How to Talk about Home Energy Upgrades

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Executive Summary

The home energy assessment is one of the few opportunities for utilities and other program implementers to meet with consumers in person. The usefulness of these interactions can be maximized by applying lessons of social psychology and human behavior. This report applies findings from message framing research to home energy assessments, and is designed to provide insight into the best strategies for encouraging homeowners to invest in upgrades. We derive our recommendations from a literature review, expert interviews, and a survey-based randomized control trial that tested message framing strategies with a nationally representative sample of US homeowners.

BENEFITS AND BARRIERS TO INVESTMENT IN HOME ENERGY UPGRADES

Homeowners who receive home energy assessments invest in home energy upgrades primarily because they are interested in bill savings, improving health outcomes, improving the comfort of their homes, or preserving the natural environment and mitigating climate change.[1]

Bill savings and upfront costs are cited by most studies as the primary drivers of energy efficiency upgrade decisions, but these factors may not be the best for home energy assessors to focus on when discussing upgrade options. Although financial motivators (and barriers) are certainly important to discuss and consider, focusing customers exclusively on costs and bill savings will limit their investments to those they perceive as financially cost effective, and they may be disappointed if upgrades do not result in significant cost reductions. When homeowners expand their calculus of cost effectiveness to include the sizeable nonfinancial benefits of upgrading, they are more likely to invest.

Fortunately, research shows that comfort and health can also be strong motivators of energy efficiency upgrade decisions. Homeowners may not be motivated by the terms *comfort* or *health*, but they are motivated to get rid of cold drafts, remove mold, reduce allergy symptoms, and insulate against noise, among other issues. Helping consumers understand and factor these nonfinancial benefits into upgrade decisions can encourage deeper investment in home energy upgrades.

Although we found that most people respond to home energy upgrade messages that discuss bill savings, health, and comfort, and that some respond to discussions of the natural environment, the optimal message will always be one that resonates best with the specific customer at hand. For example, we found that residents in the Southern United States typically respond best to messages highlighting the health and comfort benefits of upgrades. Studies with other populations found other messages to be most effective. Several researchers have conducted market segmentation analyses and proposed specific messages

[1] Although the focus of this paper is home energy efficiency upgrades that follow home energy assessments, another important access point for upgrades is contractors who suggest them following a call for other jobs (e.g., to fix, renovate, or upgrade other parts of the home). Indeed, many homeowners install home energy upgrades simply because they are recommended by their contractor. For example, 29% of participants in an Arkansas HVAC rebate program took part in it because their contractor recommended it (A. Thomas et al., "Evaluation of 2013 DSM Portfolio: Final" [Little Rock: CenterPoint Energy Arkansas, 2014]).

for different segments. Learning customers' specific needs, motivations, and values is therefore a vital aspect of home energy assessments.

SUBTLE MESSAGE FRAMING TECHNIQUES

In addition to studying which benefits to highlight, we also tested subtle message framing strategies addressing how information is presented to customers. This research is preliminary and only scratches the surface of possible framing options; the effects are generally small, but they are significant.

In our research, homeowners indicated a higher interest in home energy upgrades under the following conditions.

They were already committed to investing in necessary repairs. Efficiency upgrade costs were perceived as more acceptable if they were presented after customers were asked to imagine that they were already investing money into fixing their homes.

The "no-brainer" upgrades were removed from the list of upgrade options and replaced by "stretch" upgrade options. If a clear no-brainer item (e.g., lighting) is on the list of potential upgrades, then other effective upgrade options on the same list appear less appealing in comparison. When no-brainer upgrades are removed from the list and replaced with stretch options (that have a lower savings to investment ratio than any other upgrades on the list), customers are more willing to consider investing in the more expensive upgrades. No-brainer options can be presented to homeowners separately in a way that does not reduce their uptake, but also does not trigger a comparison to more substantial upgrades. Follow-up research with real-world purchase decisions is required to confirm the effectiveness of this strategy.

The payback period is presented as a specific month and year in the future as opposed to as years-from-today. Assessors should generally avoid dwelling on the fact that a specific upgrade (or group of upgrades) has a long payback period. However, if payback periods must be discussed, they should be framed as month-year rather than years-from-today when possible.

