

Political ideology affects energy-efficiency attitudes and choices

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This research demonstrates how promoting the environment can negatively affect adoption of energy efficiency in the United States because of the political polarization surrounding environmental issues. Study 1 demonstrated that more politically conservative individuals were less in favor of investment in energy-efficient technology than were those who were more politically liberal. This finding was driven primarily by the lessened psychological value that more conservative individuals placed on reducing carbon emissions. Study 2 showed that this difference has consequences: In a real-choice context, more conservative individuals were less likely to purchase a more expensive energy-efficient light bulb when it was labeled with an environmental message than when it was unlabeled. These results highlight the importance of taking into account psychological value-based considerations in the individual adoption of energy-efficient technology in the United States and beyond.

Climate change presents a major challenge to our current level of energy consumption. Much attention has been given to the development of energy-efficient technology as a way of addressing the problem of global warming and reducing the cost of energy use for consumers, but the demand for energy efficiency has not met expectations (1, 2). There are a number of potential roadblocks to the adoption of energy-efficient technology. People do not know the cost and energy savings associated with different technologies (3–5), and climate change is not viewed as an immediate threat requiring action now (6, 7). In addition, people tend to have short time horizons and discount the future hyperbolically, so that the upfront costs of switching to a new technology, even when it results in long-term net savings, can deter investment in more expensive energy-efficient products (8).

Given these issues, one strategy for making energy-efficient technology attractive to consumers has been to focus on its environmental benefits (9). For example, a 2010 North American advertising campaign for the Toyota Prius (arguably the best-known hybrid car) emphasized its environmental upside by telling viewers that “the world gets fewer smog-forming emissions” with a Prius, resulting in “harmony between man, nature, and machine.” Similarly, the ENERGY STAR website (jointly run by the United States Department of Energy and the Environmental Protection Agency) promotes energy-efficient products as providing ways for people to “save energy and fight climate change.” Because these messages explicitly emphasize environmental benefits, they likely resonate well with individuals who value protecting the environment. However, this emphasis on the environment might detract from the appeal of energy efficiency among individuals who do not want to be associated with environmental concern.

This research investigated whether relying on environmental concern to promote energy-efficient technology may, in fact, present an additional roadblock to increasing demand by deterring otherwise interested consumers from purchasing these products because of the message’s (unwanted) value connotations. “Value” is defined as the importance individuals place on an issue or concern, which can result in either attraction to or repulsion from associated targets (10–12). This definition refers specifically to the psychological valuation of an entity (its perceived importance) rather than its economic valuation (its monetary worth; ref.

11). Accordingly, our focus is on the influence these psychological valuations have on individuals’ judgments and choices. In two experiments, we examined the importance individuals place on energy-related concerns as a function of their political ideology and the consequences these differing psychological valuations have for individual’s choices of energy-efficient products.

Political ideology provides a shared belief and value system through which people view and react to the world around them (13–15). In the United States, ideology is likely to be a major determinant of the value that people place on protecting the environment. Environmental concerns are part of a politically liberal ideology in the United States and have been correspondingly devalued by political conservatives. These different ideological positions are marked by diverging beliefs about the state of the world and the role of government in addressing societal issues. Compared with those on the political left, right-leaning individuals are more likely to dismiss concerns about climate change and to favor policies that protect free market opportunities for businesses by minimizing environmental regulation (16–18). Although protecting the environment is likely to be a priority for political liberals (a category that typically corresponds to the Democratic Party in the United States), political conservatives (a category that typically corresponds to the Republican Party in the United States) may find that this issue conflicts with the ideology to which they subscribe. Therefore, appeals regarding energy efficiency that label these choices as reflecting concern for the environment might repel a substantial segment of the US population that does not identify as politically liberal.

The United States presents a particularly informative context to study the effect of political ideology on energy-efficiency attitudes and choices. Because of the two-party political system in the United States, the divergence on environmental issues produces a salient in-group/out-group distinction in which value-based concerns are likely to play an important role (19, 20). Because the United States is the second largest producer of carbon emissions in the world (21), it is crucial to understand what factors will affect Americans’ adoption of energy-efficient measures. More broadly, this investigation is important because of the potential impact that individual actions can have on reducing carbon emissions globally (22, 23).

We first investigated the attitudinal underpinnings of people’s support for energy-efficient technology, specifically whether the concept of energy efficiency itself might be polarized along ideological lines. Although numerous findings demonstrate ideological divides for climate change and other environmental issues in the United States (e.g., refs. 16–18), whether such divides extend to individuals’ attitudes about energy efficiency has not yet been established. Although energy efficiency provides numerous benefits (including energy independence and reduced energy costs),

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its benefit to the environment (i.e., reducing the level of carbon dioxide emissions) may lead to ideological divides. We hypothesized that the political polarization around environmental issues in the United States will affect Americans' support for investing in energy-efficient technology. Specifically, we expected that the ideological difference in support for investment would result primarily from those on the political right placing less psychological value on reducing carbon emissions than those on the political left.

