Encouraging Energy Efficiency: Product Labels Activate Temporal Tradeoffs

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Abstract:The current research presents the "10-year energy cost" label as an effective nudge to increase energy efficient choices by retail consumers. Its efficacy is demonstrated in both lab and field studies (Studies 1a and 1b) and compared to other energy labels (Studies 4 and 5). The current work proposes that it is effective partly because many consumers have a latent "long-term dollar cost-reduction" goal. Normally, when consumers purchase energy using products, they do not think about long-term costs. However, the "10-year energy cost" label activates this latent goal in the presence of an appropriate behavioral path to achieving the goal, increasing the proportion of energy efficient choices (Studies 3 and 4). Thus, this nudge is somewhat selective, having its greatest impact on consumers who self-report actively pursuing long-term cost reduction goals (Study 5).

*Keywords: Product Labels, Attribute Framing, Intertemporal Choice, Energy Paradox*

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Consumers often purchase inefficient products such as air-conditioning units or clothes driers that have lower up-front costs but are much more expensive to operate in the long run, implying annualized discount rates of up to 90% among low-income consumers, and a waste of approximately $15 billion in 2010 in the U.S. alone (Hausman 1979; U.S. Energy Information Administration 2010). Given the costs of energy use, such wasteful choices are bad not only for consumers' budgets, but also for society and the environment. For these reasons, inefficient lightbulbs were outlawed in a number of countries as well as several U.S. states and Canadian provinces. However, such legal prohibitions often have unintended consequences, and some consumers may be pushed in a direction that is not in their self-interest (Sahoo and Sawe 2015). Thus, we explore a solution to this dilemma that preserves consumers’ freedom of choice, and "nudges" consumers in the right direction.

Towards this goal of improving consumer choice without regulatory requirements, a number of "choice architecture" techniques (Thaler and Sunstein 2008) have been developed. Many of these techniques fall into three categories: defaults, information restructuring, and information feedback (Camilleri and Larrick 2015). A *default* option is one that will be chosen automatically if nothing is done. When energy efficient options are set as the default in home renovation, people choose them much more often (Dinner et al. 2011). This happens partly because of effort minimization and partly because the default option becomes the "status quo" choice, and hence people are more likely to think of good things in its favor. *Information restructuring* makes some aspects of the product information more salient and useful for consumers and can be used to highlight energy efficiency information, for example by labelling efficient products with the "energy star" certification. This method is intuitively appealing and inexpensive to implement. However, although some studies using information provision to increase energy efficient choices have found positive effects (Bull 2012; Camilleri and Larrick 2013; Min et al. 2014), other studies have found mixed or null results (Abrahamse et al. 2005; Anderson and Claxton 1982; Waechter et al. 2015). *Information feedback* is used to update consumers about the consequences of their choices, for example about energy use through smart meters (Sintov and Schultz 2015). Direct feedback such as this, when delivered on a regular basis, has been found to reduce consumption between 5% and 15% (Darby 2006). Consumption can be further reduced by giving consumers feedback on how their energy usage compares to their neighbors, along with an injunctive norm to describe their relative standing (e.g., a happy face for saving energy, Shultz et al. 2007).

Here, we introduce a new information restructuring tool: 10-year energy cost labeling, which we believe to be the most effective nudge yet in this category. We examine how and why it works, and demonstrate that it works better than other labeling techniques.

*Previous Research on Energy Labeling and Purchase Behavior*

Although behavioral scholars have studied energy labelling for at least 35 years, to the best of our knowledge there are only three published field studies measuring actual purchase decisions. At 18 department stores in Western Canada, Anderson and Claxton (1982) labelled small and large refrigerators with kilowatt hour (kWh) labels, annual dollar cost labels, or "no energy label" control. "Sales staff emphasis" of energy information was also manipulated, but had no significant effect. The labels had no effect on large, "frost free" refrigerator purchases, but did improve the efficiency of small refrigerator purchases, from 118 kWh/month in the control condition to 101 kWh/month in the energy label conditions. There was no significant difference between the two energy label conditions, but the sample was small in some conditions (e.g., 16 consumers per cell). The reason why labels were more effective for the small refrigerators may be that the ratio of the energy cost relative to the purchase price was greater for these models. In a post-purchase mail questionnaire, only one-third of participants in the treatment groups recalled seeing energy labels – even when store staff had been instructed to emphasize them to consumers. Therefore, limited label prominence or salience may have reduced the effect of the labeled information.

Kallbekken, Sælen, and Hermansen (2013) provided information on lifetime energy costs of fridge-freezers and tumble driers at six electrical retail stores in Norway. In their studies, both products already had mandatory EU energy labels, showing the kWh usage and an energy letter grade of G to A+++. Kallbekken and colleagues also manipulated sales staff training on the "co-benefits" of energy efficiency for both the consumer and the retailer. Results showed that while labeling alone had no effect, labeling plus staff training reduced the average energy usage of tumble driers sold by 5% (with no effect on fridge-freezers). The authors speculate that the intervention was more effective for the tumble driers because the difference in lifetime energy costs (between the most efficient and least efficient unit) was relatively large -- 625 euros difference for the tumble driers, vs. 250 euros difference for the fridge freezers.

More recently, Allcott and Taubinsky (2015) approached 1,561 potential lightbulb customers in four "big box" stores in east coast U.S. cities with an iPad survey. The survey asked for each customer's estimated daily usage, desired wattage, and desired number of bulbs. In the information treatment group, the iPad displayed the annual energy cost, lifetime energy costs, and total user costs (energy plus bulbs) for the category of compact fluorescent lightbulbs (CFLs) versus incandescent lightbulbs. These estimates were customized for each individual participant, based on their survey answers. All participants were given a coupon for 10% off lightbulb purchases, which was used to track their purchases. Half the participants were also given a coupon for 30% off CFL purchases. Although the economic incentive (coupon) was effective for increasing CFL purchase rates, the information treatment was not. The authors speculate that the lack of an information provision effect may have been due to the fact that the in-store environment involved hundreds of different lightbulb packages and many other stimuli competing for attention. This may have made it difficult for information treatment consumers to internalize, recall, and apply the energy information when they actually chose a package. Alternately, existing in-store signage may have already fully informed consumers, thus the information treatment provided nothing new and had no effect.

In addition to these three studies on actual purchase behavior, a pair of online field studies (Deutsch 2010a; Deutsch 2010b) measured clicks on washing machines and cooling appliances (but not actual purchase data). In the control condition, participants saw regular product price information, while in the information treatment condition, they also saw operating costs and total life-cycle cost (i.e., purchase price plus operating costs). The information treatment reduced the mean energy use of virtually chosen washing machines by 0.8% and cooling appliances by 2.5%. However, the information treatment either had no effect on the volume of clicks (on washing machines, similar to Grimmer et al. 2015 who found no impact on purchase intent), or *decreased* the volume of clicks (on cooling appliances), which suggests that such information treatments may not be desirable for online retailers.

*Why 10-Year Energy Cost? Costs Loom Larger Than Savings Due To Asymmetric Temporal Discounting*

Taken together, these field studies show modest and somewhat unreliable effects of energy labeling on purchase decisions. Furthermore, they provide little guidance about when or why labeling is effective. The motivating assumption is that the consumer households are in an information deficit – not understanding the benefits that energy efficiency might bring – and thus that better information disclosure would lead to better decision making. However, lab studies of energy labeling have not always supported this assumption. Eye-tracking data shows that European-style ratings of energy efficiency (e.g., A++) attract consumer attention but do not affect choices (Waechter et al. 2015). 5-year automobile fuel savings labels have no effect on consumer preferences for efficient vehicles, but monthly "total cost of ownership" labels do (Dumortier et al. 2015). Likewise, "annual cost" information leads people to choose more energy efficient light bulbs (Min et al. 2014). These apparently divergent findings can be explained by the power of dollar-loss frames: consumers respond more strongly to loss-framed energy information than gain-framed (Bull 2012), and respond more to information labels in dollar frames than to information labels in energy frames (Bull 2012; Camilleri and Larrick 2013).