RECOMMENDATIONS

A 1988 study demonstrated that home energy assessors who were trained to apply a few social psychology principles to home energy assessments may increase consumers' intention to invest in upgrades.[2] Based on our literature review and original research, we recommend that home energy assessors:

- Provide an interesting and engaging experience to homeowners when conducting the assessment
- Listen to homeowners and carefully tailor their discussion of upgrades to address the homeowners specific concerns and motivations

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[2] M. Gonzales, E. Aronson, and M. Costanzo, "Using Social Cognition and Persuasion to Promote Energy Conservation: A Quasi-Experiment," *Journal of Applied Social Psychology* 18 no. 12 (1988): 1049–66. markcostanzocom.ipage.com/wp-content/uploads/2015/03/Energy-Auditor-Training-127094.pdf.

- Attempt to focus on nonfinancial benefits
- Develop rapport with customers and help them navigate through the upgrade process from start to finish
- Apply subtle message framing strategies to maximize the effectiveness of the information presented to homeowners

Introduction

Good salespeople know that the way they present a product and interact with a customer can go a long way to making a sale. The same is true for home energy assessments. Without changing the price of energy efficiency upgrades or the cost of energy, contractors who have completed assessments can significantly change the likelihood of making sales simply by the way they talk about them. The assessment is one of the few opportunities for efficiency professionals to meet with consumers in person; these interactions should not be squandered.

Contractors can maximize the usefulness of their consumer interactions by applying lessons from social psychology and human behavior. This report presents lessons from message framing research and puts them in the context of home energy assessments. It is designed to provide insight into the best strategies for encouraging homeowners to invest in upgrades with high upfront costs or long payback periods.

Information in this report comes from four sources:

- An experimental test of several message framing strategies on 1,905 nationally representative single-family homeowners in the United States
- Interviews with experts
- Written reports on home energy assessment programs
- Academic studies in persuasion and cognitive science

We investigate two types of message framing strategies in this report. The first strategy addresses the specific benefits and barriers that matter most to customers. This might mean discussing bill savings or comfort benefits, for example, or explaining why upgrading may not be as difficult or time-consuming as consumers might think.

The second message framing strategy focuses on subtle variations in format, style, and wording. For example, we will examine the effectiveness of changing the way lists of upgrade options are presented and the difference between how payback periods are described. We developed each of these framing strategies from various psychology and cognitive science theories on decision making and mental shortcuts. We then tested each of these strategies in an online experiment, described in Appendix A.

Although we discuss the key elements of the assessment itself and the importance of the assessor's interpersonal interactions, these are not a major focus of the report. We highly recommend Fuller et al. (2010) for an overview of how assessment programs can be designed and delivered to communities of homeowners to maximize investment. In this report, we focus primarily on the messages that home energy assessors use to sell upgrades, either in person or through written reports.

HOME ENERGY ASSESSMENTS

Home energy assessments, also known as home performance assessments or home energy audits, involve onsite visits in which energy efficiency experts inspect a customer's home, discuss his or her concerns, and offer recommendations for upgrades. On average, customers who choose to purchase upgrades complete their upgrades five months after the

assessment (Crane-Smith 2011). However conversion rates (the rate at which customers purchase recommended upgrades) can sometimes be a problem for assessment programs (e.g., Breukers et al. 2009; Jaffe and Stavins 1994). Frequently, participants go through the assessment process, but either do not purchase the recommended upgrades or purchase only the cheapest upgrades with the shortest payback periods (e.g., Palmer, Walls, and O'Keeffe 2015).

Home Performance with ENERGY STAR™ (HPwES) is a program developed by the US Environmental Protection Agency and the US Department of Energy (DOE) in which a certified expert conducts an assessment and recommends upgrade bundles tailored for the entire home. Complete bundles of upgrades ensure that customers reap the maximum energy efficiency benefits, which may not be realized by upgrading individual elements. They also prevent health and safety problems that can be created or exacerbated by one-off retrofit projects that do not allow for adequate ventilation, introduce moisture issues, and so on. Still, whole home retrofits can be expensive, and homeowners are hesitant to invest. In a survey of nearly 500 assessors (some of whom may have been HPwES contractors), 71% estimated that homeowners purchase at least one recommended upgrade "fairly often" or "always," but only 1% of homeowners follow all of the recommendations (Palmer et al. 2011).