Study 1 provided an empirical test of whether political ideology is associated with attitudes toward the development and use of energy-efficient technology in a US sample. Importantly, this study investigated whether the (hypothesized) link between political ideology and support for energy efficiency results primarily from the psychological value placed on environmental (reducing carbon emissions), energy independence (reducing dependence on foreign oil), or financial issues (reducing energy costs). We expected the ideological divide on energy efficiency would be explained best by the divergent psychological value placed on the environmental component of energy efficiency.

Building on the findings of study 1, study 2 examined how these psychological valuations affect the demand for energy-efficient products (also in a US sample). We investigated how labeling products with an environmental message affects people's actual decision to purchase an energy-saving product (i.e., to buy an energy-efficient fluorescent light bulb versus an incandescent light bulb). We expected that labeling the product as an environmental choice would make it unattractive to those who are more politically conservative, resulting in fewer choosing to purchase the energy-efficient option than if the environment had not been made salient.

Experiments

Study 1: Attitudes Toward Investment in Energy Efficiency. Design. Study 1 [$n = 657$ US participants; 49% male; ranging in age from 19–81 y; mean (M) = 44.62, $SD = 13.94$] examined whether there is an ideological difference in individuals' support for investment in energy-efficient technology and whether this difference is driven by the importance placed on energy-related concerns (the effect of energy use on the environment, energy independence, and energy cost). We hypothesized that greater political conservatism would be associated with less support for investing in energy efficiency. We expected that individuals who were more conservative would place less psychological value on the environmental issue of reducing carbon emissions, which should mediate the relationship between political ideology and support for investment in energy efficiency. We additionally expected greater transideological appeal (i.e., less polarization) for the psychological value placed on reducing dependence on foreign oil and the financial cost of energy for consumers.

Participants were provided with a short description of energy efficiency and answered questions about the psychological value they placed on reducing carbon emissions that harm the environment,

reducing dependence on foreign oil, and reducing the financial cost of energy use to consumers. Participants indicated how much they were in favor of investing in energy-efficient technology (see *Methods* for a full description of study procedure and measures).

Results. We assessed whether participants' political leanings were related to their support for investment in energy efficiency and the importance they placed on energy-related concerns. Participants' political ideology composite of their ideological leanings and political party identification (see *Methods* for a full description; higher numbers indicate greater conservatism; scale range = 1–7; $M = 3.76$, $SD = 1.42$) was entered as an independent variable in linear regression equations predicting the extent to which individuals favored investment in energy-efficient technology and the value they placed on reducing carbon emissions, reducing dependence on foreign oil, and reducing the cost of energy use (Table 1). Each regression included the following demographic controls: self-reported age, sex, education level, and income, because these factors have been shown to correlate with beliefs about global warming (18, 24). The order in which participants answered the valuation questions and the order in which they indicated their political ideology (*Methods*) did not affect the relationship between political ideology and these measures (Table S1).

As expected, the more conservative participants were, the less they favored investing in energy-efficient technology (Table 1). With regard to individuals' psychological valuation of the environment, energy independence, and energy costs, all three judgments were associated with participants' political ideology: The more conservative participants were, the less psychological value they placed on all these concerns (Table 1). However, as shown in Fig. 1, the ideological divide was greatest for reduction of carbon emissions, indicating the polarizing nature of environmental concerns (and the relatively broader appeal of energy independence and cost concerns across ideological lines). In additional analyses, we also included a sex \times ideology interaction term, because conservative males tend to express the greatest denial of climate change (25). This interaction was a significant predictor for the valuation of carbon emission reductions but did not predict investment in energy efficiency or ratings for the other values; Table S1).

To examine whether the psychological value placed on the reduction of carbon emissions is primarily responsible for the relationship between political ideology and attitude toward investment in energy efficiency, we conducted bootstrap mediation analyses (26) that allowed for the simultaneous examination of the psychological value placed on the reduction of emissions, dependence on foreign oil, and cost of energy use as explanations for this relationship (see Table S2 for full mediation results). Although all the measures were significant mediators of the link between ideology and support for investing in energy efficiency, reducing emissions explained more of the variance in

Table 1. Linear regressions predicting how much participants favored investment in energy-efficient technology and how much they valued three features of energy efficiency (reduced carbon emissions, foreign oil dependence, and energy costs) from the political ideology composite (centered: $M = 3.76$, $SD = 1.42$) and demographic controls

Predictor variables	Favor investment	Standard error	Carbon emission reduction	Standard error	Foreign oil reduction	Standard error	Cost reduction	Standard error
Ideology composite	−0.24***	(0.03)	−0.39***	(0.03)	−0.10***	(0.03)	−0.14***	(0.03)
Age	0.004	(0.003)	0.01*	(0.004)	0.01***	(0.003)	0.01**	(0.003)
Sex (male = 0; female = 1)	0.13	(0.09)	0.36*	(0.10)	0.10	(0.08)	0.19*	(0.08)
Education level	−0.02	(0.03)	−0.05	(0.04)	−0.03	(0.03)	−0.06	(0.03)
Income level	0.06	(0.05)	0.01	(0.06)	0.04	(0.05)	0.01	(0.05)
Constant	5.49***	(0.22)	5.23***	(0.25)	5.31***	(0.21)	5.56***	(0.20)

