Leveraging the motivational effects of labels: Lessons from retrofitting

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abstract

Retrofitting—replacing obsolete home infrastructure with more energy-efficient substitutes—will be essential to reducing energy use and carbon emissions in the future. Yet European and American households have proved reluctant to undertake these changes. Evidence has shown that a home energy audit can motivate people to retrofit their homes. In this article, we show that including the EU energy label—which displays the property's energy-efficiency rating—in energy audit reports is a simple way to enhance the audit's effectiveness: When energy audits are required as part of the process of selling a property, home sellers are motivated to improve their property's energy-efficiency rating through retrofitting and doing so makes their property more valuable. Drawing on insights from the behavioral science literature, we offer suggestions for how policymakers can leverage this motivation to expand household investments in retrofitting. Although our proposals focus on retrofitting, some of them could also encourage other actions that would reduce energy consumption.

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A decade ago, an article in *Science* called on the behavioral science community to deliver low-cost and scalable interventions to reduce energy consumption.[1] For consumers, replacing inefficient appliances with more energy-efficient ones results in bigger reductions in household energy consumption than does curtailing or modifying the use of existing energy-draining equipment.[2] An open question is how to induce homeowners to take this step.

In this article, we summarize findings on tested interventions that encourage *retrofitting*, or replacing obsolete home infrastructure with more energy-efficient substitutes. We then offer advice, based on behavioral science research, for ways to improve the effectiveness of one of the most successful interventions: the home energy audit.

Failed Interventions

Surprisingly, even when the financial returns are high, homeowners are reluctant to install energy-saving technologies. Data on this point come from a randomized controlled trial by the North American energy provider OPower.[3] OPower offered all its customers rebates ranging from $50 on an energy-efficient washing machine up to $5,000 on home insulation to encourage them to take steps to retrofit their homes to save energy. One group of randomly chosen customers—the treatment group—additionally received tailored recommendations on retrofits that would deliver cost savings (for instance, they were told that a new air-conditioning unit would save the household a specific amount of money). But the messages did little good: Only 4.8% of the treatment group, compared with 4.4% of the other participants—the control group—claimed rebates on energy-efficient purchases. It is striking that this intervention produced such modest effects, because the treatment group (a) had the

requisite information to retrofit, (b) had a financial incentive to act, and (c) received an intervention that heightened their motivation to reduce energy consumption.[3,4]

A second resource-intensive and behaviorally informed randomized controlled trial also yielded discouraging results.[5] In this experiment, thousands of low-income households in Michigan received an in-person visit by a field worker from their community who explained the benefits of replacing inefficient heating and cooling systems and offered to help the members of the household complete the paperwork for free retrofitting. The campaign increased retrofitting by the treatment group relative to a control group, but only 6% of eligible households undertook retrofits, and the administrative price of the intervention was high: Using field workers cost more than $1,000 per household.

Motivating Consumers to Retrofit: The Success of Energy Audits

There is good news, however. Although many interventions have failed, requirements that home sellers deliver information about energy performance to prospective owners have succeeded in getting some sellers to retrofit their homes. Sellers of certain houses in Texas were required to provide buyers with audits of home energy performance. This requirement caused home buyers to place greater value on energy performance and motivated sellers to invest in the energy efficiency of their properties.[6]

Additionally, how audit results are presented can affect how influential the energy-performance information is. An American study found that, relative to presenting cost information alone or displaying the U.S. Energy Star label, using an energy-efficiency label

similar to the current iteration of the European Union's energy label seemed to especially motivate investment in retrofitting.[7]

The EU energy label displays the energy-efficiency ratings of buildings and certain appliances. These ratings are given on a seven-level scale, in which each level is represented by a combination of colors and letters. The level corresponding to the most efficient rating, at the top of the scale, is colored green and labeled *A*, and the least efficient level is colored red and labeled *G*; the in-between levels have various colors and are labeled with sequential letters. Any good label makes important information salient and easy to evaluate. The EU energy label has been praised on this basis[7]: If there is one thing everyone learns at school, it is that an A is better than an F. And indeed, other things being equal, a home rated A is likely to sell for a higher price than a house rated B. Additionally, consumers are responsive to the label's color coding: In experiments that hold the letter constant, products are more sought after when their category is colored green.[8] Although the thresholds on the EU energy label are arbitrary, data from Ireland,[9] published in 2016, and England,[10] published in 2018, suggest that sellers will invest to boost their property into a higher energy-efficiency category.

