Encouraging Energy Efficiency: Product Labels Activate Temporal Tradeoffs

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Abstract: Why has the uptake of energy efficient products been so slow despite substantial investment in public awareness campaigns? We propose that many consumers have a latent "long-term cost minimization" goal related to energy-consuming products. However, when consumers purchase such products, they do not think about long-term costs. Through a "10-year energy cost" label, we activate this latent goal, thus increasing the proportion of energy efficient choices in a field study in five drug stores over a period of six weeks. In a series of four lab studies, we confirm the suggested psychological mechanism and demonstrate the efficacy of this technique relative to existing alternatives.

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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 (Hausman, 1979; U.S. Energy Information Administration, 2010). These wasteful choices are bad not only for consumers' budgets, but also for society and the environment. For these reasons, inefficient lightbulbs were outlawed in several U.S. states and Canadian provinces. However, legal prohibitions such as these often have unintended consequences, and some consumers may be pushed in a direction that is not in their self-interest (Sahoo & Sawe, 2015). Thus, we explore solutions to this dilemma that preserve consumers’ freedom of choice, and "nudge" consumers in the right direction.

Towards this goal, a number of "choice architecture" techniques (Thaler & Sunstein, 2008) have been developed. Broadly, these fall into three categories: defaults, information restructuring, and information feedback (Camilleri & 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, Johnson, Goldstein, & Liu, 2011). This happens partly because the default option becomes the "status quo" choice, and people are more likely to think of good things in its favor. *Information restructuring* can be used to highlight energy efficiency information for consumers, for example by labelling efficient products with the "energy star" certification. This method is intuitively appealing and inexpensive to implement. Although studies using information provision to increase energy efficient choices have sometimes found positive effects (Bull, 2012; Camilleri & Larrick, 2013; Min, Azevedo, Michalek, & de Bruin, 2014), other studies have found mixed or null results

(Abrahamse, Steg, Vlek, & Rothengatter, 2005; Anderson & Claxton, 1982; Waechter, Sütterlin, & Siegrist, 2015). *Information feedback* is used to regularly update consumers about the consequences of their energy choices, for example through smart meters (Sintov & Schultz, 2015). Direct feedback such as this 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 (e.g., a happy face for saving energy, Shultz, Nolan, Cialdini, Goldstein, & Griskevicius, 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.[1] 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 -- with *n*s as low as 16 per cell -- so results should be interpreted with caution.) The reason why labels were more effective for the small refrigerators may be that the size of the energy cost relative to the

[1] "Sales staff emphasis" of energy information was also manipulated, but had no effect.

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, & Hermansen (2013) provided information on lifetime energy costs of fridge-freezers and tumble driers at six electrical retail stores in Norway. (Note that 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 labeling alone had no effect, while 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 & Taubinsky (2015) approached 1,561 potential lightbulb customers in four "big box" stores 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 CFLs versus incandescent. 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 (Deutsch, 2010a, 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, Miles, Polonsky, & Vocino, 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? The role of asymmetric temporal discounting

Taken together, this set of field studies shows modest and somewhat unreliable effects of energy labeling on purchase decisions. Furthermore, it provides 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 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 dollar frames than to energy frames (Bull, 2012; Camilleri & Larrick, 2013).

Consumers discount future benefits at a high rate (Frederick, Loewenstein, & O'Donoghue, 2002; Lynch & Zauberman, 2006), which helps explain why emphasizing the *benefits* of energy efficiency has such unreliable results. However, future losses and future gains are processed using different brain areas (Xu, Lian, Wang, Li, & Jiang, 2009) and lab studies of intertemporal choice reveal that discount rates are much lower for losses than for gains (Hardisty & Weber, 2009; Mischel, Grusec, & Masters, 1969; Thaler, 1981). In some cases, people even want to get losses over with immediately (Hardisty, Appelt, & Weber, 2013), leading to negative discount rates for loss. For example, when given the choice between paying $70 today or paying $70 in one month, 50% of people prefer to pay it immediately. 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.

In particular, we test the proposition that many consumers have a latent "long-term cost minimization" goal. We propose that normally when consumers are making purchases, long-term costs are not salient, or at least much less salient than immediate up-front costs. However, a label focusing on future costs can activate the "future cost" goal, thus increasing the proportion of energy efficient choices.

We focus on the use of a 10-year future dollar cost label to activate this goal. 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 & Larrick, 2014). Consumers perceive energy usage differences between products as larger when scales are expanded (e.g., from cost per month to cost per year) and place more weight on energy usage in the decision process. Expanding scales in this way may also lead consumers to broaden their decision frames (Read, Loewenstein, and Rabin 1999), evaluating the consequences over a larger time horizon., 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 when 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 & 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".

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 cost" goal activation mechanism and compare it to two other mechanisms: planning horizon and information provision. In Study 3, we directly manipulate the goal activation mechanism (without providing any information about energy use to participants) and find the same effect on choices. In Study 4, we show that the "future cost" goal is specific to dollar costs, outperforming other frames such as dollar savings or kWh costs.

Study 1a: 10-year energy cost labels and efficient choices in the lab

Method

In partnership with a government-owned utility company in British Columbia, Canada (BC Hydro), we recruited 147 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: furnaces, vacuums, light bulbs, and televisions (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 product in use, and average electricity rate.” To ensure a high degree of realism, each product was accompanied by a photograph, purchase price, energy usage (in kwh), brand name, and other relevant product details (such as vacuum 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 information was explained to participants as needed (for example, lumens for light bulbs and AFUE for furnaces). 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 different photos (accurately depicting each product) and multiple different product attributes. For example, for the lightbulb choice, the inefficient bulb was a 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. We chose to focus on energy costs rather than total cost of ownership (including replacement costs) for several reasons. 1) Whereas energy cost is relatively clear and easy to calculate (e.g., a 60 watt bulb uses 60 watts of electricity), other ownership costs such as product lifetime have more uncertainty and depend more on usage conditions 2) Energy cost is easier to communicate to consumers. 3) The same energy cost formula can easily be applied across multiple product categories (in contrast to total ownership cost, which has idiosyncratic aspects in each product category).

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.[2]