THE HOME ENERGY ASSESSMENT ITSELF

Customers who request home energy assessments are making an initial (small) commitment to energy efficiency. The foot-in-the-door model suggests that people who make initial small commitments are later more likely to follow up with larger commitments that are behaviorally consistent (Freedman and Fraser 1966). That is, once this small commitment to energy efficiency is made, customers are subsequently more likely to make larger commitments, such as investing in upgrades. This same effect is at play when a contractor is called for a home repair—customers frequently invest in energy efficiency upgrades when they are already committed to investing in another repair or renovation project.[1]

However, if homeowners do not perceive the home energy assessment as a small commitment to energy efficiency, the foot-in-the-door phenomenon may not be an influence. This perception of commitment is less likely, for example, if the assessment is free. Although 41% of home energy assessors believe that the cost of the audit is a "major" or "critical" issue for requesting one (Palmer et al. 2011), homeowners who receive free or inexpensive assessments are less likely to follow through with the recommended upgrades. When homeowners are offered very inexpensive assessments, they may conduct them out of curiosity or to help plan for other (non-efficiency) home renovations (e.g., Ingle et al. 2014). In one study, free assessments led to 20% fewer upgrades than paid assessments (Palmer, Walls, and O'Keeffe 2015).

Similarly, when homeowners participate in assessments simply to fulfill the requirement of a solar installation program, they are not more likely to invest in efficiency upgrades prior

[1] This can also be explained as "sunk costs" (Arkes and Ayton 1999) or "shopping momentum" (Dahr, Huber, and Khan 2007).

to installing solar panels (Langheim, Arreola, and Reese 2014). Notably, a cheaper (or free) assessment increases the number of assessments that are completed (especially among low-income households). Therefore these assessments may slightly increase participation, even if most assessments do not lead to conversions. One industry expert explained that free assessments may also be ineffective because they cut corners by being more generic and less personally tailored (Olivia Patterson, senior director, Opinion Dynamics, pers. comm., August 30, 2017). These untailored assessment reports could be part of the reason that free assessments lead to lower conversion rates.

Another relevant social psychological principle is the reciprocity effect. Assessors often offer to install free devices during an assessment, such as faucet aerators (that reduce water use) or energy-efficient lightbulbs. These devices reduce energy consumption immediately and also trigger the reciprocity effect, whereby people feel a general drive to return favors that are done for them (Gouldner 1960). Thus a small act of installing no-cost upgrades may help encourage the sale of larger upgrades down the road. Indeed, home energy audit programs that include direct install activities are the most successful (Research Into Action 2015).

Home energy assessments usually include several steps, some of which consumers cite as particularly persuasive. For example, in surveys of homeowners who had undergone assessments, respondents cited various assessor activities as important, including doing a blower door test, personally showing locations for improvements, providing tailored reports, using infrared images, and describing estimates of energy savings (Palmer, Walls, and O'Keeffe 2015; Ingle et al. 2014, 2012). All of these could potentially be explained by a customization effect: personally tailoring energy efficiency advice significantly increases the effectiveness of that advice (e.g., Daamen et al. 2001).

Why Request an Assessment?

Home energy assessments are not frequently requested by homeowners. In one case study, only 5% of eligible Bonneville Power customers completed a home energy assessment (Fuller et al. 2010). Energy assessments are typically requested by higher-income, higher-educated households (Stern et al. 1986; Hirst, Berry, and Soderstrom 1981; Wirtshafter 1985). In 2004, one review identified five primary motivations for customers to request home energy assessments from the HPwES program: (1) concerns about old, poorly designed, or poorly performing buildings; (2) interest in environmental health; (3) concerns about energy costs; (4) a desire for improved comfort; and (5) an attempt to conserve natural resources (Knight, Lutzenhiser, and Lutzenhiser 2004).

As the habit discontinuity theory (Bamberg 2006) predicts, homeowners are more likely to disrupt their daily routines and change their behaviors during major life events. This may help explain why people are more likely to request home energy assessments when buying or moving into a home (DOE 2010; DOE 2013). Similarly, homeowners are more likely to get assessments when they engage in other home repairs or renovations. Contractors can seize opportunities for home energy assessments when they are called for other repairs by explaining that home installations will not work at maximum effectiveness, or may cause other problems such as condensation, if the whole home is not inspected first.