Unstandardized regression coefficients (with SE in parentheses) are reported. Ideology composite: Higher numbers indicate greater conservatism. Note: 31 participants were excluded from these analyses because they did not provide their income level (remaining $n = 626$). The results do not differ if these participants are included in the analyses.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

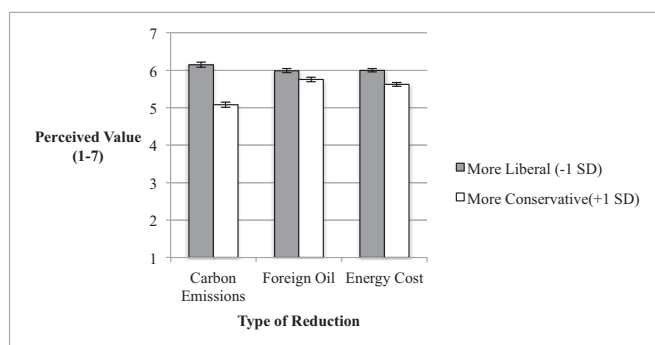


Fig. 1. The psychological value (\pm SE) participants placed on reducing carbon emissions, reducing dependence on foreign oil, and reducing the cost of energy use based on their political ideology (± 1 SD from the mean).

this relationship than did reducing the dependence on foreign oil [bootstrapped coefficient (B) = -0.08 , $SE = 0.02$, 95% confidence interval (CI) = -0.12 to -0.04] or reducing cost ($B = -0.08$, $SE = 0.02$, 95% CI = -0.13 to -0.03), which did not differ from one another ($B = 0.00$, $SE = 0.02$, 95% CI = -0.03 to 0.04). This mediational analysis provided evidence that the ideological difference in favoring investment in energy efficiency is driven most strongly by the divergent psychological value placed on the environmental issue of emission reduction.

Additional evidence for the polarizing effect of environmental concerns comes from analyses that included the strength of participants' belief in global warming [which was negatively related to conservatism, $r(657) = -0.53$, $P < 0.001$]. When this variable was included as a predictor of the three energy-related concerns in the linear regressions described previously, the more conservative participants were, the greater the psychological value they placed on reducing dependence on foreign oil [B (unstandardized regression coefficient) = 0.09 , $SE = 0.03$, $t(619) = 2.88$, $P = 0.004$] and (nonsignificantly) on the cost of energy use [$B = 0.05$, $SE = 0.03$, $t(619) = 1.61$, $P = 0.11$]. This result indicates that, when their relatively lower concerns about global warming are taken into account, the political right places a greater psychological value than the left on energy independence and reduced energy costs. This reversal did not occur for the reduction of carbon emissions [$B = -0.01$, $SE = 0.03$, $t(619) = -0.21$, $P = 0.84$]. This result suggests that conservatives may respond more positively to appeals for energy efficiency based on cost and energy independence, and such appeals also should resonate with liberals (as shown in Fig. 1).

Discussion. These results demonstrate that there are ideological differences in the support for investments in energy efficiency in the United States, with more politically conservative individuals being less in favor of investing in energy-efficient technology than those who are more politically liberal. Moreover, this difference is driven primarily by the different psychological value placed on reducing carbon emissions, with more conservative individuals viewing this issue as less important than those who are more liberal. The next study examines the consequences of this differential psychological valuing of the environment on individuals' choices. Specifically, we investigated how labels that reflect environmental concerns affect individuals' choices regarding the purchase of an energy-efficient product when people are aware of the cost savings that energy efficiency can provide.

Study 2: Light Bulb Choice. Design. Study 2 ($n = 210$ participants recruited from a pool of participants drawn from a US university population; 61% female; ranging in age from 18 to 66 y; $M = 22.36$, $SD = 7.04$) examined how pairing a product with an environmental label affected people's actual buying behavior and whether the effect was moderated by their political leanings and the upfront cost of the energy-efficient option. This study thus

focuses on two potential roadblocks to the adoption of energy efficiency in the United States: greater upfront costs for energy-efficient technology and the emphasis on the environment in the promotion of energy efficiency. Study 1 demonstrated that more conservative individuals' lower support for investment in energy-efficient technology was based primarily on the lower psychological value they placed on the environmental issue of reducing carbon emissions. We thus hypothesized that labeling an energy-efficient light bulb as reflecting a concern with the environment would deter its purchase by individuals who are more politically conservative. We examined whether an aversion to an environmental label would deter purchasing when the energy-efficient option had a greater upfront cost than an incandescent bulb (as it typically does in the market) and when it did not.

Participants were given \$2 (which was separate from their compensation for participating in the experiment) to purchase a light bulb, and any money they did not spend on the light bulb they kept for themselves. Their choice was between incandescent and compact fluorescent light (CFL) bulbs that produced equivalent lumens (brightness). In one condition the bulbs had the same price (\$0.50), and in the other condition, the CFL bulb was more expensive (\$1.50) than the incandescent bulb (\$0.50). Environmental salience was manipulated by varying whether the purchase of the CFL bulb came with a "Protect the Environment" sticker or a blank sticker. Aside from the message, the stickers were identical. Participants were assigned randomly to one of the four conditions (see *Methods* for full description of the study procedure and measures).