Results

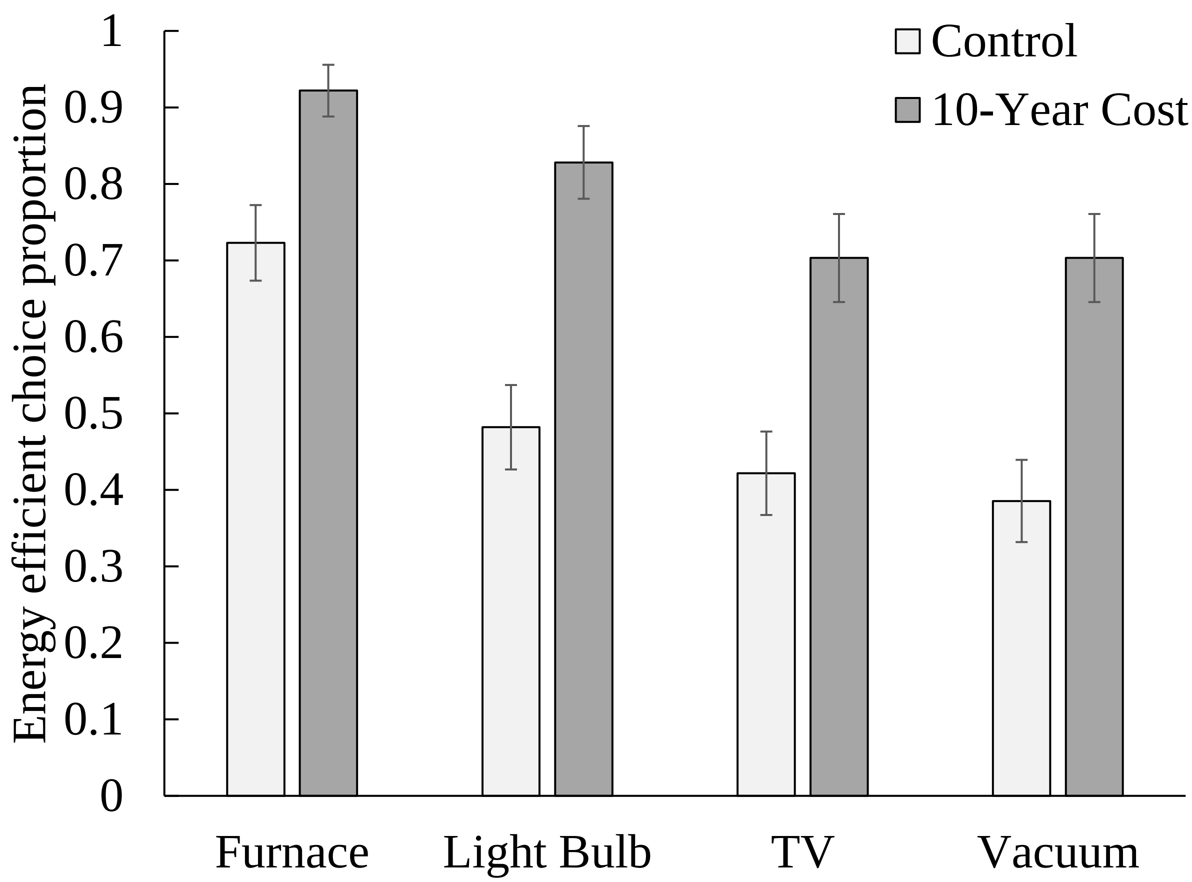
As seen in Figure 1, the 10-year cost information increased the proportion of energy efficient choices. This was confirmed with a 2 (condition, between) x 4 (product, within) GLM, which found a main effect of labelling condition, $F(1,145) = 33.4$, $p < .001$, $\eta^2 = .19$, a main effect of product, $F(3,435) = 15.3$, $p < .001$, $\eta^2 = .10$, and no interaction, $F(3,435) = 1.0$, $p = .41$, $\eta^2 = .01$. 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, $F(1,143) = 4.4$, $p = .04$, $\eta^2 = .03$, but this did not interact with our manipulation, $F(1,143) = 0.8$, $p = .38$, $\eta^2 = .01$. 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.

Figure 1

Proportion of energy efficient choices in the control and 10-year cost conditions in Study 1a. Error bars show +/- one standard error.

[2] We put these measures after the decision was complete to avoid demand effects or contaminating responses in any way. However, retrospective self-reports on mental processing are often unreliable (Nisbett & Wilson, 1977), and indeed none of the process measures in this study yielded significant results, hence they will not be discussed further. In Study 2, we employed these same process measures *during* the decision task, which is a proven method (e.g., Appelt, Hardisty, & Weber, 2011; Johnson, Haubl, & Keinan, 2007), and we report the methods and results in Study 2, below.



Discussion

Across a variety of products, 10-year energy cost labeling increased the proportion of consumers that 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 efficient choices in the field

Method

This study was run in five London Drugs home goods stores[3] in greater Vancouver (stores A, B, C, D, and E), 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 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, according to the schedule shown in Table 1. During "control" weeks, the assigned stores used the regular store labels (shown in 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 Vancouver area. These costs were then multiplied by two because there were two lightbulbs in each package.[4]

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, other, non-lightbulb products were also on the endcap.) This setup closely mirrored the dichotomous choice paradigm used in Study 1a.[5] Store

[3] London Drugs is a mid-size western Canadian chain retailer of home and health products

[4] In later studies we switched to showing the 10-year cost per bulb instead, as this was more intuitive to consumers. Also, 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.

[5] The store also gave us the opportunity to manipulate the labels on two of the (many) lightbulbs available in the aisle. The results of this exploratory condition (as well as a follow-up lab study we conducted) provide an interesting wrinkle but one that is not central to our story, so we present this data in Appendix B.

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.

Table 1

Experimental design for Study 1a. "NA" indicates data that was dropped due to an error in the experimental procedure at that week and location.

Store	**Week 1 09-Mar**	**Week 2 16-Mar**	**Week 3 23-Mar**	**Week 4 30-Mar**	**Week 5 06-Apr**	**Week 6 13-Apr**
A	Control	10-year	Control	10-year	Control	10-year
B	Control	Control	10-year	Control	10-year	Control
C	Control	10-year	Control	10-year	Control	10-year
D	Control	Control	10-year	Control	10-year	Control
E	Control	10-year	Control	10-year	Control	NA

Results

Over 6 weeks, 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. Consumers chose the energy-efficient CFL 12% of the time with the control labels, and 48% of the time 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 much more 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.[6] However, these results may alternately (or additionally) be explained by other mechanisms. 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 & Larrick, 2013).

Study 2: Activating future cost minimization goals

Method

242 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 1, 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).

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[6] Although the effect size is fairly large, there is an important caveat as we discovered in another condition and follow-up study (reported in Appendix B): while the 10-year energy cost labelling is effective if it is applied to all of the products in a display, it is not effective if only two products are labeled out of a multi-product display.

For each pair of products, participants first read the instruction "Imagine you are shopping for a [furnace]. 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 1b), 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?" On a 7-point scale with "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 DV.

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 furnace 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.