Incentives, marketing, and retail/manufacturer relationships are important for energy efficiency programs in general, and they are likely important for assessments as well (York et al. 2015). One key marketing strategy is to get out into the community. Community-based outreach, in which people tell others in their social networks about assessment programs, can work well (McEwen 2012). Also, contractors can take advantage of face-to-face marketing opportunities by attending events such as neighborhood fairs and telling people about the benefits of getting an assessment (SBW Consulting 2013).

Alternative methods of home assessment can also improve outcomes. Home energy assessment programs that allow multiple types of assessments (e.g., online, mail-in, telephone, and walk-through) tend to have the best outcomes (Research Into Action 2015). One new and promising strategy could be to provide group home assessments such as the Chicago Metropolitan Agency for Planning's "house parties" (Olson, Plagman, and Silberhorn 2014). These group assessments leverage the power of social norms and social pressure to encourage upgrading.

THE PERSON CONDUCTING THE ASSESSMENT

Both experience and interpersonal skills are important for home energy assessors. Typically, home energy assessments are conducted by contractors with extensive experience in home construction and repair, but little sales training (Aronson 1990), or by relatively skilled sales people with little experience in home repair. Persuasive people are credible, trustworthy, and attractive or likeable (Perloff 2003).

The personal touch goes a long way with home energy assessments. Assessors can be effective sales people if they listen, show empathy, and display a sense of similarity with customers (e.g., McBane 1995). By listening to customers' needs, rather than immediately telling them what they should do, assessors accomplish two goals: (1) they learn how to best tailor their explanation of benefits to the specific homeowner, and (2) they develop rapport with their customers. For example, many home energy assessors recommend lighting upgrades first because they are the most financially cost effective. However financial considerations are not always top-of-mind for homeowners. Listening to customers and trying to understand their perspective helps assessors understand what matters most to them. For example, some customers might have concerns about drafts or home aesthetics; in that case, the assessor might begin by recommending window upgrades (which have higher nonfinancial than financial benefits). Effective assessors put aside their own judgments about what is best for homeowners and instead attempt to empathize with, and view the situation through, each customer's unique perspective.

Listening, showing empathy, and talking about personal similarities facilitate bonding, which increases the assessor's trustworthiness and likeability (Perloff 2003). Maintaining eye contact, smiling, nodding, leaning forward, and eliciting self-disclosure can also help generate rapport (e.g., Chaikin et al. 1978; Palmer and Simmons 1995; Miller, Berg, and Archer 1983). Similarly, framing recommendations as helping improve as well as fix the home might increase action. It is easy to forget that pride can help motivate behavior, but anticipated emotions of both pride and guilt help motivate pro-environmental action (Onwezen, Antonides, and Bartels 2013). In addition, one report cites the assessor's enthusiasm as an important factor (Ingle et al. 2014). These simple conversational skills go a

long way toward building a bond between the assessor and the homeowner and, ultimately, can affect both the purchase of home energy upgrades and satisfaction with the program. It is no surprise that a key element of the HPwES assessment is discussing with homeowners their specific concerns, goals, and limitations.

Transmitting information about home energy upgrades from assessor to homeowner is insufficient for encouraging customers to take action (e.g., Stern 1999). Effective assessors also help guide customers through three types of barriers to upgrading (Billingsley, Stratton, and Fadrhonc 2016): information barriers, decision-making barriers, and transactional barriers. This means that, following the assessment, the most effective assessors provide information about costs and available rebates or financing options; review assessment results with customers and discuss their decisions with them; and help schedule appointments and complete paperwork.

Factors That Affect Decisions

When most people discuss message framing for home energy upgrades, they usually ask, "Which benefits of upgrading should we highlight?" A number of surveys, discrete choice experiments, interviews with experts, focus groups, and reviews have examined this question (e.g., Electric Power Research Institute 2010; SEEAction 2011; Knight, Lutzenhiser, and Lutzenhiser 2004). The vast majority of these reports examine financial benefits and barriers to investment as the primary motivator (or demotivator) of action. However there are important reasons why financial messages may not be optimal, and several nonfinancial benefits and barriers can play key roles in decision making.