Across the conditions in this study, we held constant the information presented about the two light bulb options. All participants were provided with information about the energy-efficiency benefits of the CFL bulb compared with the incandescent bulb (e.g., the CFL bulb lasts for 9,000 more hours and reduces energy cost by 75%). All the differences described concerned energy use and cost; there was no explicit mention of any environmental benefits. Because environmental salience was manipulated via a superficial feature of the product (the label) rather than by information about the product's specific environmental benefits, we can isolate the influence of psychological value-based concerns on energy-efficient choices when individuals have information just about the product's energy and cost-saving benefits. **Results Manipulation checks.** Overall, the CFL bulb was seen as superior to the incandescent bulb in function, savings, and environmental benefit ($P < 0.01$; Table S3). Participants completed these judgments after they had made their choice as to which light bulb to purchase. The light bulb purchase was seen as more expressive of one's values when the sticker contained the environmental message ($M = 3.60$, $SD = 1.53$) than when it was blank ($M = 3.13$, $SD = 1.51$, $t(208) = 2.24$, $P = 0.026$). As in study 1, the participants who were more conservative were less likely to endorse a belief in global warming [$B = -0.28$, $SE = 0.08$, $t(200) = -3.56$, $P < 0.001$], indicating that conservatives were less concerned about this environmental issue than were liberals.

Light bulb choice. When the bulbs were the same price, the content of the label had no effect. All participants (except one) chose the CFL bulb, suggesting that long-term economic considerations dominated their choice process. Indeed, participants rated the CFL bulb as offering greater savings when the bulbs were the same price than when the CFL bulb had a greater upfront cost [$M_{\text{EqualCost}} = 6.03$, $SD = 1.23$ vs. $M_{\text{UnequalCost}} = 5.04$, $SD = 1.81$, $t(208) = 4.65$, $P < 0.001$], and they viewed the incandescent bulb as offering lesser savings [$M_{\text{EqualCost}} = 2.70$, $SD = 1.63$ vs. $M_{\text{UnequalCost}} = 3.43$, $SD = 2.00$, $t(208) = 2.92$, $P = 0.004$].

In contrast, when the CFL bulb was three times more expensive than the incandescent bulb, environmental salience influenced choice differently based on political ideology (see Table 2 for full logistic regression results and Tables S4 and S5 for logistic regression results for the label conditions separately). The political ideology measure was a composite of the standardized scores for their ideological leanings and political party affiliation

Table 2. Logistic regression predicting the probability of purchasing the CFL bulb based on label and political ideology (unequal-cost condition only)

Predictor variables	B	SE	Wald	P value	e ^B (odds ratio)
Ideology composite (linear)	-0.48	0.32	2.29	0.130	0.62
Label (-1 = blank label; 1 = env label)	-0.67	0.29	5.45	0.020	0.51
Label × ideology composite (linear)	-0.63	0.32	3.95	0.047	0.53
Ideology composite (quadratic)	0.31	0.31	0.98	0.322	1.36
Label × ideology composite (quadratic)	0.69	0.31	4.84	0.028	1.98
Constant	-0.00	0.29	0.00	0.99	1.00

The ideology composite comprises standardized political ideology and party affiliation scores (higher numbers indicate greater conservatism). B, unstandardized regression coefficient.

(see *Methods* for a full description; higher numbers indicate greater conservatism; $M = -0.01$, $SD = 0.83$). In addition to the linear ideology term, we also included a quadratic term to examine whether political moderates chose the CFL bulb at a rate similar to that of more liberal participants, at a rate similar to that of more conservative participants, or at a rate in between. Although political moderates' attitudes toward environmental issues fall between those of liberals and conservatives (18), whether their choices would follow this linear pattern was unknown. As shown in Table 2, both the linear and quadratic interaction terms were significant predictors of light-bulb choice.

As shown by the predicted probabilities of choosing the more expensive CFL bulb (Fig. 2), more politically moderate and conservative participants were deterred from purchasing the CFL bulb when it had an environmental label. We conducted flood-light regression analyses (27, 28) that assessed whether light-bulb choice based on label varied significantly across the ideological spectrum from -1 to +1 in increments of 0.2 (i.e., the simple effect of label at each specified level of ideology; see Table S6 for full results). Participants were significantly less likely to purchase the CFL bulb if it came with an environmental label when their score on the linear ideology composite ranged from 0 to 0.8 ($P < 0.03$; both -0.2 and 1 were marginally significant). All other values were not significant ($P > 0.20$). These results show that the more moderate and conservative participants preferred to bear a long-term financial cost to avoid purchasing an item associated with valuing environmental protection.