Results

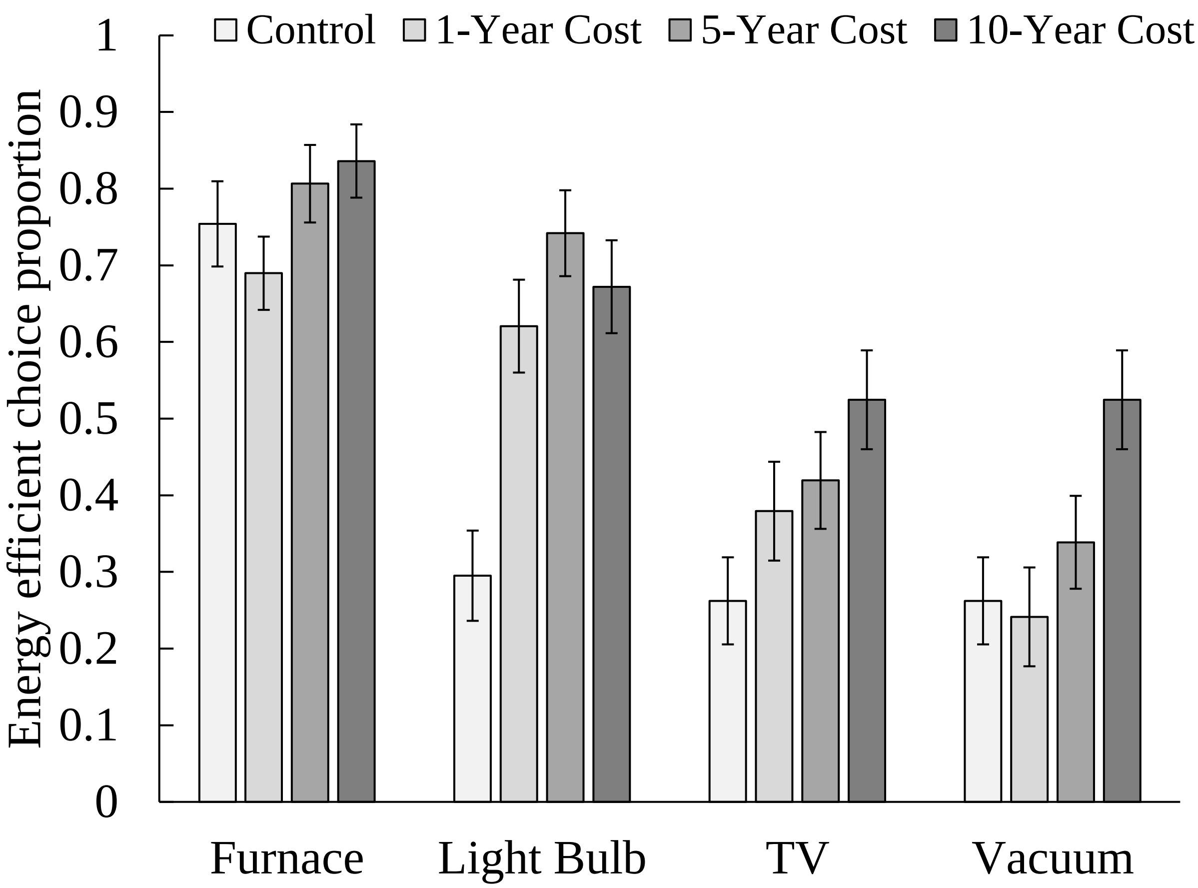
Product Choices

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 Study 1. However, the effectiveness of 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, $F(3,238) = 7.9$, $p < .001$, $\eta^2 = .09$, a main effect of product, $F(3,714) = 57.1$, $p < .001$, $\eta^2 = .19$, and an interaction, $F(9,714) = 7.9$, $p < .01$, $\eta^2 = .04$. Looking at pairwise contrasts 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, $F(2,178) = 4.0$, $p = .02$, $\eta^2 = .04$. 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 than 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 moderately effective.

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.



Product Goals

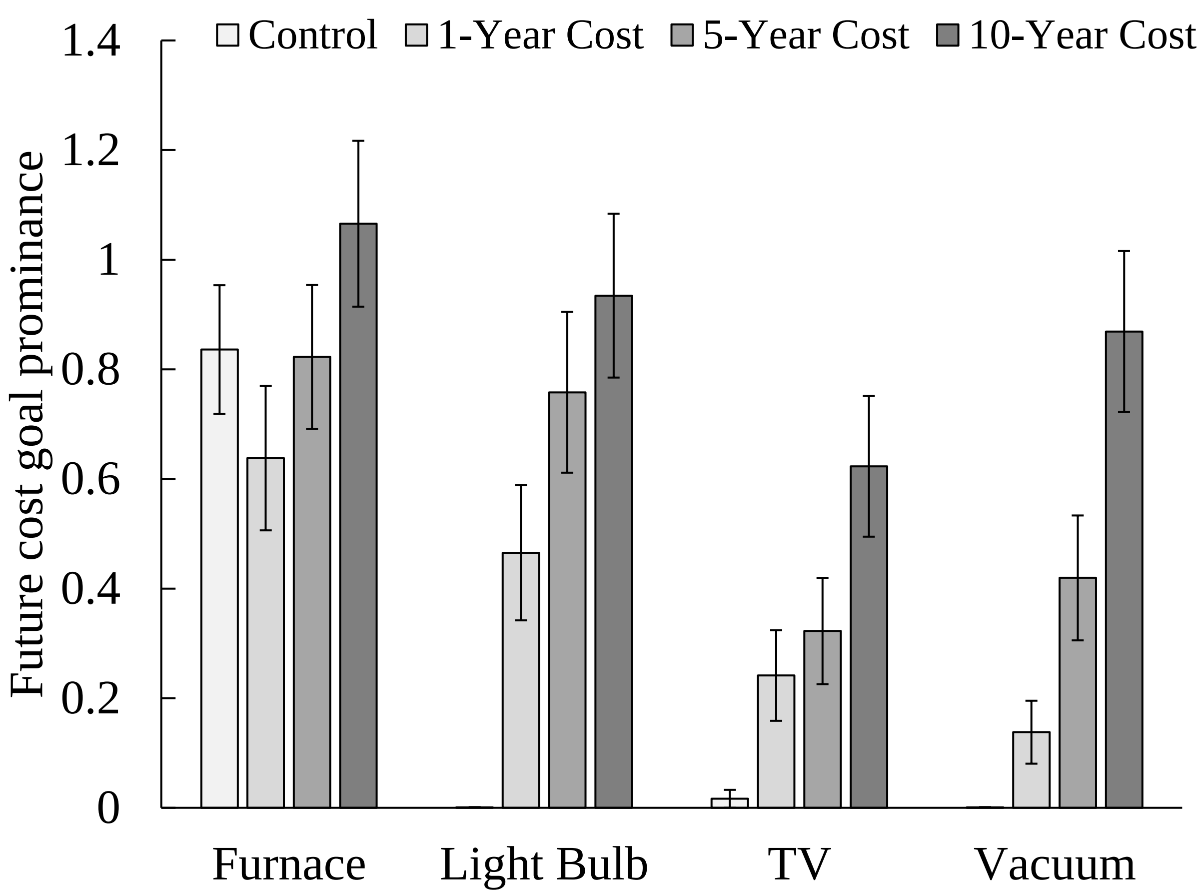
The "most important" goal for each product was coded by two independent, blind coders for whether it mentioned long-term costs or not. Coders agreed on 94% of the codes, and disagreements were resolved by discussion. The second and third most important goal listings for each product were each only coded 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. A 4 (labeling condition, between) x 4 (product, within) GLM confirmed a main effects of labeling condition, $F(3,238) = 11.4$, $p < .001$, $\eta^2 = .13$, product, $F(3,714) = 32.5$, $p < .001$, $\eta^2 = .12$, and the interaction, $F(9,714) = 3.8$, $p < .001$, $\eta^2 = .05$.

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.

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.