One reason for the inefficacy of "energy savings" labeling is that consumers discount future gains at a high rate (Frederick et al. 2002). Thus, emphasizing the *benefits* of energy efficiency over time will not have strong effects. However, laboratory studies of intertemporal choice reveal that discount rates are much lower for losses than for gains (Hardisty and Weber 2009; Thaler 1981), consistent with the finding that future losses and future gains are processed using different brain areas (Xu et al. 2009). This suggests that many consumers may be motivated to avoid future financial losses—even far future losses—when the effects of energy inefficiency are framed in terms of costs rather than savings.

However, we propose that when consumers are making purchases, long-term costs are not salient, or at least much less salient than immediate up-front costs. Field data supports this proposition: Alcott (2011) reports that forty percent of American consumers “did not think about fuel costs at all” when purchasing an automobile. In the insurance domain, consumers are five times more sensitive to premiums than to out-of-pocket costs (Abaluck and Gruber 2011). Thus the future operational cost of electric appliances is a type of "shrouded attribute" (Gabaix and Laibson 2006). Although a non-efficient light bulb manufacturer may find it desirable to keep the long-term cost shrouded, this is not necessarily in the best interest of retailers, who often earn higher margins on newer, more efficient products.

Despite the lack of attention to, and the low salience of, long-term costs, it seems likely that most consumers have a latent "long-term cost" minimization goal. Therefore, we proposethat a label focusing on the future energy costs can activate the "future cost" goal, increasing the salience and relevance of the provided information, and thus increasing the proportion of energy efficient choices.

In particular, we focus on the use of a 10-year future dollar cost label to activate this goal. The *10-year* frame ensures that the future cost will be meaningful relative to the upfront cost of the product. This is in accord with literature demonstrating the benefits of "scaling up" the energy cost units from annual operating costs to lifetime costs (Bull, 2012) or from cost per 100 miles to cost per 100,000 miles (Camilleri and Larrick 2013). Consumers perceive energy usage differences between products as larger when scales are expanded (e.g., from cost per month to cost per year) and hence place more weight on energy usage in the decision process. Expanding scales in this way may also lead consumers to broaden their decision frames and to evaluate the consequences over a larger time horizon (Read et al. 1999). In addition, using the familiar dollar frame provides a fluent and easily comprehended future-cost counterweight to the current purchase price. Consumers evaluate dollar costs on a daily basis, when shopping and viewing advertisements. This repeated exposure and practice may make dollar-cost framing more fluent and meaningful than other frames such as kWh or dollar savings.

We use the "10-year energy cost" label rather than other long-term dollar cost frames such as "life-cycle cost" or "total cost of ownership" because it requires fewer assumptions, is more easily calculated, and more easily communicated to consumers. As noted by Shubert and Stadelman (2015) "providing life-cycle information is no easy task and requires several assumptions (e.g., on product lifetime or discount rates), which may be contested". Furthermore, the "10-year energy cost" label is visually fairly simple and can easily be added to existing price labels (similar to unit cost pricing). This stands in contrast to other energy labels (such as the European label) which require a large and specialized layout. Furthermore, the same energy cost formula can easily be applied across multiple product categories (in contrast to total ownership cost, which has idiosyncratic elements in each product category).

In sum, the "10-year energy cost" combines several desirable features: goal activation, scale expansion, transparency, and ease of implementation. As we describe in the studies below, it is quite effective at nudging consumers to choose more energy efficient products, and outperforms alternative energy labels. Taken together, we argue that the "10-year energy cost" label is the best energy labeling technique currently available.

*Background Literature on Goal Activation*

In general, consumers' decisions are influenced by three types of goals: consumption, criterion, and process (Van Osselaer et al. 2005). Consumption goals are the perceived benefits of using the product. In this case, the benefit of the efficient product is lower future dollar costs. Criterion goals are non-consumption goals such as being able to justify a choice or express a personality trait. In this case, some consumers may have the goal to choose the more "sensible" long-term option. Process goals are those about the choosing rather than the final choice, such as a goal to avoid decision effort. The 10-year energy cost labels make it easier to compare immediate and future costs across products, which thus reduces decision effort and potentially satisfies process goals.

All three types of goals function as declarative memories (Kruglanski et al. 2002; Read 1987). As such, they may be activated by associative connections to other concepts in memory or by contextual cues. Critically, goals that are more highly activated are more accessible and have a stronger impact on behavior (Van Osselaer and Janiszewski 2012). Thus, stronger activation of long-term cost goals by the "10-year cost" label leads to more energy efficient choices.

Just as goals can be activated by other memory structures and contextual cues, so too can they be inhibited. In fact, activating one goal often inhibits other goals in a competitive fashion (Brendl et al. 2003); upfront cost labels are ubiquitous and salient, and may thereby *suppress* activation of the long-term cost goals. This provides another reason why long-term cost goals are typically not active and do not influence consumer choice, leading to the "energy paradox" (Jaffe and Stavins 1994). In contrast, activating the long-term cost goal with "10-year cost" labels may also reduce the importance of other goals such as product features and up-front cost. This would further drive consumers to choose more efficient options.

Of course, goal activation will only be effective for those people that actually have the goal. For example, when restaurant goers were subtly given dieting reminders in the menu, current and chronic dieters chose healthy options more often, but non-dieters were not affected (Papies and Veling 2013). Likewise, the "10-year energy cost" labels should only be effective to the extent that they tap into an existing goal in consumers.

In summary, "10-year energy cost" labels serve as a contextual cue to activate consumers' future dollar cost-reduction goal, thereby increasing its importance in the choice process. Where does this latent future dollar cost-reduction goal come from? And why is it more important than other potentially relevant goals, such as gaining future dollar savings, reducing related losses such as kwH cost, or % energy cost? We propose that there are several contributing factors. Over the course of consumers' lives, they evaluate dollar costs when shopping, much more frequently than any other attribute or frame (such as dollar savings or energy cost). Nearly every product has a dollar cost, often prominently displayed. Over time, through practice, this type of information becomes fluent and valued by consumers, more so than other relevant attributes. *Future* dollar costs are also valued and fluent for consumers, but this is often a "shrouded" attribute (Gabaix and Laibson 2006) that is not made salient to consumers. Furthermore, it is *not* an attribute that readily comes to mind without prompting (as seen in the Study 2 results, below). Therefore, future dollar costs are something that consumers care about and are fluent with, yet goals to reduce such costs are latent unless activated by something in the environment such as product labels. Furthermore, future dollar costs are more easily integrated into the decision process than are other attributes, because it is relatively easy to compare and trade off immediate and future dollar costs (as opposed to trading off immediate costs and future savings, for example).

*The Current Research*

The current research makes several contributions to the literatures on choice architecture and consumer goals. First, we introduce an effective nudge that solves the "energy paradox" (Jaffe and Stavins 1994) and can potentially be applied to other decisions with long-term costs. Second, we demonstrate the importance of activating latent goals and matching nudges to consumer goals (Ungemach et al. 2017). Finally, we show that this type of nudge is somewhat selective, helping to move consumers towards their stated goals while not manipulating others who do not share that goal.