Importantly, participants' choice of light bulb was not explained by the perceived environmental benefit offered by the CFL bulb, because the ratings of the incandescent and CFL bulbs on this dimension were not affected by the label, by participants' political ideology (either linear or quadratic), or by their interaction (Table S7). This result rules out the alternative explanation that the presence of an environmental label increases how much participants think the energy-efficient bulb benefits the environment (rather than simply making the environment salient). Furthermore, there also was no difference in the perceived

quality of the incandescent and CFL bulbs across the different conditions and political ideologies (Table S7).

Discussion. These findings indicate that connecting energy-efficient products to environmental concerns can negatively affect the demand for these products, specifically among persons in the United States who are more politically conservative. Although the majority of participants, regardless of ideology, selected the more expensive energy-efficient light bulb when it was unlabeled, the more moderate and conservative participants were less likely to purchase this option when an environmental label was attached to it. In addition, it might seem surprising that the environmental label did not produce a large increase in preference for the energy-efficient CFL bulb among more liberal individuals. We speculate that these participants may associate energy-efficient options with environmental benefits spontaneously and do not need a label to call the benefits to their attention.

These results also speak to the role of financial incentives as a way of increasing demand for energy-efficient options. When the CFL bulb was discounted to match the price of the incandescent bulb, psychological value-based concerns did not influence choice. All participants except one picked the discounted CFL bulb, suggesting that when energy-efficient options do not require larger upfront costs than standard options, psychological valuations are less likely to dissuade people from choosing energy efficiency. However, until equal upfront costs become a reality (such as through long-term loans for energy-efficiency upgrades or the reduction of costs through economies of scale), labeling energy-efficient choices as reflecting environmental concerns has the potential of deterring some individuals from selecting energy-efficient options.

General Discussion

The present results demonstrate that there are ideological differences in attitudes toward energy efficiency in the United States. More politically conservative individuals are less in favor of investing in energy efficiency than are those who are more politically liberal, a finding driven primarily by the polarized psychological valuation of carbon emissions reduction. Although one of the primary benefits of energy-efficient options is that they place less strain on the environment, not everyone values environmental protection. These differing psychological valuations have consequences for the adoption of energy efficiency, because promoting environmental protection can decrease the demand for energy efficiency among nonliberals. In particular, our results indicate that in the United States (one of the largest producers of carbon emissions in the world), those on the political right will avoid purchasing more expensive energy-efficient options when the choice is reflective of concern for the environment, even though they might have otherwise purchased these options.

The generalizability of these results to understanding attitudes toward and choices regarding energy efficiency in other countries and cultures depends on whether psychologically valuing environmental protection is linked strongly with specific ideologies or political parties. For example, although Europeans tend to be more concerned about climate change than Americans

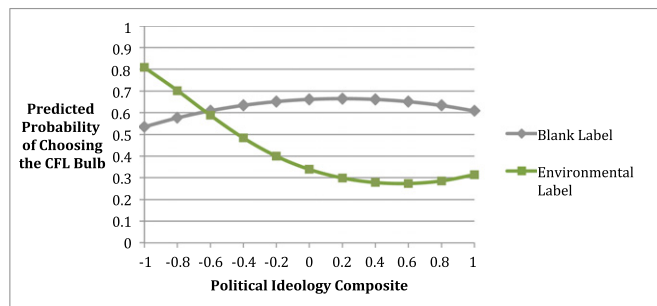


Fig. 2. The predicted probability of participants choosing the more expensive CFL bulb based on their political ideology (higher numbers indicate greater conservatism) and whether an environmental value was salient. The x-axis contains values from -1 to 1 from the mean of the political ideology composite.

(29), there is still a left–right ideological divide on environmental issues in the European Union (30), suggesting that the present findings may generalize to these countries. More abstractly, making the environment salient could negatively impact the adoption of energy efficiency whenever valuing environmental protection is viewed as undesirable. In the United States, the political polarization surrounding climate change (16–18) provides one means of operationalizing the value placed on environmental concerns. More research is needed to examine how the relationship between political ideology and the valuation of environmental protection varies cross-culturally and influences attitudes towards and choices about energy efficiency.

One open question is what underlies this ideological divide on energy efficiency when it is associated with environmental protection. There are a number of possible reasons for this difference. Political conservatism is associated with a preference for the status quo (14), traditionalism (31), and a lesser reliance on harm and fairness principles in moral domains (32). Environmental protection (particularly in the context of proposed “solutions” to the problems created by climate change) typically challenges the economic status quo and tradition (10, 17), and relies on harm/fairness notions of morality (33). Hence any or all of these basic psychological factors might contribute to the present findings.

Although the psychological value placed on reducing carbon emissions is divided along political lines in the United States, study 1 demonstrated there is greater transideological agreement about the psychological value placed on saving money and securing energy independence. Focusing on these issues that have a broader appeal is one possible solution to the environmental polarization problem. Indeed, when only cost information was available to participants in study 2 (i.e., the blank-label conditions), there were no ideological differences in the selection of the energy-efficient option. Alternatively, there may be sources of political common ground with regard to the environment itself, because framing environmental protection in terms of psychological values that appeal to those on the political right (such as purity or patriotism) increases concern for the environment among political conservatives (17, 33). Future research should identify whether tapping these less polarizing concerns, morals, and values can bridge the ideological gap in the willingness to pay for energy-efficient options.