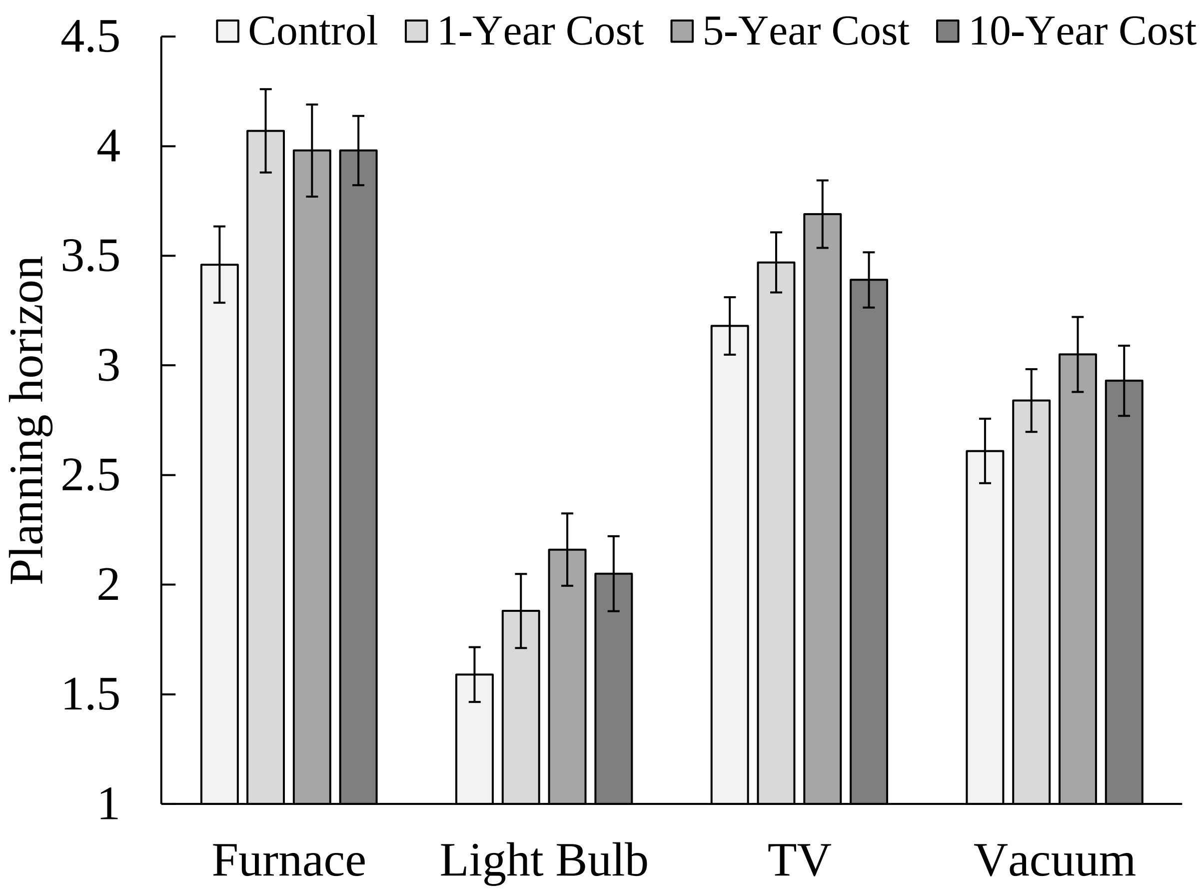


Planning Horizon

As seen in Figure 4, future cost labeling slightly increased the participants' planning horizons. A 4 (labeling condition, between) x 4 (product, within) GLM confirmed main effects of labeling condition, $F(3,238) = 2.8$, $p = .04$, $\eta^2 = .03$, and product, $F(3,714) = 265.8$, $p < .001$, $\eta^2 = .53$, but no interaction, $F(9,714) = 3.8$, $p = .58$, $\eta^2 = .01$. 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 $p > .05$.

Figure 4

Mean planning horizon distance in the control, 1-year, 5-year and 10-year cost conditions in Study 2. Error bars show +/- one standard error.

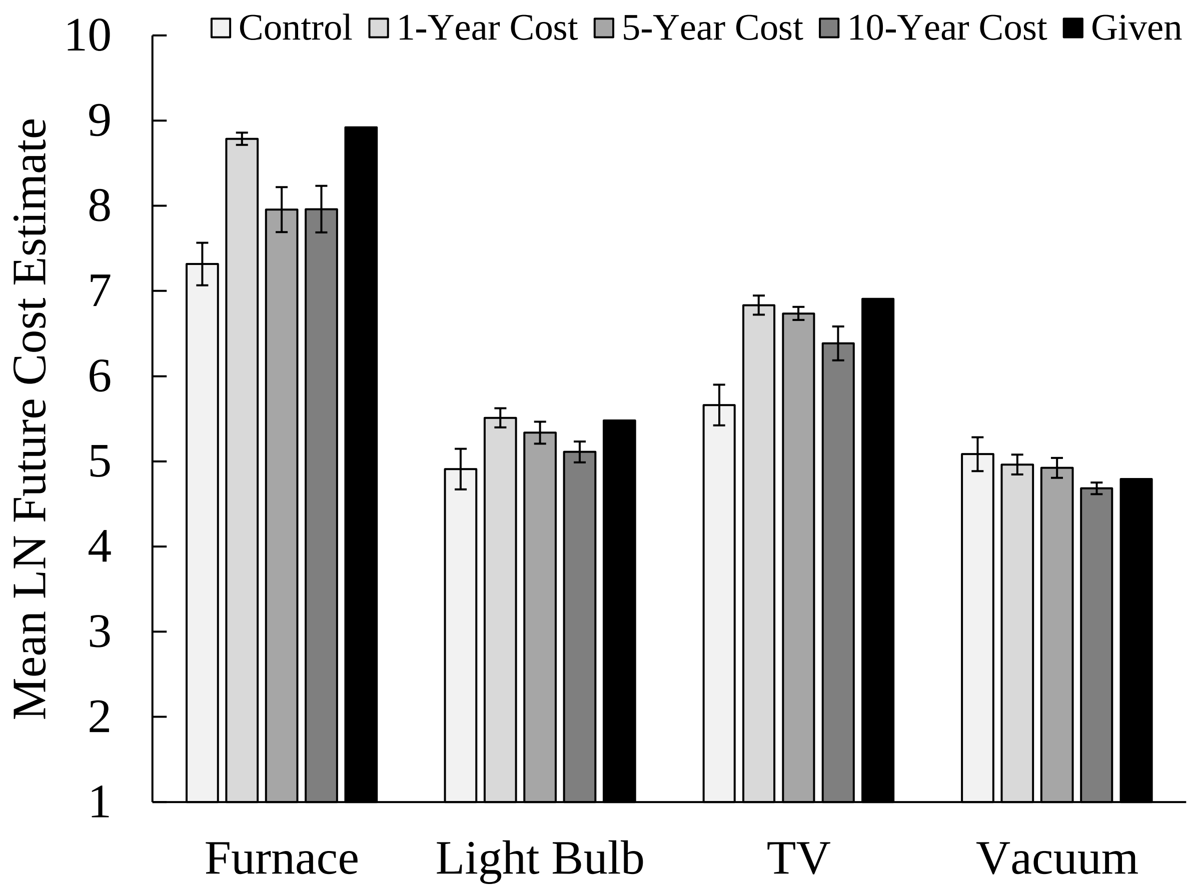


Subjective Cost Estimates

To put participants' 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 5, future cost labeling increased participants' future cost estimates for the furnace, light bulb, and TV, but had no effect or decreased estimates for the vacuum. A 4 (labeling condition, between) x 4 (product, within) GLM confirmed main effects of labeling condition, $F(3,238) = 8.0$, $p < .001$, $\eta^2 = .09$, product, $F(3,714) = 322.0$, $p < .001$, $\eta^2 = .58$, and the interaction, $F(9,714) = 4.2$, $p < .001$, $\eta^2 = .05$. 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, planning horizon predicts choices while controlling for label condition and marginally mediates the effect of label condition on choices, $p = .06$, but the mediation pathways for the other products are non-significant, all $p > .10$.

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 amount that was given to participants in the 1-year, 5-year, and 10-year cost conditions. Error bars show +/- one standard error.



Comparison of goal prominence, planning horizon, and subjective cost estimates

Powerful 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 linear models (one for each product), combining labeling condition and all three process measures into the same model with no interactions. The results are summarized in Table 2. In each model, goal prominence is the best predictor, except for furnace choices, for which there are no good predictors.

Table 2

A series of four linear models (with no interaction terms) using goal prominence, planning horizon, LN cost estimates, and labeling condition to predict choices, in Study 2.