FINANCIAL MOTIVATION (AND DEMOTIVATION)

Financial motivation is usually cited as the top reason for investing (or not investing) in home energy upgrades.[2] This is borne out by homeowner surveys (Murphy 2014; Palmer, Walls, and O'Keeffe 2015; Fischback 2014; Achtnicht and Madlener 2012; Ingle et al. 2014; Mortensen, Heiselberg, and Knudstrup 2014; Alberini and Bigano 2015), assessor surveys (Palmer et al. 2011), focus groups with homeowners (US DOE 2013; Langheim, Arreola, and Reese 2014), expert interviews (NREL 2010), and program evaluations (EMI Consulting 2016; Gamtessa 2013). Among these studies, roughly half include participants who have undergone home energy assessments or completed some upgrades, as well as participants who have not.

Financial concerns are both a benefit of and barrier to upgrading. On the one hand, homeowners appear to be strongly motivated by the prospect of bill savings (and to a lesser degree, increased home values); on the other hand, homeowners are prevented from upgrading by high upfront costs and long payback periods. Some evidence suggests that the negative perceptions of upfront costs may outweigh the positive perception of bill savings as the dominant driver of upgrade decisions (Christie, Donn, and Walton 2011).

[2] Sometimes these are referred to as *energy benefits*. However most homeowners are interested in the financial aspects of energy savings rather than saving energy per se (DOE 2010).

Given this apparently overwhelming evidence that financial factors drive homeowner decision making, many experts call for improved, more accessible financing options and additional incentive and rebate programs (Fuller 2009; SEEAction 2011; Mortensen, Heiselberg, and Knudstrup 2014). Traditional rebate programs, as well as innovative financing options such as on-bill financing (including a variant called Pay as You Save, or PAYS), Property Assessed Clean Energy (PACE) finance, and others (e.g., Bell, Nadel, and Hayes 2011) help defer the upfront cost of home efficiency upgrades, thus making the upgrades more financially cost effective and removing the financial barrier for participation.

The Problem with Focusing on Money

Financial barriers of upgrading can be reduced with payment plans, financing options, and incentives. However the financial benefits are difficult to change or increase. One of the major hurdles of using financial justifications for home energy upgrades is that some are not financially cost effective based on energy savings alone (Galvin 2014). When energy prices are low, homeowners are less inclined to invest in upgrades. Similarly, the long payback periods for some home energy upgrades (Soratana and Marriott 2010) can be a significant concern to homeowners (Fischback 2014). This is not to say that home upgrades are cost ineffective, but rather that most homeowners and many contractors fail to account for the sizeable nonfinancial benefits when considering cost effectiveness.

Financial returns on investment vary greatly among home upgrade options and are only part of the equation for homeowners debating which upgrades to purchase. For example, air sealing and insulation may be purchased for their financial cost effectiveness, but other upgrades, such as windows, may be purchased for aesthetic reasons (despite long payback periods). Thus, windows are sometimes packaged with other upgrades, adding a desirable feature for customers who get most of their bill savings from other upgrades.

The perception of costs is as important as the actual costs. In one study, researchers found that homeowners with high incomes were less likely to invest in energy efficiency, and they hypothesized that it was because they perceived energy expenditure as insignificant and not worth the time or investment (Gamtessa 2013).

Further, homeowners are sometimes skeptical about the savings they will earn from upgrades that are presented as financially cost effective (Pigg et al. 2016). Unfortunately, this skepticism may occasionally be justified. In a five-year study of a German retrofit program, for example, many building owners reported that they did not perceive the savings they expected (Galvin 2014). Similarly, a study of a Seattle retrofit program found that only 40% of participants said they noticed significant energy savings from their upgrades (Ingle et al. 2014). This may be because building owners did not notice the savings they achieved or because other factors negated the savings. In the case of the California Whole House program, for example, researchers found that participants who did not experience savings after upgrading had increased building occupancy, added square footage, replaced appliances that had not worked previously, or deliberately used efficient equipment more freely (Opinion Dynamics 2014).

NONFINANCIAL BENEFITS

When discussing home energy upgrades, contractors can choose to work with homeowners' strong pre-existing financial motivations, or they can attempt to shift the conversation and educate customers about the nonfinancial benefits, which they are often unaware of (Mortensen, Heiselberg, and Knudstrup 2014). Some researchers recommend policies that provide financial incentives to defer costs, as well as education to refocus homeowners on the additional benefits of home energy upgrades (e.g., Mortensen, Heiselberg, and Knudstrup 2014); others advocate for including nonfinancial (and nonenergy) benefits for cost-effectiveness analyses (Russell 2015). As one former contractor explained, "If I can shift the conversation to nonfinancial benefits of upgrading, then the homeowner becomes open to talking about upgrades that may not be financially cost effective from an energy savings perspective alone" (Michael Rogers, president, OmStout Consulting, pers. comm., March 7, 2017).