In Studies 1a and 1b, we demonstrate the effectiveness of the "10-year energy cost" nudge in a lab study and a field study. In Study 2, we establish the "future dollar cost reduction" goal activation mechanism and compare it to two other potential mechanisms: planning horizon and information provision. In Study 3, we activate the goal via an alternative method (without providing any additional information) and find the same effect on choices. In Study 4, we show that the "future cost reduction" goal is specific to dollar costs, outperforming other labels such as dollar savings or kWh costs. In Study 5, we show that the "10-year energy cost" label is more effective on consumers who self-report a "future cost reduction" goal.

**STUDY 1A: 10-YEAR ENERGY COST LABELS IN THE LAB**

*Method*

In partnership with a government-owned utility company, we recruited 147 community residential energy customers (51% female, median age bracket = 55-64) for a “Power Poll” survey, on a volunteer basis. We did not exclude any participants in any of our studies. Demographics were collected in a previous, intake survey. Participants were randomly assigned to either the control condition or a “10-year estimated cost” condition. All participants faced a series of four choices between different pairs of products: light bulbs, vacuums, televisions and furnaces (in random order). In each pair, one product had a higher price, but used less energy. The dependent variable was the proportion of choices for this more efficient option. Experimental materials for all studies are provided in the online supplemental.

On each product pair page, all participants first read the instruction, “Imagine you are shopping for a [vacuum cleaner]. After careful consideration, you narrowed down your choice to the two options below. Which one would you like to purchase?” In the 10-year cost condition, this was followed by “Note: The 10-year estimated cost is based on the product’s electricity usage, average number of hours of product use, and average electricity rate.” To ensure a high degree of realism as well as a reasonably complex information environment, each product was accompanied by a photograph, purchase price, energy usage (in kWh), brand name, and other relevant product details (such as vacuum bag capacity). In the 10-year cost condition, an additional line of information was added just below the price, for example “10-year estimated cost: $120.66”. Furthermore, other product-specific information was defined to participants as needed (for example, lumens for light bulbs and AFUE for furnaces were described and defined). We calculated the 10-year costs based on typical usage and the typical residential electricity rate ($0.1127 per kWh) in the Vancouver, BC area.

Two of the product pairs (light bulbs and furnaces) were based on real products, and as such had non-identical photos across a pair (accurately depicting each product) and multiple different product attributes. For example, for the lightbulb choice, the inefficient bulb was an 820 lumen, 60 watt GE incandescent bulb for $0.97 with a 10-year cost of $239.40, while the efficient bulb was an 800 lumen, 13 watt Polaroid LED bulb for $17.99 with a 10-year cost of $51.87.

The other two product pairs (televisions and vacuums) were experimentally controlled, hypothetical products that we constructed for the study, which varied only in price and energy usage. After making decisions on all four products, participants answered process questions about important product features, planning horizons, and energy cost estimates.1

*Results*

As seen in Figure 1, the 10-year cost information increased the proportion of energy efficient choices across product categories. This was confirmed with a 2 (condition, between) x 4 (product, within) GLM, which found a main effect of labelling condition, F(1,145) = 33.4, *p* < .001, η2 = .19, a main effect of product, F(3,435) = 15.3, *p* < .001, η2 = .10, and no interaction, F(3,435) = 1.0, *p* = .41, η2 = .01. Pairwise contrasts on the effect of condition for each product separately were all significant at *p* = .002 or lower.

Participants who were retired were more likely to choose the energy efficient option, F(1,143) = 4.4, *p* = .04, η2 = .03, but this did not interact with our manipulation, F(1,143) = 0.8, *p* = .38, η2 = .01. None of the other demographic variables (age, own/rent, business owner, TPS, education, gender, ethnicity, and household income) predicted product choice, nor did they interact with our manipulation.

[Insert Figure 1 about here]

*Discussion*

Across a variety of products, 10-year energy cost labeling increased the proportion of consumers that (hypothetically) chose the more energy-efficient options. These results are consistent with our theory that 10-year cost labeling activates long-term cost goals. We next extend the results to a field setting with real purchases.

**STUDY 1B: 10-YEAR ENERGY COST LABELS IN THE FIELD**

*Method*

Study 1b was run in five branches of a major drug and home goods retailer in a major North-American city over a period of six weeks, during which time we measured the sales of two target light bulbs. One was a 72w Halogen bulb 2-pack for $4.29, and the other was a 23w CFL bulb 2-pack for $12.99. These bulbs were matched on brand name and light quality ("soft white") and similar in level of brightness (1490 lumens Halogen vs. 1600 lumens CFL). We manipulated the price labels used for the bulbs, alternating stores between "control" weeks and "10-year cost" weeks. During "control" weeks, the assigned stores used the regular store labels (see Appendix A), and during "10-year cost" weeks, the assigned stores used a similar label that also displayed the 10-year energy cost of each option ($207 for the Halogen bulbs and $66 for the CFL bulbs). We calculated the 10-year costs based on the watts, 3.5 hours of usage per day (many lightbulb packages estimate usage at 3-4 hours per day) and the typical residential electricity rate ($0.1127 per kWh) in the local area. These costs were then multiplied by two because there were two lightbulbs in each package.(In later studies we switched to showing the 10-year cost per bulb instead, as this was more intuitive to consumers.) Note that we did not discount future costs, because 1) this would be confusing to many lay people, and 2) most people psychologically discount future outcomes, which would lead to “double discounting” if we also formally discounted future outcomes on their behalf.

In the first week of the study, all five stores displayed the control labels. In week 2, three stores had the 10-year cost labels and two had the control labels. In week 3, the store labels were reversed, such that there were two stores with the 10-year cost label and three with the control label. Weeks 4-6 continued this process, switching the labels back and forth each week. The labels were changed by the store managers, and the displays were photographed each week to document the experimental condition and general store environment.

On one endcap (endcaps are shelves of products that are presented at the end of the aisles) at each store, the two target bulb packages were available for purchase, but no other lightbulbs were displayed. (However, a number of other, non-lightbulb products were also displayed on the endcap.) This setup closely mirrored the dichotomous choice paradigm used in Study 1a.2 Store employees recorded the number of bulbs taken from each location each week, and this was checked against sales data from the registers. The dependent variable was the proportion of efficient CFLs purchased.

*Results*

Over the six week study period, there were 26 bulbs purchased in the Control condition, and 29 purchased in the 10-year energy cost condition. We coded each purchase as "1" if it was a CFL purchase, and "0" if it was a Halogen purchase. The energy-efficient CFLs made up 12% of the purchases made with control labels, and 48% of the purchases made with the 10-year energy cost labels, z = 3.3, *p* = .001.

*Discussion*

When lightbulbs were sold on store endcaps, shoppers purchased the energy efficient option relatively more often (i.e., 4 times as often) with 10-year energy cost labeling than with control labeling. This is consistent with our latent goal theorizing and with the results of Study 1a. However, these results may alternately (or additionally) be explained by other mechanisms tied to the 10-year cost labels beyond our goal account. For example, perhaps consumers consistently underestimate long-term costs, and the 10-year cost manipulation increases their estimates and changes their choices. Or, perhaps participants normally take a short time horizon (e.g., a few months to a year) when considering product purchases, and the 10-year cost manipulation nudges them to consider a longer timeframe (up to 10-years); thus changing their choices. In Study 2, we investigate each of these three possible mechanisms. Participants first consider a pair of products, then indicate their product goals and planning horizon, then make their choice, and then estimate their personal long-term energy costs for the inefficient product. Furthermore, in addition to the control and 10-year cost conditions, we also explore 1-year and 5-year cost conditions, to test the importance of metric scaling (Camilleri and Larrick 2013).