	Furnace		**Light Bulb**		**TV**		**Vacuum**	
	p	***η²***	***p***	***η²***	***p***	***η²***	***p***	***η²***
Goal Prominence	.43	.00	<.001	.06	.01	.03	<.001	.08
Planning Horizon	.55	.00	.01	.03	.10	.01	.02	.02
Cost Estimate	.43	.00	.30	.01	.02	.02	.25	.01
Labeling Condition	.26	.02	<.01	.06	.36	.01	.29	.02

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, replicating previous results on scale and metric design (Camilleri & Larrick, 2013).

The effect of future cost labeling on choices was partly mediated by the activation of long-term cost goals for three of the four products studied. However, long-term cost goals were already active in the control condition for furnace choices, 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. Notably, 10-year cost labeling was effective for vacuums even though participants in the control condition were *over*estimating the 10-year cost.

Thus the 10-year label actually lowered participants' cost estimates. 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 driver of the 10-year cost manipulation, these are self-reported findings and are correlational in nature. When participants listed their product goals they had not yet made an explicit choice between the products. However, it is possible that they quickly made up their mind internally, 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 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 has the same effect as 10-year cost label

Method

184 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 Studies 1 and 2).

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 scale to assess their general tendency to consider the future when making decisions (Strathman, Gleicher, Boninger, & Edwards, 1994) and demographics.

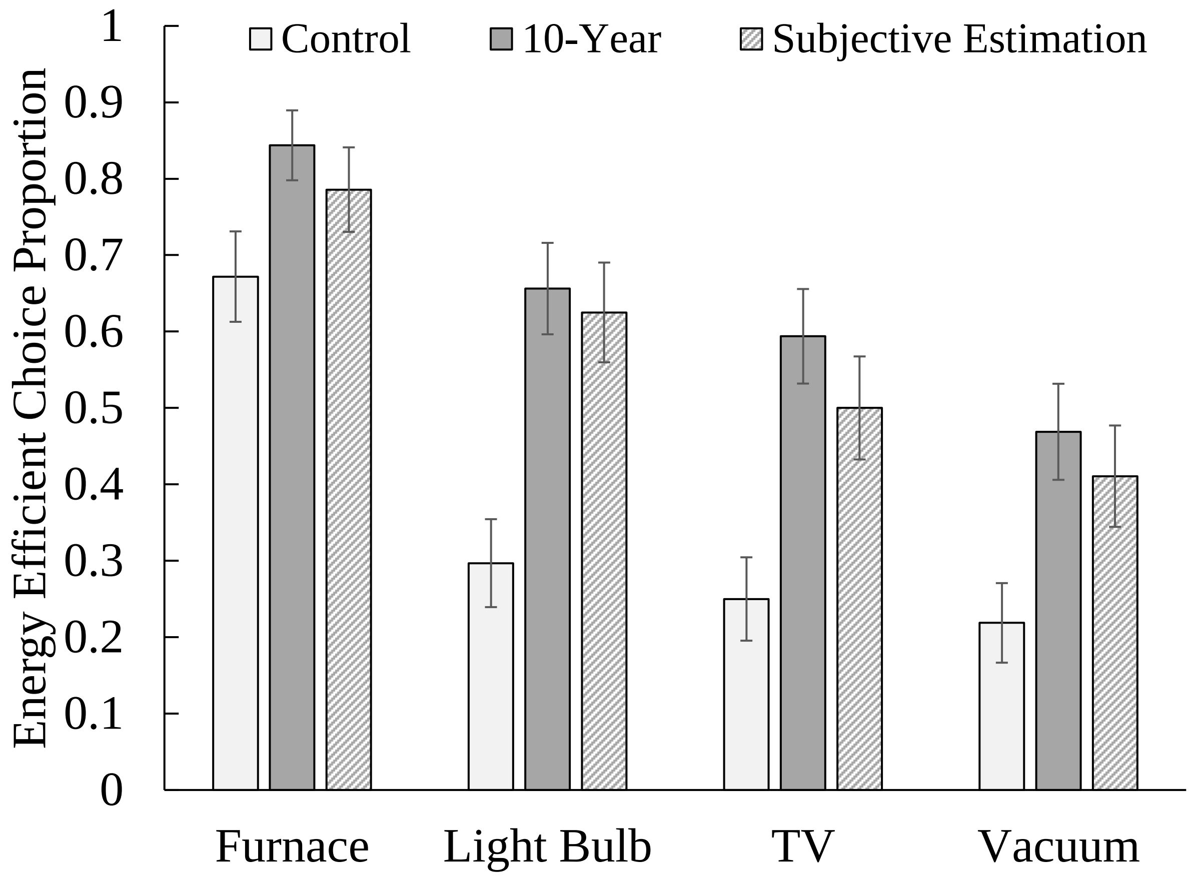
Results

Choices

As summarized in Figure 5, the pattern of choices in the control condition and 10-year cost condition 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, $F(2,181) = 15.2$, $p < .001$, $\eta^2 = .14$, a main effect of product, $F(3,543) = 33.7$, $p < .001$, $\eta^2 = .16$, and no interaction, $F(6,543) = 1.1$, $p = .39$, $\eta^2 = .01$. 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, $p = .17$.

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.



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. As seen in Table 3, 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. Of course, we do not know if our estimates or the participants' average estimates are closer to the truth; previous research suggests that the wisdom of crowds often outperforms expert estimates (CITE NEEDED).

Do subjective estimates predict choices? In other words, are participants who estimate a larger 10-year cost gap between products more likely to choose the efficient option? To answer this question, we computed difference scores for each product pair, subtracting the estimate for the efficient product from the estimate for the inefficient product. Overall, participants that estimate a larger difference are modestly more likely to choose the efficient product. Difference scores are positively but modestly correlated with choices for furnaces, rho = .22, $p = .10$, bulbs, rho = .27, $p = .05$, TVs, rho = .24, $p = .07$, and vacuums, rho = .31, $p = .02$.

Table 3

*Experimenters' estimates of the 10-year cost of each product, compared with participants' average estimates of the 10-year cost, in Study 3. Significant differences between experimenters' estimates and participants' average estimates indicated with * for p < .05 using 1-sample t-tests.*

	Experimenters' Estimate		**Participants' Estimate**	
	Efficient	**Inefficient**	**Efficient**	**Inefficient**
Furnace	$5,500	$7,500	$5,511.70	$6,178.66
Light Bulb	$51.87*	$239.40	$180.92*	$353.38
TV	$600	$1,000	$882.86	$1,146.91
Vacuum	$60.97*	$120.66*	$433.27*	$586.93*

Individual differences

Contrary to what might be expected, 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, $F(1,178) = 4.3$, $p = .04$, $\eta^2 = .02$, though the effect size is small. A significant interaction with product type, $F(1,178) = 4.6$, $p = .03$, $\eta^2 = .03$, indicates that this was more true 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. Therefore, the 10-year cost technique and the subjective estimation technique seem to be robust.

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 demonstrates 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 participants to think about long-term cost; the exact numbers used are not as important.

One open question is the valence of this long-term cost goal. Must it be framed as losses as captured by long-term costs, or would a long-term savings goal activation be equally effective? 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.

Study 4: Relevant goal activation is specific to future dollar costs

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.