Further evidence of the power of the energy audit and the motivating effect of well-designed energy-efficiency labels comes from the 2018 English study, in which researchers looked at changes in the distribution of energy ratings for a representative sample of homes before and after the United Kingdom adopted its own version of the EU energy label.[10] That version combines the color–letter categories of the EU energy label with numerical indications of efficiency at each of the levels (see Figure 1).

--Bookings put Figure 1 around here.--

The United Kingdom adopted the label after the British Parliament passed a law in 2004 that required an energy audit of any residential property on the market and the display of the audit's results on the EU energy label. The audit is conducted by an independent engineer, who inputs various measures of the fabric and fittings of the building into an algorithm to deliver a standard assessment procedure (SAP) score. The SAP score goes from 1 (*least efficient*) to 100 (*most efficient*) and is a measure of "how much energy a dwelling will consume, when delivering a defined level of comfort and service provision," according to the U.K. Department for Business, Energy & Industrial Strategy.[11] Although the SAP existed prior to the 2004 legislation, few property owners or buyers would have encountered it because they were not required to have properties audited for energy efficiency.

As is shown in Figure 2, the 2018 study found that before the label went into use, the proportion of homes in the highest part of the E level (54 points) was about the same as the proportion of homes just across the threshold at the D level (55 points). (This E–D threshold was studied because of the sample size—a majority of homes in the data set were rated either E or D; see Figure 4 in reference 10.) A year after the label's introduction, however, a statistically significant number of homes had shifted up to the bottom of the D category. Among homes that were identified in the data set as having been sold in the year prior to data collection—which were required to have an energy label—researchers found a dramatic increase in the number of homes at the 55-point level of the D category and a dramatic decrease in the number of homes at the top of the E category.

Brookings: Put Figure 2 about here.

The results tell this story: Properties that, with modifications (such as those listed in Table 1), could jump the threshold into a higher color–letter category were indeed modified by their sellers so that they would move to a new category. We confirmed this narrative in a recent working paper. In that work we found that, when their property was on the market, 4% of sellers in England from 2012 to 2019 invested in retrofitting and applied for an updated energy label.[12] Our analysis identified two predictors of filing for a new label: (a) the initial label showed the current energy-efficiency score to be close to a threshold, and (b) the second audit brought the property into a higher color–letter category.[12]

One mechanism that might contribute to these results is that, as in Table 1, English energy labels display the expected costs of replacing or installing an energy-efficient technology as well as the number of points the property would be expected to gain from these investments. The energy label made it easy for sellers to calculate whether their investment would enable a property to cross the threshold to a new energy-efficiency category. We estimate in the working paper that sellers gain thousands of pounds in the selling price from boosting a property across a threshold.[12]

--Brookings: Put Table 1 about here--

In short, energy audits can induce retrofitting. It is important to note that the effects of retrofitting can be large, as the 2018 study found.[10] Estimates indicate that the reduction in energy use that resulted when sellers retrofitted their homes to squeak into the D level from the E level was equivalent to the total annual electricity consumed by 11,542 English households (27,702 people),[13,14] which is approximately the current population of

Shakespeare's hometown, Stratford-Upon-Avon (27,445 people).[15] In other words, the energy labels succeeded in significantly cutting energy use in buildings for sale in the United Kingdom.

We now suggest additional ways to use homes' energy-efficiency labels to spur reductions in energy consumption. We base these recommendations on lessons gleaned from behavioral science research.