**STUDY 2: MEASURING FUTURE COST GOALS**

*Method*

Two hundred forty-two participants (50% female, mean age = 34) were recruited from Amazon Mechanical Turk for a study on decision making. The overall design and stimuli were the same as Study 1a, except that there were four between-subject conditions: control, 1-year cost, 5-year cost, and 10-year cost. We also added several process measures (described below).

For each pair of products, participants first read the instruction "Imagine you are shopping for a [furnace/vacuum/light bulb/TV]. After careful consideration, you narrowed down your choice to the two options below. Please read the product information." After reading the product information (which was the same as in Study 1a), participants answered a question about product goals, "As you consider purchasing a new [vacuum], what product features are most important to you? Please list the three most important product features." This was followed by three free-response fields, labeled "Most important", "Second most important", and "Third most important". On the next page, participants answered a question about planning horizon for that product purchase, "When purchasing a new [vacuum], roughly how far ahead do you plan?". Participants answered using a 7-point scale with labels including "Not at all", "Up to one week", "More than one week up to one month", "More than one month up to one year", "More than one year up to five years", "More than five years up to ten years", and "Ten years or more". On the next page, participants were presented with the product information again and answered the question "Which one would you purchase?" This was the primary dependent variable.

On the next page, participants were shown the product information for only the inefficient product from that product pair, and answered the question "Please imagine that you purchased the [vacuum] above. How much do you estimate your household would spend on energy to use this [vacuum] in your home, over a period of 10 [1] [5] years? Please enter a dollar amount." Participants in the control condition and 10-year cost conditions estimated the 10-year cost, while participants in the other two conditions estimated the 1-year and 5-year cost, respectively. Note that participants in the 1, 5, and 10-year cost condition could just copy the product information if they desired, but they may have felt that their personal usage would be different from the average estimated usage and put a different dollar amount instead.

After completing this procedure for all four product pairs, participants answered a number of demographic questions including gender, age, ethnicity, English language, income, available financial resources in case of an emergency, type of residence, home owner or renter, and how long they plan to stay in their current residence. None of these moderated the results below, and they will not be discussed further.

*Results*

*Product choices.* As seen in Figure 2, participants generally chose the energy efficient option more often in the 1, 5, and 10-year cost conditions than in the control condition, consistent with the results of Studies 1a and 1b. However, the manipulation was less effective for furnaces than for other products. This was confirmed with a 4 (condition, between) x 4 (product, within) GLM, which found a main effect of labeling condition, F(3,238) = 7.9, *p* < .001, η2 = .09, a main effect of product, F(3,714) = 57.1, *p* < .001, η2 = .19, and an interaction, F(9,714) = 7.9, *p* < .01, η2 = .04. Pairwise contrasts for each product reveal different patterns for each product. For furnaces, the 10-year condition is marginally higher than the 1-year condition, t(117) = 1.90, *p* = .06, and no other differences are significant. For lightbulbs, the 1-year, 5-year, and 10-year conditions are significantly above control, each *p* < .001, but not significantly different from each other. For TVs, the 5-year condition is marginally higher than control, t(121) = 1.85, *p* = .07, and the 10-year condition is significantly above control, t(120) = 3.05, *p* < .01, but no other differences are significant. For vacuums, the 10-year condition is significantly higher than every other condition, each *p* < .04 or stronger, but no other differences are significant.

Is there a reliable effect of attribute scaling? In other words, is 10-year cost more effective than 5-year cost, and in turn more effective than 1-year cost? To answer this question, we calculated the proportion of energy efficient choices made by each participant (averaging across the four products). Comparing the three "cost" labeling conditions with an ANOVA confirmed a significant effect of scaling, F(2,178) = 4.0, *p* = .02, η2 = .04. Follow-up pairwise comparisons found that people chose efficient products more often in the 10-year condition (mean = .64) than in the 1-year condition (mean = .48), t(117) = 2.7, *p* = .01. However, the 5-year cost condition (mean = .58) was not significantly different from either the 1-year cost condition, t(118) = 1.8, *p* = .08, or the 10-year cost condition, t(121) = -1.1, *p* = .26. Overall, then, attribute scaling was generally effective, although we could not pinpoint the point at which it became effective.

[Insert Figure 2 about here]

*Product goals*. The "most important" goal for each product was coded by two independent, blind coders for whether it mentioned long-term costs or not. Coders agreed on 91% of the codes (kappa = .91), and disagreements were resolved by discussion. The second and third most important goal listings for each product were each only coded by one of the two coders. We calculated a measure of long-term cost goal prominence by recoding mention of long-term cost as a 3 if it was the first thing the participant mentioned, a 2 if it was second, a 1 if it was third, or a 0 if it was not mentioned.

As seen in Figure 3, future cost labelling generally increased long-term cost goal prominence. Notably, long-term cost goals were generally at or near zero in the control condition, except for furnace purchases, where they were already quite pronounced in the control condition. In the 10-year energy cost condition, long-term costs were mentioned as a goal by 64% of the participants, thus indicating that the majority of consumers have this goal when they are prompted by the 10-year energy cost labels. A 4 (labeling condition, between) x 4 (product, within) GLM confirmed a main effects of labeling condition on long-term goal mentions, F(3,238) = 11.4, *p* < .001, η2 = .13, product, F(3,714) = 32.5, *p* < .001, η2 = .12, and the interaction, F(9,714) = 3.8, *p* < .001, η2 = .05. Long-term cost goal prominence was correlated with choices for light bulbs, r = .33, *p* < .001, TVs, r = .20, *p* < .01, and vacuums, r = .35, *p* < .001, but not furnaces, r = .07, *p* = .28. Furthermore, for light bulbs, TVs, and vacuums, goals predict choices while controlling for labeling condition (all *p* = .02 or lower), and the bootstrapped mediation pathways are significant at *p* = .03 or lower. These results are consistent with a mediating model in which the 10-year energy cost labels activate long-term cost goals, which in turn predict more energy efficient choices.

[Insert Figure 3 about here]

*Planning horizon*. Future cost labeling also slightly increased the participants' planning horizons, from 2.7 (SD = 0.9) in the control condition, to 3.1 (SD = 1.0) in the 1-year cost, 3.2 in the 5-year cost (SD = 1.2), and 3.1 (SD = 1.0) in the 10-year cost condition. In contrast, product type had a much larger effect on planning horizon, from 1.9 (SD = 1.2) for lightbulbs, to 3.4 (SD = 1.1) for TVs, 2.9 (SD = 1.2) for vacuums, and 3.9 (SD = 1.4) for furnaces. A 4 (labeling condition, between) x 4 (product, within) GLM confirmed main effects of labeling condition, F(3,238) = 2.8, *p* = .04, η2 = .03, and product, F(3,714) = 265.8, *p* < .001, η2 = .53, on planning horizon but no interaction, F(9,714) = 3.8, *p* = .58, η2 = .01. Planning horizon was correlated with choices for light bulbs, r = .22, *p* < .001, and vacuums, r = .16, p = .01, but not for furnaces, r = .04, *p* = .53, or TVs, r = .11, *p* = .08. For light bulbs, planning horizon predicts choices while controlling for label condition and partially mediates the effect of label condition on choices, *p* = .01, but the mediation pathways for the other products are non-significant, all *p* > .05.