Our findings demonstrate the influence of framing and contextual effects on people’s selection of energy-efficient options (34, 35) and the importance of individual-level, behavioral factors in adopting energy-efficient measures (22, 23). These results also speak to the importance of recognizing that people’s choices can be based on noneconomic sources of value. The present results complement previous research demonstrating the influence of identity-related concerns on people’s economic decisions (36, 37), because people make choices that align with important identities and provide distance from unwanted identities (38–40). Our results demonstrate that individuals will forego economically beneficial options if these options promote a value that is in conflict with their political ideology.

Although much attention has been given to information gaps and lack of immediate concern about the impact of climate change as reasons why people do not choose energy-efficient options despite their long-term economic benefits (3–7), this research identifies an additional roadblock to the widespread adoption of energy efficiency in the United States: the value individuals place on the environment. This psychological valuation is based on people’s political ideology, and affects their energy-efficiency preferences (even when provided with information about the economic benefits of energy efficiency). When energy efficiency is promoted as reflecting environmental concern, individuals’ energy-efficient choices can be polarized along ideological lines.

Methods

Study 1. Participants. Participants in the experiment ($n = 657$ individuals who reside in the United States; 49% male; age range, 19–81 y; $M = 44.62$, $SD = 13.94$) were recruited via the Clear Voice survey service (whose research

panels meet the Code of Standards of the Council of American Survey Research Organizations; www.clearvoicesurvey.com) and participated in the experiment in exchange for monetary compensation.

Procedures. At the beginning of the study, participants completed an instructional attention check (adapted from ref. 41). Differing from previous uses of these attention checks, participants were not excluded if they failed to answer the question correctly. Instead, they were informed their answer was incorrect and were not allowed to continue to the study until they responded correctly. Participants then were provided with a short description of energy efficiency (i.e., “Technology is considered energy efficient when it uses less energy to produce the same level of performance”). **Valuation.** After reading the description of energy efficiency, participants indicated “how much each of the following is an important reason to invest in energy-efficient technology”: the technology’s ability to reduce “the level of carbon emissions that harm the environment,” “dependence on foreign oil,” and “the financial cost of energy use to consumers” (presented in a random order). The scales were anchored at 1 (not at all important) to 7 (very important).

The next set of questions asked participants about the extent to which they thought that they individually, Americans, and the US government (presented in this fixed order) had a “moral obligation” to reduce “the level of carbon emissions that harm the environment,” “dependence on foreign oil,” and “the financial cost of energy use to consumers” (presented in a random order). Participants answered the identical set of questions with regard to how much they individually, Americans, and the US government “would benefit from” these three reductions. The order in which participants answered these two sets of questions (moral obligation and benefit) was counterbalanced. We collapsed across targets (self, Americans, US government) and questions (importance, moral obligation, and benefit) to form composite measures for the value placed on reducing carbon emissions ($\alpha = 0.93$; $M = 5.60$, $SD = 1.34$), dependence on foreign oil ($\alpha = 0.83$; $M = 5.86$, $SD = 1.01$), and cost of energy use ($\alpha = 0.79$; $M = 5.81$, $SD = 0.98$).

Support for Investment. After completing these questions, participants indicated how much they were in favor of “investing in the development and use of energy-efficient technology” with regard to themselves individually, Americans, the US government, and US businesses ($\alpha = 0.83$; $M = 5.85$, $SD = 1.12$).

Political Ideology. Participants indicated how much they identified as being politically liberal or conservative (*i*) in general, (*ii*) on economic issues, and (*iii*) on social issues, on a scale from 1 (very liberal) to 7 (very conservative). The midpoint of the scale was labeled as moderate. Participants provided their responses to these questions either at the beginning of the study (before reading the description of energy efficiency) or at the end (after indicating how much they favored investing in energy-efficient technology). At the conclusion of the study, participants indicated the extent to which they identified with four political groups: Democrats, Independents, Republicans, and the Tea Party on a scale from 1 (not at all) to 7 (very much). The ideology measure was a composite of both these political ideology and party affiliation measures (see ref. 42): the three items assessing ideology ($\alpha = 0.93$; $M = 4.10$, $SD = 1.51$) and how much participants identified with Democrats (reverse-scored), Republicans, and the Tea Party (a faction within the Republican party; $\alpha = 0.70$; $M = 3.40$, $SD = 1.58$). The composite ideology measure had good reliability ($\alpha = 0.87$; $M = 3.76$, $SD = 1.42$); higher numbers indicated greater conservatism.

The study concluded with participants indicating how much they agreed with statements related to global warming (carbon emissions will heat up the atmosphere, changing human behavior can reduce global warming, and preventing global warming is important; $\alpha = 0.93$). They then provided their demographic information (age, sex, education level, and income level).