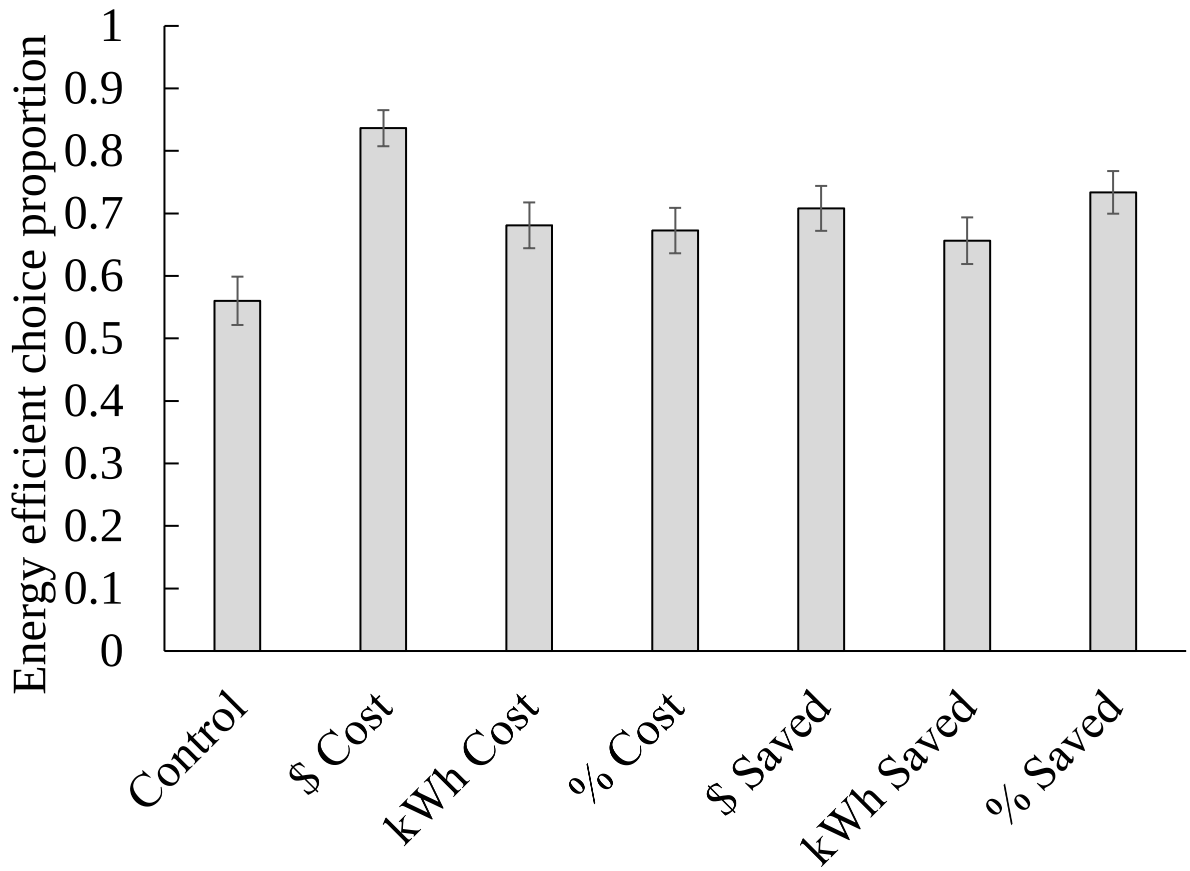
After participants made their choice between the two light bulbs, they were presented with manipulation check questions. Participants were then presented with various demographic questions such as age, gender, ethnicity, country of birth, and income.

Results

As summarized in Figure 6, people chose the energy efficient lightbulb more often in the 10-year dollar cost (loss) condition than in any other. An omnibus ANOVA across the seven conditions found a significant effect of condition, $F(6,1148) = 5.6$, $p < .001$, $\eta^2 = .03$. 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, $p = .04$.

Figure 6

Proportion of energy efficient choices in the control, 10-year dollar cost, 10-year kWh cost, % energy cost, 10-year energy saved, 10-year kWh saved, and % energy saved conditions in Study 4b. Error bars show +/- one standard error.



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 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: one derived from adding *any* scaled and translated attribute (Ungemach et al., 2013) 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 frames, consistent with our theory that it activates a latent "long term cost minimization" goal.

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), retailers (through improved sales of energy efficient products), and the environment (through decreased carbon emissions). This intervention could also be applied to non-energy using products with significant future costs, such as printer ink. We show that this intervention is driven (in part) by activating consumers' latent goal to minimize long-term costs, and that an alternative method of activating this goal has a similar impact on choices.

One process driver we did not investigate is perceived risk (Qiu, Colson, & Grebitus, 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).

The success of 10-year energy cost labels is also explained by the "SCORE" principles outlined by Larrick, Soll, & Keeney (2015). 10-year energy cost labels are relatively *simple* (especially compared with total cost of ownership), they focus *consumption* (rather than efficiency, as the European style labels do), they link energy information to an *objective* (ie, 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 and reactance may overtake the benefits of an expanded scale.

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 & 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 hurt by the nudge. 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 & Sawe, 2015). Ideally, the 10-year energy cost labels should be tailored to the consumer where possible – e.g., with state-specific usage and pricing information (Davis & Metcalf, 2014).

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of environmental psychology, 25*(3), 273-291.

Allcott, H., & Taubinsky, D. (2015). Evaluating behaviorally motivated policy: Experimental evidence from the lightbulb market. *The American Economic Review*, *105*(8), 2501-2538.

Anderson, C. D., & Claxton, J. D. (1982). Barriers to consumer choice of energy efficient products. *Journal of Consumer Research*, *9*(2), 163-170.

Appelt, K. C., Hardisty, D. J., & Weber, E. U. (2011). Asymmetric discounting of gains and losses: A query theory account. *Journal of Risk and Uncertainty, 43*, 107-126. doi: 10.1007/s11166-011-9125-1

Bull, J. (2012). Loads of green washing—can behavioural economics increase willingness-to-pay for efficient washing machines in the uk? *Energy policy*, *50*, 242-252.

Camilleri, A. R., & Larrick, R. P. (2013). Metric and scale design as choice architecture tools. *Journal of Public Policy & Marketing*.

Camilleri, A. R., & Larrick, R. P. (2015). Choice architecture. *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable, and Linkable Resource*.

Darby, S. (2006). The effectiveness of feedback on energy consumption. *A Review for DEFRA of the Literature on Metering, Billing and direct Displays*, *486*, 2006.

Davis, L. W., & Metcalf, G. E. (2014). Does better information lead to better choices? Evidence from energy-efficiency labels

Deutsch, M. (2010a). The effect of life-cycle cost disclosure on consumer behavior: Evidence from a field experiment with cooling appliances. *Energy Efficiency*, *3*(4), 303-315.

Deutsch, M. (2010b). Life cycle cost disclosure, consumer behavior, and business implications. *Journal of Industrial Ecology*, *14*(1), 103-120.

Dinner, I. M., Johnson, E. J., Goldstein, D. G., & Liu, K. (2011). Partitioning defaults: Why people choose not to choose. *Journal of Experimental Psychology: Applied*, *17*(4), 332-341.

Dumortier, J., Siddiki, S., Carley, S., Cisney, J., Krause, R. M., Lane, B. W., . . . Graham, J. D. (2015). Effects of providing total cost of ownership information on consumers' intent to purchase a hybrid or plug-in electric vehicle. *Transportation Research Part A: Policy and Practice*, *72*, 71-86.

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature, 40*, 351–401. doi: 10.1257/002205102320161311

Grimmer, M., Miles, M. P., Polonsky, M. J., & Vocino, A. (2015). The effectiveness of life-cycle pricing for consumer durables. *Journal of Business Research*, *68*(7), 1602-1606.