*Subjective cost estimates*. To put participants' running cost estimates on a common 10-year scale, we multiplied estimates in the 1-year condition by 10, and multiplied estimates in the 5-year condition by 2. The distributions were highly skewed, so we natural log transformed the resulting estimates. As seen in Figure 4, future cost labeling increased participants' future cost estimates for the furnace, light bulb, and TV, but had no effect or even *decreased* estimates for the vacuum. A 4 (labeling condition, between) x 4 (product, within) GLM on cost estimates revealed main effects of labeling condition, F(3,238) = 8.0, *p* < .001, η2 = .09, product, F(3,714) = 322.0, *p* < .001, η2 = .58, and the interaction, F(9,714) = 4.2, *p* < .001, η2 = .05. Cost estimates correlate with choices for TVs, r = .16, *p* = .01, but not for furnaces, r = .04, *p* = .58, light bulbs, r = .11, *p* = .08, or vacuums, r = .03, *p* = .63. For TVs, cost estimates also predict choices while controlling for label condition and marginally mediate the effect of label condition on choices, *p* = .06, but the mediation pathways for the other products are non-significant, all *p* > .10.

[Insert Figure 4 about here]

*Comparison of goal prominence, planning horizon, and subjective cost estimates*. Interventions such as the 10-year energy cost label often have multiple factors driving their efficacy. To help determine the relative contribution of each factor measured in this study, we ran a series of four regression models (one for each product), combining labeling condition and all three process measures into the same model with no interactions. Light bulb choices were predicted by goal prominence, F(1,235) = 13.7, *p* < .001, η2 = .06, planning horizon, F(1,235) = 6.4, *p* = .04, η2 = .03, and condition, F(3,235) = 5.0, *p* < .01, η2 = .06, but not (natural log transformed) cost estimates, F(1,235) = 1.1, *p* = .30, η2 = .01. TV choices were predicted by goal prominence, F(1,235) = 6.5, *p* = .01, η2 = .03, and cost estimates, F(1,235) = 5.3, *p* = .02, η2 = .02, marginally predicted by planning horizon, F(1,235) = 2.7, *p* = .10, η2 = .01, and not predicted by condition, F(1,235) = 1.1, *p* = .36, η2 = .01. Vacuum choices were predicted by goal prominence, F(1,235) = 21.6, *p* < .001, η2 = .08, and planning horizon, F(1,235) = 5.3, *p* = .02, η2 = .02, but not cost estimates, F(1,235) = 1.3, *p* = .25, η2 = .01, or condition, F(3,235) = 1.3, *p* = .29, η2 = .02. Furnace was not predicted by any of the factors, all *p* > .25. Note that in each model, goal prominence is the best predictor, except for furnace choices, for which there are no good predictors.

*Discussion*

Overall, future cost labeling led consumers to choose energy efficient products more often. Furthermore, the effect of 10-year cost labeling was generally stronger than 1-year or 5-year cost labeling, supporting previous findings on scale and metric design (Camilleri and Larrick 2013).

The effect of future cost labeling on choices was partially mediated by the activation of long-term cost goals for three of the four products studied. In other words, after seeing the 10-year cost labels, the majority of consumers say this is something they care about, and in turn make choices based on this active goal. However, for furnace choice, long-term cost goals were already active in the control condition (even without the 10-year energy label), which may explain why the future cost labeling had no effect for furnaces. Increased planning horizon and improved cost estimation seem to play some role in the effectiveness of future cost labeling, but their explanatory power is smaller and less reliable.

An alternative explanation for the effectiveness of the 10-year cost labels could be that people generally underestimate long-term energy costs, and the labels correct those estimates, leading people to place more weight on energy efficiency in their decision making. Inconsistent with this argument, however, the 10-year energy cost labeling was effective for vacuums even though participants were *over*estimating the 10-year cost (in the control condition). Thus the 10-year energy cost label actually lowered participants' cost estimates for this product, yet the label still had a notable impact on choices. This pattern of results suggests that goal activation is more important than increased cost estimation per se.

Although the results of Study 2 imply that future cost goal activation may be an important mediator of the 10-year cost manipulation, these are self-reported findings and the direction of influence between reported goals and choice is indeterminate. When participants listed their product goals they had not yet made an explicit choice between the products. It is possible that they quickly made up their mind and then listed goals to rationalize their choice. Thus, rather than goal activation causing choice, it is possible in Study 2 that the causal arrow goes in the other direction and that anticipated choice drives goal activation. We address this in Study 3 by directly manipulating the mechanism (rather than measuring it), and observing the impact on choice. We use a "subjective estimation" condition that is like the control conditions in previous studies except that participants are asked to estimate the 10-year cost of each product *before* making their choice. We hypothesized that this activation manipulation would have the same effect as the 10-year cost manipulation. This condition also rules out a pure "information provision" account of the 10-year cost condition, as participants in this condition are not given any additional information.

**STUDY 3: ALTERNATIVE GOAL ACTIVATION**

*Method*

One hundred eighty-four participants (44% female, mean age=33) were recruited from Amazon Mechanical Turk and completed the study. Participants were randomly assigned to one of three conditions: control, 10-year cost, or subjective estimation. In all conditions, participants considered four pairs of products (in random order), identical to those used in Study 2. For each pair, participants read the instruction "Imagine you are shopping for a [vacuum] cleaner. After careful consideration, you have narrowed down your choice to the two options below. Please read the product information." The product information was the identical in the control and subjective estimation conditions, while the 10-year cost was provided in the 10-year cost condition (the same as in previous studies).

In the subjective estimation condition, participants next answered two questions (before making their choice): "How many dollars do you estimate you would spend on energy costs to use Product A, over a period of 10 years?" and "How many dollars do you estimate you would spend on energy costs to use Product B, over a period of 10 years?"

In all conditions, participants then answered the question, "Which one would you purchase?" and made their choice between the more efficient Product A and the less efficient Product B. The proportion of Product A choices was the main dependent variable.

Finally, participants completed the Consideration of Future Consequences (CFC) scale to assess their general tendency to consider the future when making decisions (Strathman et al. 1994) and demographics. The CFC scale consists of twelve statements about being more present-oriented or future oriented, such as "I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences", answered on 5-point scales ranging from "extremely characteristic" (+2) to "uncertain" (0) to "extremely uncharacteristic" (-2).

*Results*

*Choices*. As summarized in Figure 5, the pattern of choices in the control and 10-year cost conditions replicated the results of Studies 1 and 2. More importantly, the choices of participants in the subjective estimation condition were nearly indistinguishable from those in the 10-year cost condition. In other words, having participants estimate the 10-year cost of each product had the same effect on choices as giving them that information explicitly. An omnibus GLM with labeling condition (3 levels, between) and product (4 levels, within) confirmed a main effect of labeling condition, F(2,181) = 15.2, *p* < .001, η2 = .14, a main effect of product, F(3,543) = 33.7, *p* < .001, η2 = .16, and no interaction, F(6,543) = 1.1, *p* = .39, η2 = .01. Follow-up pairwise comparisons on each product and labeling condition pair found that the proportion of energy efficient choices in the 10-year cost condition was always significantly greater than the control condition, *p* = .02 or lower, the 10-year cost condition and the subjective estimation condition were never significantly different, all *p* = .31 or greater, and the subjective estimation condition was significantly greater than the control condition for the light bulb, *p* < .001, TV, *p* < .01, and vacuum, *p* = .02, but not the furnace, *p* = .17.

[Insert Figure 5 about here]

*Estimates*. How accurate were participants' estimates of the 10-year cost? Participants' cost estimates were highly skewed. We analyze average estimates (rather than median or log-transformed estimates) because previous research on the wisdom of crowds has found that mean estimates often outperform median or transformed estimates, and we found this to be the case as well. Participants' average estimates in the subjective estimation condition were generally close to the calculated estimates that we used in the 10-year cost condition. The exception is that participants significantly overestimated the 10-year cost of the efficient light bulb, as well as the 10-year cost of both vacuums. For lightbulbs, we estimated the 10-year cost of the efficient bulb to be $51.87 and the inefficient bulb to be $239.40, while participants estimated $180.92 and $343.38. For the vacuum, we estimated $60.97 and $120.66, while participants estimated $433.27 and $586.93. These were significantly different at *p* < .05. For TVs, we estimated $600 and $1,000, while participants estimated $883 and $1,147. For furnaces, we estimated $5,500 and $7,500, while participants estimated $5,512 and $6,179. These (TV and furnace estimates) were not significantly different from our own estimates. Of course, we do not know if our estimates of average usage or the participants' average estimates of their own usage are closer to the truth; previous research suggests that the wisdom of crowds often outperforms the judgment of an expert (Galton 1907).