Study 2. Participants. Individuals ($n = 210$, 61% female; age range, 18–66 y; $M = 22.36$, $SD = 7.04$) participated in laboratory experiments at the University of Pennsylvania in exchange for monetary compensation (\$10 for a 1-h session).

Procedures. On entering the laboratory, participants were seated at an individual cubicle in which the 60-W incandescent light bulb and the 13-W CFL bulb were displayed. The two bulbs were made by the same manufacturer. In front of the CFL bulb, there was either a blank sticker (blank-label condition) or a sticker that read “Protect the Environment” (environmental-label condition). The stickers were otherwise identical.

Participants read that they would have a choice of purchasing one of the two light bulbs shown in their cubicle and learned that they had been allotted an additional \$2, completely separate from the compensation for their participation, which they would use to purchase one of the two light bulbs to take home with them. Participants were informed that they would keep any portion of the \$2 that they did not spend on the light-bulb purchase.

Participants then were provided with information about the similarities (in lighting power and quality; use in standard sockets) and differences (in energy efficiency) between the two bulbs. Participants were informed that the CFL bulb was more energy efficient ("It uses less energy to produce the same amount of light"), that it would last 9,000 hours longer than the incandescent bulb, and that it would reduce energy costs by 75% compared with the incandescent bulb.

The relative cost of the light bulbs was manipulated in two conditions. Participants either learned that the cost of the bulbs was the same (both the incandescent and the CFL bulb cost \$0.50, because of the availability of discounted CFL bulbs) or that the CFL bulb was more expensive (priced at \$1.50, compared with the \$0.50 incandescent bulb). Participants were told that they had to purchase one of the two bulbs and were reminded how much money they would be able to keep for themselves if they bought either bulb (\$1.50 or \$0.50, respectively).

For the manipulation of environmental salience, participants were told that if they chose the CFL bulb, they would receive either the blank sticker (blank label) or the Protect the Environment sticker (environmental label) displayed in their cubicle. Participants were assigned randomly to the cost and label conditions; however, because of a procedural error, more participants were run in the blank-label condition ($n = 117$) than in the environmental-label condition ($n = 93$).

Immediately before participants made their choice, they were provided with a table summarizing the similarities and differences between the two light bulbs. Participants then made their bulb selection.

Value expression and light bulb evaluation. After making their choice, participants were asked if they were to buy a CFL bulb with a blank or Protect the Environment sticker, how much this choice would express to others who they were, their values, and their political beliefs, as well as how much it would affirm them (presented in a counterbalanced order). These measures were

combined into a value expression composite ($\alpha = 0.91$). Participants also evaluated each bulb with regard to its lighting power, lighting quality, monetary savings, and benefit to the environment. The lighting power and quality measures were combined into overall measures of light-bulb function (incandescent bulb: $\alpha = 0.88$; CFL bulb: $\alpha = 0.81$).

Global warming and political ideology. Participants completed a three-item measure of their beliefs about global warming (same as in study 1; $\alpha = 0.80$). As in study 1, the ideology measure was a composite of how participants identified themselves ideologically and their party affiliation. Participants indicated how much they identified as politically liberal or conservative in general, on economic issues, and on social issues on a scale from 1 (very liberal) to 7 (very conservative). The midpoint of the scale was labeled moderate ($\alpha = 0.81$; $M = 3.43$, $SD = 1.26$). For affiliation, they indicated the political party they most identified with: 1 = Democrat (55%), 2 = independent (22%), and 3 = Republican (20%). The affiliation measure was treated as a three-point scale ($M = 1.64$, $SD = 0.80$). The composite ideology score was computed by averaging the standardized score for the three ideology measures and the one affiliation measure ($\alpha = 0.86$; $M = -0.01$, $SD = 0.83$). The participants who identified as "other" (4%) were not included in the composite score.