Ways to Further Leverage Energy Efficiency Labels

Recommendation 1: Mandate That a Standardized Label Depicting Accurate Energy Audits be Presented in Property Brochures

Recommendation 1 has three dimensions: observability, standardization, and timing. Each contributes to the effectiveness of the EU energy label. Energy audits provide information on a building's energy performance that is otherwise unobservable or obscure. Publishing these results leads consumers to place greater value on energy efficiency and sellers to make investments in improving energy efficiency.[6] This information will weigh more heavily in home buyers' decisions if it can be easily compared across properties, hence the need for standardization. If the government mandates that the result of an audit be included in any literature or listings describing the property, this information would allow potential home buyers to make side-by-side comparisons of the energy performance of alternative sites at a time when they are selecting properties to visit. We return to the importance of timing in Recommendation 4.

Although we emphasize the benefits of mandating information disclosure and labeling, we note that there are costs as well. A mandate imposes administrative expenses on the agencies that bear the burden of policing compliance. Additionally, the audit is another expense home sellers will incur. Last, there are political barriers to mandates. A libertarian might perceive compulsory audits and labels as regulatory overreach.

Recommendation 2: Make It Easy for Home Buyers to Accurately Evaluate Labels

The color–letter categories displayed on the EU energy label are easy for consumers to interpret, even by Americans who are unfamiliar with the rating system.[7] If this exact label is not used, policymakers should ensure that the labels they design are straightforward and highlight the most important information.

We should note, though, that it is possible that the EU energy label sacrifices accurate evaluation for ease of interpretation. The label depicts energy efficiency per unit area rather than total energy consumption, and so some larger, more energy-consuming homes appear to outperform smaller homes. In theory, this depiction could bias choice toward high-capacity rather than low-consumption options. In fact, a field experiment found that the introduction of the EU energy label caused consumers to purchase higher-capacity freezers than they otherwise would have.[16] It is possible that such distortions in energy-efficiency ratings affect purchasing decisions among home buyers, too. Although one may argue that home buyers usually have set ideas about the target size of the properties they would consider, the presence of such distortions cannot be completely ruled out as an influence. This constitutes an important policy trade-off for optimal label design.

Recommendation 3: Label Designers Should Take Perceptions of Thresholds Into Account & Consider Setting Dynamic Thresholds

Any scale, by accident or design, will manifest thresholds. Even a continuous scale such as an odometer that runs from 0 to 999,999.9 miles contains certain salient numbers that act as reference points and evoke heightened responses. For example, research shows that the mile that pushes a car from 9,999 miles to 10,000 miles is especially costly to resale value.[17] Because the perception of thresholds is unavoidable, the question becomes, How can policymakers deploy thresholds to nudge behavior in a desired direction? (A *nudge* encourages a behavior without interfering with freedom of choice.)

Answering this question requires some understanding of the potential downsides of thresholds, one of which is that they can discourage changes. People who find that their property is far from a threshold might view retrofitting as a poor investment if the home will end up staying in the same energy-efficiency category even after improvements are made. Sure enough, a data set of residential property sales in England and Wales revealed that the properties least likely to receive investments in energy efficiency while on the market were those with initial audits placing them far from a threshold in the U.K. version of the EU energy label.[12]

A related drain on motivation is complacency: People quit their efforts once they have successfully crossed a threshold. In the study with results depicted in Figure 2, homes that were boosted into the bottom of the D category by the retrofitting investments made by home sellers then stayed where they landed.

These demotivating effects can be reduced by making the thresholds *dynamic*, or relative. Instead of fixing the seven color–letter categories at arbitrary absolute levels of energy efficiency, the categories could represent septiles. As the housing stock becomes more energy efficient, thresholds would move up. If thresholds shift over time, properties that are currently distant from a threshold might eventually become close to moving up a category or, more important, down a category. Because people are loss averse[18] and concerned with rank position,[19] we expect the prospect of dropping into a lower category to be especially motivating.

