent individuals from adopting a behavior, such as convenience, access, or psychological barriers such as perceptions of efficacy and control.⁴⁰ Programs designed to overcome or minimize these barriers (to the extent possible) have a greater likelihood of success. For example, programs to promote the use of smoke alarms have achieved adoption rates within the range of 33 to 95% using door-to-door canvassing to distribute alarms. This method also used less financial and volunteer resources than using flyers to inform households of free alarm giveaways.⁴¹ Behavioral targets should be selected based on the potential impact of changing a behavior as well as the likelihood that a behavior can be changed (i.e., plasticity). In many cases, changes in infrastructure (i.e., improved access to public transportation) may be necessary before social marketing or other behavioral interventions have any chance of success for that behavior. Policymakers should be cognizant of these factors when allocating resources and should consult experts in social marketing in addition to those who have expertise in product marketing.⁴²

9. People Often Follow the Crowd. Humans generally do not like to be in the minority. Bringing attention to common behaviors within a population, termed a *descriptive norm*, will induce many individuals to conform to that behavior. For example, learning that one's peers are taking steps to conserve energy, recycle, or even reuse a bathroom towel before sending it to laundry induces many to do the same.⁴³ A recent study has shown that providing utility customers with a bar graph displaying their recent monthly electricity use compared to a group of comparable neighbors and a group of "efficient neighbors" led to a 1 to 2% reduction in electricity use through curtailment that persisted for up to a year after the intervention was initiated.⁴⁴ Although logical on the surface, this psychological principle

⁴⁰ See DOUGLAS MCKENZIE MOHR, *FOSTERING SUSTAINABLE BEHAVIOR: AN INTRODUCTION TO COMMUNITY BASED SOCIAL MARKETING* (1999).

⁴¹ Van M. Ta et al., *Evaluated Community Fire Safety Interventions in the United States: A Review of Current Literature*, 31 J COMMUN HEALTH 176, 197 (2006).

⁴² For an overview of social marketing techniques, see DOUGLAS MCKENZIE MOHR, *supra* note 46.

⁴³ P. Wesley Schultz, *Changing Behavior with Normative Feedback Interventions: A Field Experiment on Curbside Recycling*, 21 BASIC APPL. SOC. PSYCH. 25, 36 (1998); Noah J. Goldstein et al., *A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels*, 35 J. CONSUMER RES. 472 (2008); P. Wesley Schultz et al., *The Constructive, Destructive, and Reconstructive Power of Social Norms*, 18 PSYCH. SCIENCE 429 (2007).

⁴⁴ Ian Ayres et al., *Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage*, Working Paper available for download here: <http://www.nber.org/papers/w15386>. These data suggest that even larger gains may also be possible by tailoring home energy reports to high energy-using households. In this study, the highest energy users reduced their energy use by around 7% while the lowest energy-using households (which received feedback that they used less energy than their peers) actually increased energy, again demonstrating the impact of social norms in both directions.

requires many to suspend intuition regarding how to motivate behavior change. Public information campaigns often begin with statements to explicate the scale of the problem. By doing this, they may be inadvertently promoting the undesirable behavior by communicating a descriptive norm.⁴⁵ These findings indicate that it is better to emphasize what people are “doing right” than what they “aren’t doing right.” When what is typical within a group is undesirable, it is better to emphasize what is desirable (i.e., an *injunctive norm*) while de-emphasizing the undesirable norm. Furthermore, identifying and promoting “early adopters” of efficient technologies and behaviors may be a powerful means of triggering processes of normative influence, particularly when individuals are well-known or respected members of a community. Work on diffusion of innovation suggests that the adoption of new technologies such as solar panels often follow patterns of social affiliation and group membership.⁴⁶

10. People Strive for Consistency. Dissonance refers to the discomfort that is felt when a person holds contradictory ideas, cognitions, or behaviors.⁴⁷ For example, a self-proclaimed environmentalist would likely feel anxious about purchasing an inefficient vehicle or failing to recycle a plastic bottle. To reduce dissonance, individuals will modify an attitude, belief or behaviors to bring them in line with one another. Those interested in changing behavior have learned that calling attention to behavioral inconsistencies can motivate individuals to act more in line with the way that they feel. For example, individuals who express attitudes in support of resource conservation have been shown to curtail water and energy use after receiving feedback indicating that they are high users of a

⁴⁵ For example, in an effort to reduce the amount of petrified wood stolen from park lands, Arizona’s Petrified Forest National Park posted signs reading, “Your heritage is being vandalized every day by theft losses of petrified wood of 14 tons a year, mostly a small piece at a time.” When the sign was changed to simply communicate that removing wood is undesirable (i.e., an injunctive norm) rates of theft declined from 8% to just under 2%. Robert B. Cialdini, *Crafting Normative Messages to Protect the Environment*, 12 CURR. DIR. PSYCH. SCI. 105, 107 (2004).