However nonfinancial benefits may take second place only because of how they are presented and asked about. In many of the reports on the financial benefits of upgrades cited above, respondents were given options that may bias the results toward financial answers. For example, when presented with a list of potential reasons for upgrading, financial reasons are always offered as an option in the list (while some nonfinancial options may be left out). Further, financial reasons are sometimes presented in multiple ways (save money, capitalize on incentives, take advantage of short payback period, etc.). As a result, respondents may think that being motivated by money is the "right answer," and may rationalize their decisions as being financially motivated when they are actually motivated by both financial and nonfinancial reasons.

Financial motivation may be seen as homeowners' primary motivation because of how the conversations are framed to begin with. Respondents asked about their motivations for upgrading may be inadvertently primed to think about finances because of how the conversation starts (Wilson, Crane, and Chryssochoidis 2015). Surveys, focus groups, and interviews that begin by asking for personal financial information or information about how much respondents invested in various upgrades in the past may frame the entire conversation to focus on financial aspects of upgrading. In the same way, home energy assessors who begin a conversation about upgrading by talking about finances will unwittingly focus homeowners on the economics of their decisions and narrow their options to those that are financially cost effective from an energy savings perspective. Unlike most other products that people purchase, home energy upgrades are marketed on their ability to reduce energy costs. This is unusual because for the vast majority of other household items, cost savings are presented as merely an ancillary benefit, not the primary reason for investment.

In addition, in many surveys, nonfinancial answer options can be more difficult to understand than financial options. For example, the answer option "I chose to retrofit my home to save money on my energy bill" is easier to visualize and understand than "I chose to retrofit my home to increase my comfort." The term *comfort* in this context is somewhat nebulous, and could be interpreted in different ways. When this comfort concept is broken down into particulars—such as cold drafts, glare from windows, noise, and so on—it resonates more with homeowners and they indicate having these concerns (Shelton Group

2017). *Health* and *environmental* benefits are similarly nebulous terms that can be broken down to increase their clarity. Customers are more likely to indicate "I chose to do this to make sure my daughter's bedroom was warmer in the winter," than "I chose to do this to make my home more comfortable."

Commonly Cited Nonfinancial Benefits

A number of nonfinancial benefits have been put forward as potentially motivating factors for homeowners buying energy efficiency upgrades. Although financial concerns are almost always mentioned as the top motivators, comfort, the natural environment, and occupants' health are also commonly cited factors. Payback periods, home value, and investment quality/durability are mentioned often, but nevertheless less frequently.

Comfort is an umbrella term for various factors including noise, humidity, cold drafts, temperature control, natural light, glare from windows, and unwanted heat from windows (Shelton 2017). Unlike cost savings, which are easily described with one term (saving money on monthly bills), comfort is rarely described by homeowners using that umbrella term. In the annual Energy Pulse national poll (Shelton 2017), 30% of homeowners claimed that the reason they did not do home energy upgrades was "because their home is comfortable enough." However, when shown a list of sub-aspects of comfort, 86% agreed that their home was lacking at least one of the aspects (Shelton 2017). Comfort, or some aspect of it, is frequently identified by assessors (SBW Consulting 2013), homeowners (Acadia 2016; EMI Consulting 2016; Ingle et al. 2014; Mortensen, Heiselberg, and Knudstrup 2014; Murphy 2014), and other experts (NREL 2010) as the number one or two reason for doing energy efficiency upgrades. In some ways, this is unusual because cost savings and low price are usually not the primary reasons that people buy household products. They buy them because the products provide some real or symbolic value and benefit that the buyer wants. Perhaps financial factors should be less of a focus for home energy upgrade marketing as well. Smart thermostats are one example of an upgrade that has seen much market interest in response to messages about increased comfort (as opposed to cost savings).