Do subjective estimates predict choices? In other words, are participants who estimate larger costs more likely to choose the efficient option? To answer this question, we used participants' estimates of energy cost (estimates for each product alternative, as well as difference scores between the cost estimates for the two alternatives for each product) to predict their choices in a series of logistic regressions. None of these were significant, all *p* > .05. As there is substantial skew (and large outliers) in participants' estimates, we also examined non-parametric (rank) correlations between estimates and choices. Although individual product estimates are not correlated with choices (all *p* > .05), difference scores are modestly correlated with choices for bulbs, rho = .27, *p* = .05, vacuums, rho = .31, *p* = .02, TVs, rho = .24, *p* = .07, and furnaces, rho = .22, *p* = .10. In other words, participants who estimate a larger cost difference between products are modestly more likely to choose the efficient product.

*Individual differences*. Contrary to expectations, participants who were more future-oriented as measured by higher score on the Consideration of Future Consequences (CFC) scale were *less* likely to choose the energy efficient product, F(1,178) = 4.3, *p* = .04, η2 = .02, though the effect size is small. A significant interaction with product type, F(1,178) = 4.6, *p* = .03, η2 = .03, indicates that this was more marked for some products than others. Follow-up correlations showed that furnace choices were negatively correlated with CFC, rho = -.26, *p* < .001, and bulb choices, rho = -.16, *p* = .04, while TV choice was marginally related to CFC, rho = -.13, *p* = .09, and vacuum choice was unrelated to CFC, rho = .04, *p* = .63.

None of the demographic or individual difference measures moderated the effects of our experimental conditions. We ran a series of GLMs with condition (3 levels: control, 10-year cost, and subjective estimation), product type (4 levels), and the individual difference variable of interest (e.g., age). None of the individual difference variables we collected (including CFC, gender, age, gender, financial resources, income, own or rent, and how long they expect to stay in their current residence) had any significant interactions with experimental condition. Both the 10-year cost technique and the subjective estimation technique seem to be robust to individual differences.

*Discussion*

Asking participants to estimate the 10-year energy cost of each product had the same general effect as telling them the 10-year energy cost of each product. This supports our account of the causal role of goal activation for influencing choices. Furthermore, it rules out "provision of information" as a necessary component of the 10-year cost effect. In other words, the key ingredient of the 10-year cost intervention is to get consumers to think about long-term cost; the exact numbers used are not as important.

One open question is the specificity of this long-term cost goal, and whether it is distinct from a simple feature salience process. In other words, must the energy label be framed as long-term dollar costs to be effective, or would other frames such as long-term savings or % energy costs work equally well? After all, highlighting any product attribute should increase its influence on choice. However, we hypothesize that the "10-year energy cost" label is uniquely effective because it taps into a latent "long term dollar cost" goal in consumers. We address this in Study 4, by comparing the 10-year (dollar) cost intervention with alternative frames, including dollar savings, energy cost, and energy savings. In Study 5, we further address this by demonstrating that the "10-year energy cost" label is somewhat selective, having a stronger effect on consumers who self-report having the relevant goal.

**STUDY 4: SPECIFICITY OF FUTURE DOLLAR COST GOAL**

*Method*

A total of 1155 participants (40% female, mean age = 33) were recruited from Amazon Mechanical Turk and randomly assigned to one of seven conditions. The overall design was a 2 Goal Framing (Gain/Loss) x 3 Cost Framing (Dollar/Energy/Percentage) + 1 Control between-subjects design. All participants were asked to choose between a pair of packaged light bulbs where one package was halogen (i.e., less energy efficient but less expensive) and the other was fluorescent (i.e., more energy efficient but more expensive), the same products used in Study 1a. The dependent variable was the proportion of participants choosing the energy efficient option.

Participants were asked, “Imagine you are shopping for a light bulb. Which one would you like to purchase?” In the Control condition, the information for the light bulbs was presented in accord with the original package information as sold in the store. In the Gain (Loss) Framed Dollar condition, the information presented for each light bulb reflected how much money, in dollars, each product would save (cost) over the course of ten years. Savings estimates were relative to a 100-watt incandescent bulb (this is a standard comparison product for lightbulbs of this brightness). In the Gain (Loss) Framed Energy condition, the information reflected how much energy, in kilowatt-hours, each product would save (cost); in the Gain (Loss) Framed Percentage condition, the information reflected each light bulb’s ten-year energy cost gain (loss), in percentage, as compared to a standard 100 watt incandescent bulb. For each of these conditions, it was noted that the ten-year energy cost presented in the information was based on the product’s electricity use, average number of hours used, and the average electricity rate.

After participants made their choice between the two light bulbs, they were presented with manipulation check questions. Participants were then presented with various demographic questions such as age, gender, ethnicity, country of birth, and income.

*Results*

People chose the energy efficient lightbulb more often in the 10-year dollar cost (loss) condition than in any other. In the control condition, 56% chose the efficient option, as compared with 84% in the 10-year dollar cost condition, 68% in the 10-year kWh cost condition, 67% in the percent energy cost condition, 71% in the 10-year dollars saved condition, 66% in the 10-year kWh saved condition, and 73% in the percent saved condition. An omnibus ANOVA across the seven conditions found a significant effect of condition, F(6,1148) = 5.6, *p* < .001, η2 = .03. Follow-up pairwise contrasts showed that the 10-year dollar cost condition was significantly higher than all the other conditions, all *p* = .02 or less. The other five non-control conditions were not significantly different from each other, all pairwise comparisons *p* = .13 or greater. However, they were generally significantly greater than control: dollars saved, *p* < .01, energy saved, *p* = .07, percent saved, *p* = .001, energy cost, *p* = .02, and percent cost conditions, *p* = .04.

*Discussion*

Participants faced with the 10-year dollar cost framing were much more likely to choose the energy efficient option than participants faced with the control message, replicating earlier studies. Moreover, the 10-year dollar cost frame was more effective than all of the alternative frames (that are currently used in retail stores) such as dollar savings or percentage energy savings. These alternative frames were all very similar, whether featuring gains (savings) or losses (costs), which would seem to rule out loss aversion on its own as the critical ingredient driving the 10-year cost effect.

However, these alternative frames *were* somewhat more effective than the "no additional information" control. This suggests that the effectiveness of the 10-year cost labeling may have two components. The first component is derived from adding *any* informative scaled and translated attribute (Ungemach et al. 2017); portraying one product as better increases the attractiveness of that product. The second component is that the dollar cost frame is much more effective than other informational frames, consistent with our proposition that this frame activates a latent "long term cost minimization" goal.

An implication of the "long term cost reduction" goal activation hypothesis is that consumers who self-identify as having a long-term cost goal should respond more strongly to the label. In other words, the nudge should be selective. We explore this in Study 5, examining the effectiveness of the 10-year energy cost nudge (vs. % energy savings labels or control) for people with strong vs. weak future cost goals. We also compared the moderating influence of future cost goals vs. other individual differences, such as Consideration of Future Consequences (Strathman et al. 1994) and temporal discounting (Frederick et al. 2002). We counterbalanced the order of product choices and individual difference measures, and although order of measurement was not predicted to matter, it did.