⁴⁶ J.M. Darley, *Energy Conservation Techniques as Innovations and Their Diffusion*, 1 ENERG. BUILDINGS 339, 343 (1978); S. Sawyer, *Leaders in Change: Solar Energy Owners and the Implications for Future Adoption Rates*, 21 TECHNOL. FORECAST SOC. 201, 211 (1982). Additional work within the public health literature suggests that opinion leaders can have a powerful influence on behavior. For example, interventions that recruited popular members of the gay community to communicate messages about HIV/AIDS prevention led to a 30% decline in the percentage of individuals who reported having unprotected intercourse within that community. Jeffrey A. Kelly et al., *Randomised Controlled, Community-Level HIV-Prevention Intervention for Sexual-Risk Behaviour Among Homosexual Men in US Cities*, 350 LANCET 1500, 1504 (1997). For a replication of this effect, see also Jeffrey Kelly et al., *HIV Risk Behavior Reduction Following Intervention with Key Opinion Leaders of Population: An Experimental Analysis*, 81 AM. J. PUB. HEALTH 168, 171 (1991).

⁴⁷ See LEON FESTINGER, A THEORY OF COGNITIVE DISSONANCE (1957).

resource.⁴⁸ Individuals asked to make an upfront commitment are also more likely to follow through and adopt that behavior.⁴⁹ To our knowledge this approach has not been studied with respect to efficiency decisions; however, individuals who hold positive attitudes towards the environment, or resource conservation in general, may be motivated by messages that prime them to consider the energy use impacts of their appliance purchase at the point of decision. Although there are deep political divisions over climate change, the majority of Americans value environmental protection and energy efficiency regardless of their political affiliations.⁵⁰ When the impact of one's purchase decision (or product use decision) is made salient, this may induce dissonance for individuals if they cannot otherwise rationalize their actions.⁵¹

CONCLUSION

The principles we present here are a starting point for decisionmakers to begin to incorporate social scientific findings into their analyses. Adding these insights can improve the prospects for success of laws, programs, and policies directed at individual and household behavior. To maximize the potential for success, policymakers should combine multiple approaches to behavior change, including measures to reduce cognitive costs, increase motivation, provide more actionable and pertinent information, etc. In most cases, a single approach to changing behavior (such as the provision of information) is not sufficient to induce meaningful levels of behavior change and, therefore, multiple strategies are needed to target a wider audience and to encourage greater rates of adoption.⁵² Policymakers should consult experts in the field, as well as the literature referenced here, to further their understanding of these principles and how to apply them.

⁴⁸ C.K. Aitken et al., *Residential Water-Use – Predicting and Reducing Consumption*, 24 J. APPL. SOC. PSYCHOL. 136, 156 (1994); S.J. Kantola et al., *Cognitive Dissonance and Energy Conservation*, 69 J. APPL. PSYCH. 416, 420 (1984); C. Dickerson et al., *Using Cognitive Dissonance to Encourage Water Conservation*, 22 J. APPL. SOC. PSYCHOL. 841, 848 (1992).

⁴⁹ M.S. Pallak et al., *Commitment and Voluntary Energy Conservation*, 2 PERS. SOC. PSYCHOL. BULL. 27 (1976).

⁵⁰ Edward Maibach et al., *Saving Energy is a Value Shared by All Americans: Results of a Global Warming Audience Segmentation Analysis*, HUMAN RESOURCES FOR CLIMATE SOLUTIONS: ENERGY SMART BEHAVIORS, PEOPLE CENTERED POLICIES, AND PUBLIC ENGAGEMENT. Ed. Karen Ehrhardt-Martinez (forthcoming).

⁵¹ Wilson & Dowlatabadi, *supra* note 6, at 177.

⁵² Gardner & Stern, ENVIRONMENTAL PROBLEMS *supra* 6 at 153 – 174.