Hardisty, D. J., Appelt, K. C., & Weber, E. U. (2013). Good or bad, we want it now: Fixed-cost present bias for gains and losses explains magnitude asymmetries in intertemporal choice. *Journal of Behavioral Decision Making*, in press.

Hardisty, D. J., & Weber, E. U. (2009). Discounting future green: Money versus the environment. *Journal of Experimental Psychology: General, 138*(3), 329-340. doi: 10.1037/a0016433

Hausman, J. A. (1979). Individual discount rates and the purchase and utilization of energy-using durables. *The Bell Journal of Economics*, *10*(1), 33-54.

Johnson, E. J., Haubl, G., & Keinan, A. (2007). Aspects of endowment: A query theory of value. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*, 461-474. doi: 10.1037/0278-7393.33.3.461

Kallbekken, S., Sælen, H., & Hermansen, E. A. (2013). Bridging the energy efficiency gap: A field experiment on lifetime energy costs and household appliances. *Journal of Consumer Policy*, *36*(1), 1-16.

Larrick, R. P., Soll, J. B., & Keeney, R. L. (2015). Designing better energy metrics for consumers. *Behavioral Science & Policy*, *1*(1), 63-75.

Lynch, J. G., & Zauberman, G. (2006). When do you want it? Time, decisions, and public policy. *Journal of Public Policy & Marketing*, *25*(1), 67-78.

Min, J., Azevedo, I. L., Michalek, J., & de Bruin, W. B. (2014). Labeling energy cost on light bulbs lowers implicit discount rates. *Ecological Economics*, *97*, 42-50.

Mischel, W., Grusec, J., & Masters, J. C. (1969). Effects of expected delay time on the subjective value of rewards and punishments. *Journal of Personality and Social Psychology*, *11*(4), 363.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*(3), 231-259. doi: 10.1037/0033-295X.84.3.231

Qiu, Y., Colson, G., & Grebitus, C. (2014). Risk preferences and purchase of energy-efficient technologies in the residential sector. *Ecological Economics*, *107*, 216-229.

Sahoo, A., & Sawe, N. (2015). The heterogeneous effects of eco-labels on internalities and externalities.

Schubert, R., & Stadelmann, M. (2015). Energy-using durables–why consumers refrain from economically optimal choices. *Frontiers in Energy Research, 3,* 7.

Shultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, *18*, 429-434.

Sintov, N. D., & Schultz, P. (2015). Unlocking the potential of smart grid technologies with behavioral science. *Frontiers in psychology, 6*, 410.

Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of personality and social psychology, 66*(4), 742.

Thaler, R. (1981). Some empirical evidence on dynamic inconsistency. *Economics Letters, 8*, 201-207. doi: 10.1016/0165-1765(81)90067-7

Thaler, R., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*: Yale University Press.

U.S. Energy Information Administration. (2010). *2016 levelized cost of new generation resources from the annual energy outlook 2010*. Retrieved February 2, 2011, from http://www.eia.doe.gov/oiaf/archive/aeo10/electricity_generation.html

Waechter, S., Sütterlin, B., & Siegrist, M. (2015). Desired and undesired effects of energy labels—an eye-tracking study. *PloS one*, *10*(7), e0134132.

Xu, L., Lian, Z.-Y., Wang, K., Li, S., & Jiang, T. (2009). Neural mechanism of intertemporal choice: From discounting future gains to future losses. *Brain Research*, *1261*, 65-74. doi: 10.1016/j.brainres.2008.12.061

Appendix A: Light Bulbs and Labels Used in Study 5

Appendix B: Studies on Multi-Option Choice

Study A1: Additional field study data

In Study 1a (the field study reported in the main manuscript), we also collected data from the store aisles. The store aisles featured over a hundred different lightbulbs, with multiple levels of brightness and wattage, and multiple brands. We found an unexpected difference between the endcap data and aisle data, with the 10-year cost labels being much more effective at the endcaps (where there were only two lightbulb types available and the labels were manipulated on both) than the aisles (where there were many lightbulbs available and the labels were only manipulated on two of them).

Methods

In the aisle at each store, the two target bulbs were surrounded by a large number of other lightbulbs and promotional materials, which were not manipulated. Thus, the endcap and aisle displays varied on several dimensions, including the number of lightbulb options (two vs. many) as well as whether all bulb labels were manipulated (on the endcap) or only two out of many labels were manipulated (in the aisle).

Results

As seen in Table 4, the 10-year energy cost labels had a large effect at the endcaps but not in the aisles. At the endcaps, consumers chose the CFL 12% of the time with the control labels, and 48% of the time with the 10-year energy cost labels. In the aisles, consumers chose the CFL 38% of the time with the control labels and 39% of the time with the 10-year energy cost labels. A 2 (labeling condition: control vs 10-year) x 2 (location: endcap vs aisle) logistic regression predicting purchases found a main effect of labeling condition, beta = .50, $p = .01$, and a labeling by location interaction, beta = -.48, $p = .01$, but no main effect of location, beta = .30, $p = .12$. Follow-up pairwise contrasts with proportion tests confirmed that the 10-year manipulation was effective on the endcaps, $z = 3.3$, $p = .001$, but not the aisles, $z = 0.1$, $p = .90$.

Table 4

Study A1 results, showing the proportion of 23 watt CFL purchases (relative to 23w CFL plus 72w Halogen purchases) and the number of purchases for endcaps and aisles in the control and 10-year energy cost conditions.

	Endcap	**Aisle**
Control	.12 (n=26)	.38 (n=104)
10-year	.48 (n=29)	.39 (n=71)

Discussion

When lightbulbs were sold on store endcaps, real shoppers chose the energy efficient option much more often with 10-year energy cost labeling than with control labeling, replicating the results of our other studies. However, when the same 10-year energy cost labeling was used in the aisle, it had no effect. There are several possible explanations for this difference.

One possibility is that consumers at the endcaps were making unplanned purchases – and thus were "constructing" their preferences on the spot and were more affected by the framing of the labels – whereas consumers in the aisles were making a planned purchase and had well-established preferences, and so were unaffected by the framing of the labels. However, this explanation is ruled out by the lab study we subsequently conducted (reported below), where participants were randomly assigned to dichotomous choice vs multi-option choice.

A second possibility is that choice processes are qualitatively different for dichotomous choice vs multi-option choice, and the framing manipulation has little effect in multi-option choice. For example, perhaps the multi-option choice situation is cognitively demanding, and the labeling intervention was "washed out" by all the products and information available. After all, our 10-year label was only applied to two target bulbs, out of a huge number of bulbs on offer. In this context, the intervention may not have been strong enough to activate long-term cost reduction goals and hence influence choices. We investigate this possibility in Study A2, along with a solution – applying the 10-year energy cost label to all options (instead of only the target bulbs). If all the options have the 10-year energy cost labeling, this should be salient enough to activate consumers' long-term cost reduction goals and influence their choices. For stimuli, we used the real-world lightbulb options that were on display in stores in Study A1.

Study A2: Lab study on dichotomous choice vs multi-option choice

In this study, we replicated the pattern seen in the field study, as well as test a solution. W propose that in multi-option choice, the 10-year cost labels are effective if they are applied to all the options, but not if they are only applied to two of the options.