**STUDY 5: SELECTIVITY OF 10-YEAR ENERGY COST NUDGE**

*Method*

Seven hundred three participants were recruited from MTurk and completed the study. All participants completed four blocks of questions: product choices, distractor items, goal measures, and then demographics. Half the participants were randomly assigned to a different order, completing goal measures first, then distractor items, product choices, and demographics. For the product choices, participants were randomly assigned to one of three labeling conditions: no-information control condition, % energy savings, or 10-year energy cost. Thus, the overall design was 3 (label condition) x 2 (block order) between subjects.

Participants in the "choice first" condition first made a series of four choices between efficient and inefficient lightbulbs, TVs, vacuums, and furnaces, in one of the three energy labeling conditions (between-subjects). The product pairs were the same as in Studies 1a, 2, and 3. The control and "10-year energy cost" conditions were the same as in previous studies, and the "% energy savings" condition was similar to Study 4. For savings information, a benchmark must be chosen, and this benchmark was specified in a note below the products. An example can be found in Appendix B, and the complete stimuli can be found in the supplemental materials.

Subsequently, participants completed two individual difference measures meant to serve as distractor activities: the Regulatory Focus Questionnaire (RFQ, Higgins et al. 2001) and the Maximization Scale – short form (Nenkov et al. 2008). Next, participants completed three individual difference measures related to future outcomes: discounting of losses, future product cost goals, and the CFC scale (Strathman et al. 1994). The discounting of losses scale had participants make a series of eight choices between paying $30 immediately or paying a different amount in one year. The future amount was $25, $30, $35, $40, $45, $50, $75, or $100. The measure of future product goals consisted of two3 statements: "When I am shopping for a product for my home, I tend to seek information about long term costs", and "I care more about the upfront price of the product than the long-term cost" (reverse coded), answered on 7-point scale ranging from "strongly disagree" (-3) to "uncertain" (0) to "strongly agree" (+3). Finally, participants completed demographic measures, including age, gender, income, ethnicity, education, available resources, whether the person owns or rents their residence, and how long the person intends to stay in their current residence.

*Results*

*Order effects on choices*. Participants chose energy efficient products more often with the 10-year energy cost nudge than with a no-added-information control or an alternative energy metric (% energy savings), replicating the results of previous studies. However, there is also an order effect, such that the effect of the energy labeling condition was stronger when participants completed the product choice task first than when they completed it last. When participants made their product choices first, they chose the energy efficient option 32% of the time in the control condition, 38% in the percent savings condition, and 56% in the 10-year cost condition. In contrast, when participants made their product choices at the end of the study, they chose the energy efficient option 43% of the time in the control condition, 41% in the percent savings condition, and 52% in the 10-year cost condition. A repeated-measures GLM with labeling condition, order condition, and product type predicting choice confirms a main effect of labeling condition, F(2,697) = 18.4, *p* < .001, η2 = .05, no main effect of order, F(1,697) = 2.0, *p* = .16, η2 = .00, but a significant label by order interaction, F(2,697) = 3.5, *p* = .03, η2 = .01. A possible explanation for this interaction is an attention effect: after completing the numerous individual difference measures, participants may have been less careful in their reading and responding, thus moving all choice proportions closer to 50%. Nonetheless, follow-up ANOVAs show that the effect of label is significant both when choices are first, F(2,360) = 19.7, *p* < .001, η2 = .10, and when choices are last, F(2,337) = 3.2, *p* = .04, η2 = .02. Also unexpectedly, a labeling condition by product interaction, F(6,697) = 10.7, *p* < .001, η2 = .03, revealed that the effect of "10-year energy cost" labeling was significantly stronger for lightbulbs and furnaces than for TVs and vacuums, though the pattern was similar for all products. The furnace data was generally the weakest in previous studies, yet it was stronger than TVs and vacuums in this study. The three-way interaction of product, labeling, and order was not significant, F(6,697) = 1.5, *p* = .17, η2 = .00.

*Future cost goals*. The two future cost goal questions were correlated r = .32, *p* < .001, Chronbach's α = .49, and were averaged to create a single index4 (mean = 0.2, SD = 1.3, min = -3.0, max = 3.0). As expected (due to the distractor items), future cost goals were not influenced by order of measurement, labeling condition, or the interaction, all *p* > .19. Next, we looked at whether future cost goals predicted choices and/or moderated the effect of labeling. A repeated-measures GLM with label condition, order, future cost goals (as a continuous predictor), and product found a main effect of future cost goals, F(1,691) = 92.5, *p* < .001, η2 = .12, indicating that people who cared more about future product costs were more likely to choose the energy efficient option (collapsing across condition). This was qualified by a future cost goal by labeling condition interaction, F(2,691) = 3.2, *p* = .04, η2 = .01, indicating that future cost goals had a greater impact on choice in the "10-year energy cost" condition than in the other labelling conditions. Figure 6 visualizes this moderation by comparing the effect of labelling on people that are -1 SD vs. +1 SD on future cost goals. Regressions using long-term cost goals to predict choice explain 6% of variance in the control condition, 12% of variance in the "% energy savings" condition, and 20% of variance in the "10-year energy cost" condition. This is consistent with the theory that "10-year energy cost" labelling activates latent future cost goals. There were not any interactions between future cost goals and order of measurement, all *p* > .20.

[Insert Figure 6 about here]

*Other individual difference measures*. Discounting of future losses did not predict choices, F(1,691) = 0.8, *p* = .36, η2 = .00, nor did it interact with labelling, *p* = .54, nor did it interact with order or product or any combinations. CFC predicted more choices for the energy efficient product, F(6,691) = 27.4, *p* < .001, η2 = .04, but did not interact with labeling condition, F(6,691) = 1.4, *p* = .25, η2 = .00, and did not interact with order or product or any combinations.

*Demographic measures*. There were no significant main effects or interactions for education, income, available resources, owning vs. renting, or how long the person plans to stay in his/her current residence.

*Discussion*

Study 5 showed that people were more likely to choose energy efficient options when presented with the 10-year energy cost, replicating the results of previous studies. Again, the 10-year energy cost label was more effective than an alternative energy label (the % energy savings label, in this case).

Participants who self-reported being motivated by long-term costs were more affected by the 10-year energy cost labels, thus demonstrating that this nudge is somewhat selective. In other words, it has a stronger effect on those consumers who express a nudge-consistent goal. In contrast, other individual difference measures such as general concern with the future (i.e., the CFC), did not moderate the effect of the "10-year energy cost" nudge.

An implication of the long-term cost-minimization goal is that consumers should prefer this frame over alternatives (such as percentage energy) if given the explicit choice of which information frame to see. This could be explored in future research.

**GENERAL DISCUSSION**

Across multiple studies and products, we showed that 10-year energy cost labelling is a powerful nudge. It has the potential to improve long-term outcomes for consumers (through reduced long-term costs) and the environment (through decreased carbon emissions). This intervention could also be applied to other products that offer significant future cost savings, such as printers (and printer ink), electric razors (vs. disposables) or rechargeable batteries. We show that this intervention is driven (in part) by activating consumers' latent goal to minimize long-term costs, and that having consumers “self-activate” this goal has a similar impact on choices. Furthermore, we show that the "dollar cost" energy label has a stronger impact on choices than other similar labels, such as dollar savings, kWh cost, or % energy cost, and that it is somewhat selective, having a greater impact on consumers who report a goal of minimizing future product costs.