An important objection to a dynamic labeling approach is that updates might cause labels to lose credibility or interpretability or cause consumers to disengage from an apparently unwinnable game. These objections are testable hypotheses. Some relevant data already exist: Energy labels on appliances in Europe were updated to go beyond the letter "A" and include the categories A+, A++, and A+++. Consumers adapted and the labels continued to be effective in nudging their behavior.[8] Of course, one should be cautious when extrapolating from appliance markets to property markets. For this reason, we recommend extensive testing prior to implementing our proposal.

Recommendation 4: Provide the Label When Hassle Costs of Retrofitting Are Low & Attention Paid to Energy Efficiency Is High

Why did the EU energy label succeed in inducing retrofitting when more resource-intensive, targeted interventions failed? One potential reason is that the energy-label requirement caught people at an opportune moment.

Hassle is a major deterrent to retrofitting. This is evidenced by a field study in London to promote loft insulation.[20] In two treatment conditions, loft owners were offered the opportunity to hire workers (at market rates or at cost) who would clear out the loft for the owners so the loft insulation work could be done. These treatments resulted in greater uptake of the loft insulation upgrade than occurred in a control condition that left it to owners to arrange for their lofts to be cleared in advance of the work.

The EU energy label comes into play at a time when people are already involved in selling their homes, moving, or building additions, so arranging for energy-efficiency retrofitting adds relatively little to the hassle they are already experiencing. This low added-hassle cost may help to explain why researchers conducting the study of residential property sales in England and Wales found that 4% of sellers retrofitted their property and applied for a new energy-efficiency label while their property was on the market.[12]

Prompts to attend to the potential energy savings from retrofitting could be especially persuasive when delivered at crucial moments. For instance, institutions could offer people who are seeking mortgages or home-improvement loans additional credit that is earmarked for retrofitting investment. After all, engineering models suggest that these investments will pay for themselves via reduced energy bills.[2]

It is worth noting that people who boost their properties into a higher energy-efficiency category shortly before selling do not get to enjoy the greater comfort and savings their investments delivered. Had they made the same investment when they first moved to a property, they would have enjoyed the same selling price premium as well as the

consumption benefits of a more energy-efficient home.[12] Thus, providing information and prompts when buyers are moving into a home, a time when they are formulating plans for the future, might be especially effective. If so, it might be useful to have energy labels do more than merely present information. For instance, labels could be designed as decision aids that guide the new homeowner through the process of reaching a property's energy potential, such as by offering a table resembling Table 1 in this article; listing the contact information for various local tradespeople; and even including if–then prompts in which new homeowners articulate concrete behaviors they will enact under certain conditions (for instance, "If I am getting someone out here to fix an appliance, then I will also have them replace the boiler.")[21]

Conclusions

In this article, we have explored the implications of various strands of empirical research for the design and delivery of home energy-efficiency labels. Our recommendations were crafted with the goal of promoting retrofitting investment, but they also apply more generally. Recommendation 2, that a label be easy to evaluate, speaks to the core function of any information label. Recommendation 3, to take perceptions of thresholds into account, applies to any label in any context. As we have noted, the perception of thresholds is an unavoidable effect of any label that involves a scale. Further, it is well-established that thresholds influence decisions, including high-stakes ones,[12,17] yet little research deliberately tweaks the placement of thresholds to test effects on behavior. Our suggestion that the A–G categories depict septiles of the distribution rather than absolute levels also has a broader implication: We hypothesize that dynamic labels will generally outperform absolute labels in motivating investment, whether the investment involves money (as in retirement savings), time (as in educational contexts), or effort (as when people engage in exercise).

Recommendation 4, which essentially says to provide energy labels when people are likely to be most receptive to them, can be restated as a general principle: If your goal is to motivate a certain behavior, then be selective regarding when you prompt people to engage in that behavior. The time when individuals perceive the benefits of engaging in a behavior to be unusually high relative to the perceived costs is the moment for a prompt. Our discussion of prompts, dynamic labels, and the accuracy of energy labels suggests questions for future empirical research. We look forward to developments in this field.

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