The natural environment, or interest in protecting the environment and mitigating climate change, is sometimes cited as an important reason for investing in energy efficiency upgrades (Knight, Lutzenhiser, and Lutzenhiser 2004). However these reasons are typically mentioned in more liberal regions of the country such as Vermont (GDS Associates 2013), Northern California (SBW Consulting 2013; Langheim, Arreola, and Reese 2014), and Puget Sound (Fischback 2014). They are not universally accepted as drivers of upgrade decisions for all homeowners, but they could be very persuasive to some people. However, even in regions where residents report being generally concerned about climate change, this concern does not always translate into the specific behavior of adopting energy efficiency upgrades (e.g., Maller and Horne 2009). This is why listening to homeowners and understanding their specific motivations is crucial. Once in the home, assessors need not rely on assumptions about homeowners based on region; they can refer to customers' specific concerns. Further, by answering questions and discussing their concerns, homeowners also begin to reframe upgrade decisions as nonfinancial decisions in their own minds (Michael Rogers, president, OmStout Consulting, pers. comm., August 25, 2017).

Several recent reports, including one by the DOE (Wilson et al. 2016), have drawn a line between home energy upgrades and residents' health. Home weatherization projects and efficiency upgrades help get rid of dust mites, eliminate mold and moisture, and remove other particles that cause allergies and disease (Wilson et al. 2016). Homes that are too cold, or too hot and humid, are also unhealthy (Wilson et al. 2016). Upgrade projects can offer numerous positive health outcomes, and when these benefits are explained to homeowners who are concerned about allergies, asthma, heat stroke, arthritis, depression, or other chronic illnesses, they can help motivate upgrade investments (SBW Consulting 2013; Knight, Lutzenhiser, and Lutzenhiser 2004). However this is a relatively new area of research; most homeowners are unaware of these health benefits (Jacobsohn, pers. comm., December 5, 2016) and usually fail to cite them as reasons for upgrading (also, survey answers may not include health benefits among the options). Like the term *comfort*, homeowners are unlikely to identify the umbrella term *health* as a reason for upgrading their homes. Instead, they might talk about allergies, asthma, or other specific illnesses.

Payback periods can be effective motivators of investment decisions if the periods are short, but long payback periods may have the opposite effect. As one report by Efficiency Vermont explains, "simple payback—as predicted by contractors on audit and completion reports—was also a predictor of whether a project moved forward or not, perhaps due to the appeal to homeowners of projects that pay themselves off more quickly through reduced energy bills" (Gamble 2014). However this could also have been partly a result of how contractors framed the decision in the first place.

Despite some evidence that home value does not always increase significantly following investment in home energy upgrades (e.g., Bruegge, Carrión-Flores, and Pope 2016; Remodeling 2017), some homeowners nevertheless cite this as a reason for investing (Acadia 2016; Evergreen Economics 2015). Possibly, homeowners appreciate the durable, high-quality products and therefore experience a personal sense of increased value in their homes. With the recent addition of home energy information (e.g., HERS ratings or the Home Energy Score) to some real estate listing websites (Gold, forthcoming), this may become a stronger motivator of upgrade decisions in the future.

Beyond the physical and financial benefits of home energy upgrades, several researchers have pointed out that homeowners are motivated by the deeper emotional and social meanings of their homes and what the renovations represent (Wilson, Crane, and Chryssochoidis 2015; Gram-Hanssen 2014). They explain that houses are more than physical structures, and renovations can change these spaces in ways that affect social interactions and personal meanings. Home energy assessors might benefit from learning about residents' daily routines and how energy efficiency upgrades could meet their specific daily needs before discussing upgrade options (Judson and Maller 2014). In addition, social norms (what others are doing), altruism (acting selflessly), self-efficacy (the belief that one's actions can make a difference), and personal values (such as benevolence and universalism) influence intentions to upgrade homes (Klockner 2013; Abrahamse 2011). Social status and belonging are additional psychosocial motivators of some home upgrades, such as low or zero-carbon technologies (Stieß and Dunkelberg 2013). Homeowners may invest in these technologies to show off their social status, much like purchasing a sports car or expensive piece of jewelry. Understanding homeowners' personal motivations and values can help

home energy assessors explain home upgrades in a way that is personally meaningful for each homeowner. Further, promoting home energy upgrades using various peer-diffusion strategies in person and online can change perceptions of social norms and potentially increase uptake of renovation programs (Miller and Zarker 2016).