One process driver we did not investigate is perceived risk (Qiu et al. 2014). Consumers may worry that they will not receive the promised future advantages of energy efficient options. It is possible that the 10-year energy cost label made future outcomes more tangible and concrete, and thus decreased the perceived risk of energy efficient options. Similarly, our 10-year cost manipulation (provided by the experimenter or by the local store) may have increased trust in the future cost claims (relative to labeling by the brand). However, this alternative does not account for the efficacy of the “subjective estimation” manipulation.

The 10-year energy cost labels are consistent with the "SCORE" principles outlined by Larrick, Soll, and Keeney (2015). 10-year energy cost labels are relatively *simple* (especially compared with total cost of ownership), they focus on *consumption* (rather than efficiency, as the European style labels do), they link energy information to an *objective* (i.e., minimizing future dollar costs) that people value, they enable *relative* comparisons between products (unlike energy star labels), and they provide information on an *expand*ed scale (10-year energy cost rather than annual energy cost). One open research question is how far the scale can be expanded. Would 30-year energy cost be more persuasive than 10-year energy cost? What about 100-year energy cost? At some point, disfluency, irrelevancy, and reactance may overtake the benefits of an expanded scale. A related question is whether 10-year cost may be more effective than 9-year cost or 11-year cost, due to greater familiarity and fluency with a round number.

Another interesting future direction would be to calculate the impact that 10-year energy cost labels have on discount rates (similar to Min et al. 2014) and see whether the resulting implicit discount rates approach market rates for investment and borrowing (e.g., credit card interest rates). If so, 10-year energy cost labels could address the challenge raised by Allcott and Taubinsky (2014, pg. 21), "The theoretically ideal way to address imperfect information and inattention would be a powerful and costless nationwide information disclosure technology. Subsidies and standards have been proposed as second-best policies with the idea that practically feasible information disclosure programs either do not fully remove bias or are too costly to scale."

An important open question is whether some people are hurt by a nudge such as 10-year cost labels. It is possible that some consumers end up buying a product that does not give them a good return on investment, relative to their other opportunities and debts (Sahoo and Sawe 2015). Thus, when applied more broadly the 10-year energy cost labels should be tailored to the consumer's environment where possible – e.g., with country- and state-specific usage and pricing information (Davis and Metcalf 2014). More generally, it would be interesting and managerially useful to extend these effects from product labelling and in-store displays to other types of advertising.

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Footnotes

1 We put these process measures after the choices to avoid contaminating responses. However, *retrospective* self-reports on mental processing are unreliable (Nisbett and Wilson 1977), and indeed none of these measures yielded significant results, hence they will not be discussed further.

2 The store also gave us the opportunity to manipulate the labels on two of the (many) lightbulbs in the aisle. The results of this exploratory condition, presented in the online supplement, provide an interesting wrinkle on dichotomous vs. multi-option choice.

3 These two questions were initially developed in an exploratory fashion as part of a larger set of eight items, and chosen for the highest *r*2 for predicting energy efficient product choices.

4 Results are similar with either individual measure of future cost goals. However, the greatest main-effect explanatory power for predicting energy efficient choices comes from the combination of these two items, so we have chosen this index for all our analyses.

**FIGURE 1**

*PROPORTION OF ENERGY EFFICIENT CHOICES IN THE CONTROL AND 10-YEAR COST CONDITIONS IN STUDY 1A. ERROR BARS SHOW +/- ONE STANDARD ERROR.*

**FIGURE 2**

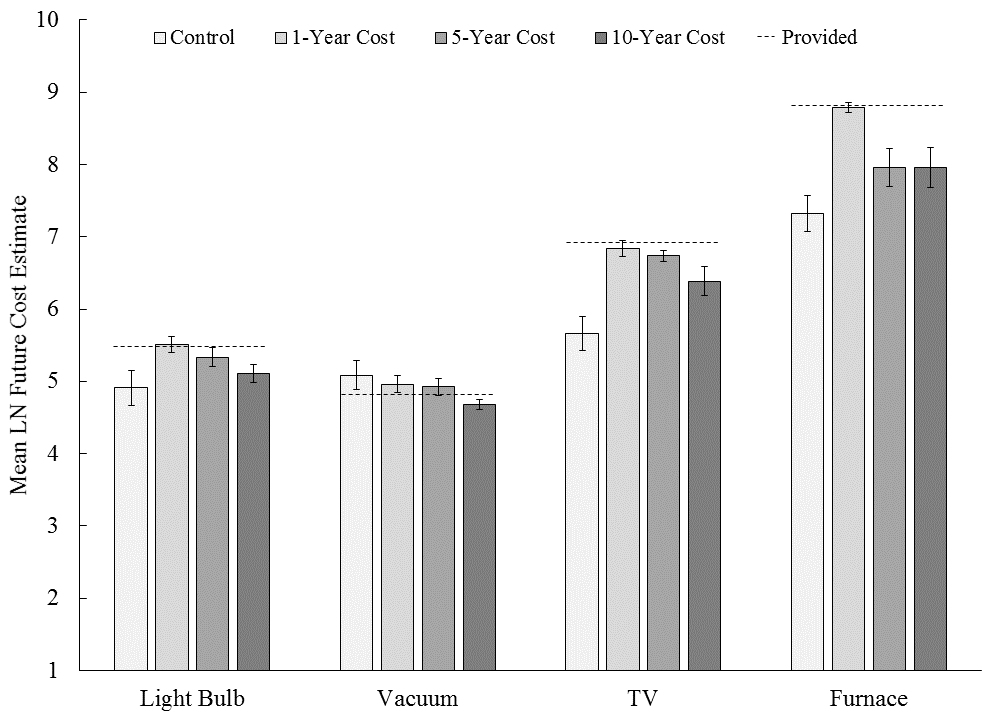
*PROPORTION OF ENERGY EFFICIENT CHOICES IN THE CONTROL, 1-YEAR, 5-YEAR AND 10-YEAR COST CONDITIONS IN STUDY 2. ERROR BARS SHOW +/- ONE STANDARD ERROR.*

**FIGURE 3**

*MEAN FUTURE COST GOAL PROMINENCE IN THE CONTROL, 1-YEAR, 5-YEAR AND 10-YEAR COST CONDITIONS IN STUDY 2. ERROR BARS SHOW +/- ONE STANDARD ERROR.*

**FIGURE 4**

*MEAN NATURAL LOGGED FUTURE COST ESTIMATES IN THE CONTROL, 1-YEAR, 5-YEAR AND 10-YEAR COST CONDITIONS IN STUDY 2, AS WELL AS THE ESTIMATE THAT WAS PROVIDED TO PARTICIPANTS IN THE 1-YEAR, 5-YEAR, AND 10-YEAR COST CONDITIONS. ERROR BARS SHOW +/- ONE STANDARD ERROR.*



**FIGURE 5**

*PROPORTION OF ENERGY EFFICIENT CHOICES IN THE CONTROL, 10-YEAR COST, AND COST ESTIMATION CONDITIONS IN STUDY 3. ERROR BARS SHOW +/- ONE STANDARD ERROR.*

**FIGURE 6**

*PROPORTION OF ENERGY EFFICIENT CHOICES IN THE CONTROL, % ENERGY SAVINGS AND 10-YEAR ENERGY COST CONDITIONS IN STUDY 5, COLLAPSING ACROSS PRODUCT TYPE AND ORDER, AS A FUNCTION OF WHETHER PARTICIPANTS REPORTED LOW FUTURE COST GOALS (-1 SD) OR HIGH FUTURE COST GOALS (+1 SD). ERROR BARS SHOW +/- ONE STANDARD ERROR.*

Appendix A: Light Bulbs and Labels Used in Study 1b





Appendix B: Example of Stimulus in Study 5