Method

671 participants, recruited from the MTurk online subject pool, completed the study. Participants were randomly assigned to one of five conditions. In the 2-option control condition and 2-option 10-year cost conditions, participants faced a choice between two lightbulbs, similar to the Study 5 endcap conditions. In the 6-option control condition, participants faced a choice between six different lightbulbs with different prices and wattages (all shown in the online supplement), including the 2 target bulbs from the 2-option condition. In the 6-option "10-year Targets" condition, the two target bulbs showed the 10-year energy cost, mimicking the "aisle" condition in Study 5. In the 6-option "10-year All" condition, all six lightbulbs showed the 10-year energy cost. All the lightbulbs options were real bulbs that were on display in the stores in

Study 5. Therefore, they vary on a number of dimensions in addition to price and wattage, including the brand, the number of bulbs in the package, and other factors.

We made two additional changes compared with previous studies. First, when calculating and displaying the 10-year energy cost, we showed the 10-year cost *per bulb*, rather than the total 10-year energy cost of the package. In other words, if an identical light bulb were sold in a 2-pack or a 10-pack, the 10-year energy cost would be the same (a pilot study indicated that this was more intuitive for participants). The second change we made was the dependent variable. In previous studies, we looked at the proportion of choices for the energy efficient bulb. In this study, we wanted to be able to measure and compare all choices in the 6-option condition and the 2-option condition. Therefore, we used wattage chosen as the DV (with lower numbers indicating that a more energy efficient option was chosen).

Results

As summarized in Figure 7, the 10-year energy cost label was effective when it was applied to all the choice options, but not when it was only applied to two out of six options.

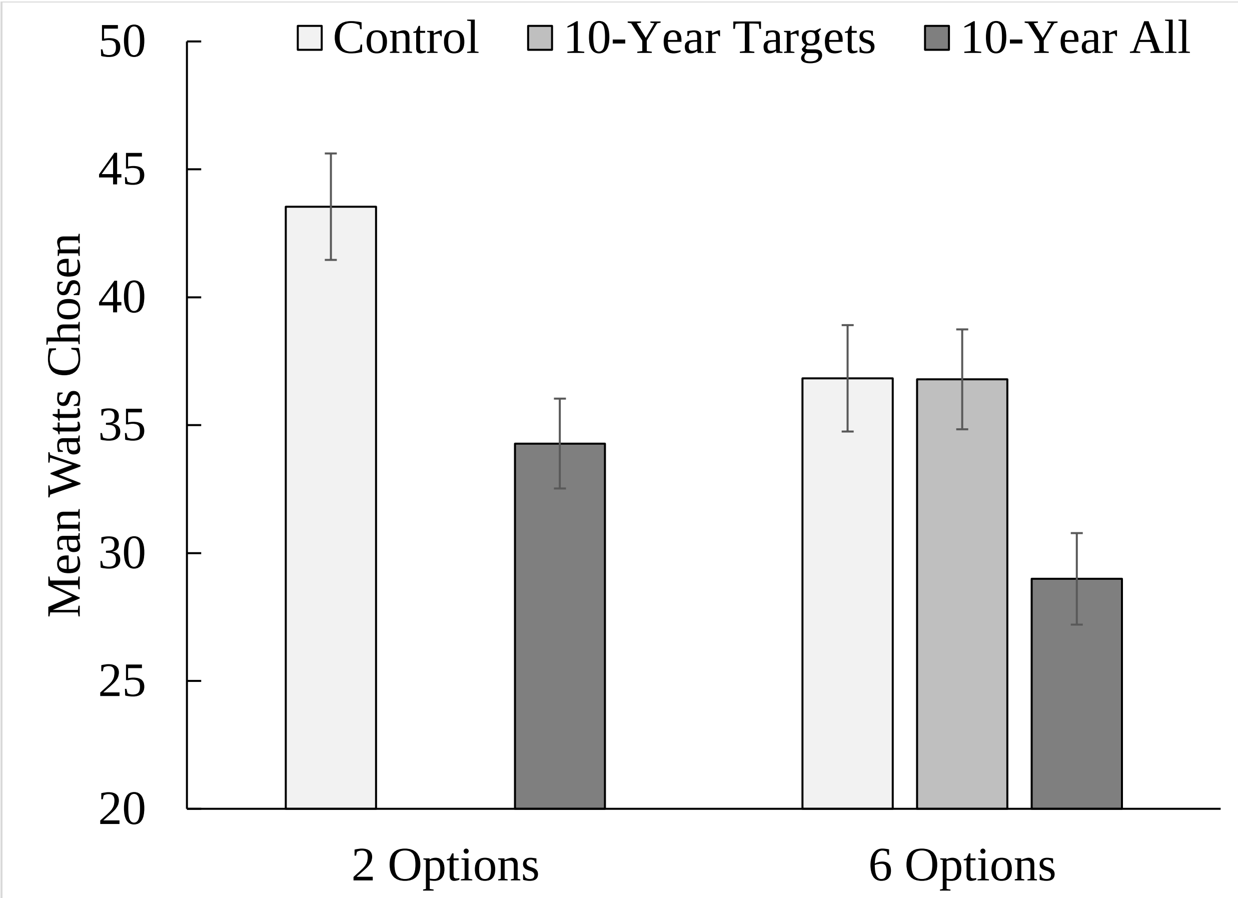
When choosing between two options, participants chose higher wattage bulbs in the control condition (mean = 43.5, SD = 24.2) than in the 10-year energy cost condition (mean = 34.3, SD = 20.7), $t(273) = 3.4$, $p = .001$, replicating the results of earlier studies.

When choosing between six options, participants chose the same wattage in the control condition (mean = 36.8, SD = 23.9) as in the 10-year target condition (mean = 36.8, SD = 22.3). In contrast, participants chose lower wattage in the 10-year all condition (mean = 29.0, SD = 20.2) than in either of the other two 6-option conditions, both $p < .01$.

Although not relevant to our hypotheses, there was also a notable main effect of number of options. Participants chose higher wattage bulbs in the 2-option condition (mean = 28.9, *SD* = 23.0 than in the 6-option condition (mean = 34.3, *SD* = 22.5), a significant difference, $t(663) = 2.6$, $p = .01$. Although the average wattage on offer was roughly equal in the 2-option condition (mean = 47.5) and the 6-option condition (mean = 47.2), the lowest upfront price was $4.29 for 72 watts in the 2-option condition and $3.49 for 60 watts in the 6-option condition. Thus, a consumer looking to minimize the immediate cost would also end up choosing a lower wattage bulb in the 6-option condition than in the 2-option condition, which may explain the observed main effect of number of options.

Figure 7

Mean wattage chosen with two product options or six product options in the control, target 10-year cost, and all 10-year cost conditions in Study 6. Error bars show +/- one standard error.



Discussion

In this study, we found that "10-year energy cost" only influences consumers' choices if it is applied to all of the options on display. This replicates the pattern of results found in the field study (Study 1), where the 10-year labeling was effective on the endcap (with only two lightbulb options, both of which had the 10-year labeling) but not in the aisle (with many light bulb options, only two of which had the 10-year labeling). This provides further insight on the "goal activation" mechanism. Apparently, some critical threshold of salience must be passed to activate the goal. When there are multiple products (each with multiple different attributes and pieces of information), 10-year cost information on one or two of them is not sufficient to catch the consumer's attention and activate the goal. An alternative account holds that both goal activation *and* the ability to compare products are both required. However, this idea is refuted by the fact that even choice share between the two target products was not affected when only those two products (out of six) had the 10-year energy cost label. This idea is also refuted by Study 3 (in the main manuscript), where it was found that providing the 10-year cost information is not a necessary condition for activating the goal and influencing choices.