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- Allcott H, Greenstone M (2012) Is there an energy efficiency gap? *J Econ Perspect* 26(1):3–28.
- Jaffe AB, Stavins RN (1994) The energy paradox and the diffusion of conservation technology. *Resour Energy Econ* 16(2):91–122.
- Allcott H (2011) Consumers' perceptions and misperceptions of energy costs. *Am Econ Rev* 101(3):98–104.
- Attari SZ, DeKay ML, Davidson CI, Bruine de Bruin W (2010) Public perceptions of energy consumption and savings. *Proc Natl Acad Sci USA* 107(37):16054–16059.
- Larrick RP, Soll JB (2008) Economics. The MPG illusion. *Science* 320(5883):1593–1594.
- Van Vugt M (2009) Averting the tragedy of the commons: Using social psychological science to protect the environment. *Curr Dir Psychol Sci* 18(3):169–173.
- Weber EU, Stern PC (2011) Public understanding of climate change in the United States. *Am Psychol* 66(4):315–328.
- Kunreuther H, Meyer RJ, Michel-Kerjan E (2013) In Behavioral Foundations of Policy, ed Shafir E (Princeton Univ Press, Princeton, NJ), pp 398–415.
- Ottman JA, Stafford ER, Hartman CL (2006) Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. *Env: Sci Pol Sustain Dev* 48(5):22–36.
- Dietz T, Fitzgerald A, Shwom R (2005) Environmental values. *Annu Rev Environ Resour* 30:335–372.
- Higgins ET (2006) Value from hedonic experience and engagement. *Psychol Rev* 113(3):439–460.
- Schwartz SH, Bilsky W (1987) Toward a universal structure of human values. *J Soc Pers Psychol* 53(3):550–562.
- Feldman S (2003) in Oxford Handbook of Political Psychology, eds Sears DO, Huddy L, Jervis R (Oxford Univ Press, New York), pp 477–508.
- Jost JT, Federico CM, Napier JL (2009) Political ideology: Its structure, functions, and elective affinities. *Annu Rev Psychol* 60:307–337.
- Knight K (2006) Transformations of the concept of ideology in the twentieth century. *Am Polit Sci Rev* 100(4):619–626.
- Dunlap RE, Xiao C, McCright AM (2001) Politics and environment in America: Partisan and ideological cleavages in public support for environmentalism. *Env Polit* 10(4):23–48.
- Feygina I, Jost JT, Goldsmith RE (2010) System justification, the denial of global warming, and the possibility of "system-sanctioned change" *Pers Soc Psychol Bull* 36(3):326–338.
- McCright AM, Dunlap RE (2011) The politicization of climate change and polarization in the American's public view of global warming, 2001–2010. *Sociol Q* 52(2):155–194.
- Seyle DC, Newman ML (2006) A house divided? The psychology of red and blue America. *Am Psychol* 61(6):571–580.
- Van Boven L, Judd CM, Sherman DK (2012) Political polarization projection: Social projection of partisan attitude extremity and attitudinal processes. *J Pers Soc Psychol* 103(1):84–100.
- Rogers S (2012) World carbon emissions: The league table of every country. *The Guardian*. Available at www.guardian.co.uk/environment/datablog/2012/jun/21/world-carbon-emissions-league-table-country. Accessed October 16, 2012.
- Allcott H, Mullainathan S (2010) Energy. Behavior and energy policy. *Science* 327(5970):1204–1205.
- Dietz T, Gardner GT, Gilligan J, Stern PC, Vandenbergh MP (2009) Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proc Natl Acad Sci USA* 106(44):18452–18456.
- O'Connor RE, Bord RJ, Fisher A (1999) Risk perceptions, general environmental beliefs, and willingness to address climate change. *Risk Anal* 19(3):461–471.
- McCright AM, Dunlap RE (2011) Cool dudes: The denial of climate change among conservative white males in the United States. *Glob Environ Change* 21(4):1163–1172.
- Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods* 40(3):879–891.
- Hayes AF, Matthes J (2009) Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behav Res Methods* 41(3):924–936.
- Spiller SA, Fitzsimons GJ, Lynch JG, McClelland GH (2013) Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *J Marketing Res* 50(2):277–288.
- Scruggs L, Benegal S (2012) Declining public concern about climate change: Can we blame the great recession? *Glob Environ Change* 22(2):505–515.
- Hooghe L, Marks G, Wilson CJ (2002) Does left/right structure party positions on European integration? *Comp Polit Stud* 35(8):965–989.
- Schwartz SH, Caprara GV, Vecchione M (2010) Basic personal values, core political values, and voting: A longitudinal analysis. *Polit Psychol* 31(3):421–452.
- Graham J, Haidt J, Nosek BA (2009) Liberals and conservatives rely on different sets of moral foundations. *J Pers Soc Psychol* 96(5):1029–1046.
- Feinberg M, Willer R (2013) The moral roots of environmental attitudes. *Psychol Sci* 24(1):56–62.
- Griskevicius V, Tybur JM, Van den Bergh B (2010) Going green to be seen: Status, reputation, and conspicuous consumption. *J Soc Pers Psychol* 98(3):392–404.
- Hardisty DJ, Johnson EJ, Weber EU (2010) A dirty word or a dirty world?: Attribute framing, political affiliation, and query theory. *Psychol Sci* 21(1):86–92.
- Akerlof GA, Kranton RE (2010) Identity economics: How our identities shape our work, wages, and well-being (Princeton Univ Press, Princeton, NJ).
- March JG (1994) *A primer on decision making: How decisions happen* (The Free Press, New York).
- Berger J, Heath C (2008) Who drives divergence? Identity signaling, outgroup dissimilarity, and the abandonment of cultural tastes. *J Pers Soc Psychol* 95(3):593–607.
- LeBoeuf RA, Shafir E, Bayuk JB (2010) The conflicting choices of alternating selves. *Organ Behav Hum Dec* 111(1):48–61.
- White K, Dahl DW (2007) Are all outgroups created equal? Consumer identity and dissociative influence. *J Consum Res* 34(4):525–536.
- Oppenheimer DM, Meyvis T, Davidenko N (2009) Instructional manipulation checks: Detecting satiating to increase statistical power. *J Exp Soc Psychol* 45(4):867–872.
- Cohen GL (2003) Party over policy: The dominating impact of group influence on political beliefs. *J Pers Soc Psychol* 85(5):808–822.