Barriers to Upgrading

In addition to motivators that drive investment in home energy efficiency upgrades, homeowners also experience barriers to upgrading. By probing customers about their personal barriers to investment, assessors can offer tailored solutions or information that may help them overcome the barriers.

Barriers fall into two major categories: structural/financial and emotional/psychological (Stern 2011). Home energy efficiency upgrade programs typically tackle the former (by streamlining the process and supporting the homeowner) but not the latter (Stern 2011). As Luztenhiser (2009) explains, most programs are designed on the physical-technical-economic model, which essentially claims that home energy efficiency upgrades can be encouraged in only two ways: providing information and providing rebates. However this model does not accurately predict real consumer behavior, which is complex and derived from numerous influences (Lutzenhiser 2009). Fortunately, home energy assessors are in a position to help break down myriad barriers and to facilitate upgrades that homeowners are otherwise motivated to purchase.

In addition to the commonly cited cost barrier, researchers have proposed several other specific barriers. These include lack of education or awareness, difficulty connecting participants to programs (and similar transaction costs), homeowner misconceptions about the value or ease (hassle) of doing upgrades, uncertainty about the contractor's skill level or the savings that will be earned, and long payback periods (Baxter et al. 2015; Fischback 2014; Fuller 2009; Evergreen Economics 2015; SEEAction 2011; Baeka and Park 2012). Taken together, these barriers can affect homeowner motivation to upgrade.

The financial problem of split incentives can also reduce the adoption of energy-efficient home upgrades. Spit incentives occur when a unit is rented and any benefits from upgrades that the landlord installs are experienced only by the renter and not by the landlord (Fuller 2009). A report for the Minnesota Department of Commerce (Pigg et al. 2016) also identified a series of other barriers including mistaken beliefs about electric space heater energy use, an aversion to unfamiliar devices, and an unwillingness to buy energy-efficient devices to replace devices or appliances that are still working. The report also noted that energy efficiency is a low priority for homeowners compared to other life concerns.

In addition, homeowners perceive risks associated with new energy-efficient technologies. When asked about solar water heaters and double-glazed windows, for example, homeowners perceived three types of risk (Christie, Donn, and Walton 2011): (1) financial (being unsure about long-term costs and savings), (2) functional (being concerned whether the technology will work), and (3) social (being worried that they might be perceived differently by others if they adopt the technology). People who are generally more risk averse are less likely to adopt energy-efficient technology, especially if they think they may

move residences within five years (Qiu, Colson, and Grebitus 2014). Assessors are in a position to tackle all of these issues through real-time in-person demonstrations.

Who Invests in Home Upgrades?

Certain specific groups are generally more likely to invest in energy efficiency upgrades. For example, one German study found that energy efficiency renovation was slightly more likely to be undertaken by older homeowners with above-average education levels (Stieß et al. 2010). Conversely, in a study of the Canadian EnergyGuide for Houses program (1998–2005), homeowners with less education and household income were more likely to invest in upgrades (Gamtessa 2013).[3] This was an unusual result that warrants further investigation; typically, homeowners with higher incomes are more likely to invest in upgrades (EIA 2017).

In preparing this report, we conducted a series of online message framing experiments with a nationally representative sample (1,905 participants) of US homeowners (owners of single detached units or homes in buildings with only two units).[4] Overall, across several questions about different upgrades, homeowners' willingness to invest was significantly predicted by several demographic factors. Although we asked participants to state preferences in response to hypothetical situations, their answers aligned with similar research on actual home upgrades. Their answers also correlated with their choice to use a link at the end of the survey to search for a home energy assessment professional.

Income and education level (two factors that are usually correlated) both predicted willingness to invest in a generally linear fashion. As income and education increased, the willingness to invest in upgrades increased as well. The number of years homeowners planned to live in their current residences also showed a similar pattern: the longer homeowners planned to stay in their homes, the more willing they were to invest in upgrades.[5] Figures 1 and 2 show these correlations.

[3] Education and income are generally highly correlated. In this study, the researchers hypothesized that homeowners with higher incomes were less likely to invest because the cost of energy was a small fraction of their overall earnings and expenditures.

[4] A more detailed explanation of the methods used for the study can be found in Appendix A.

[5] One exception was that participants who indicated that they had no plan to move were not more likely to upgrade.

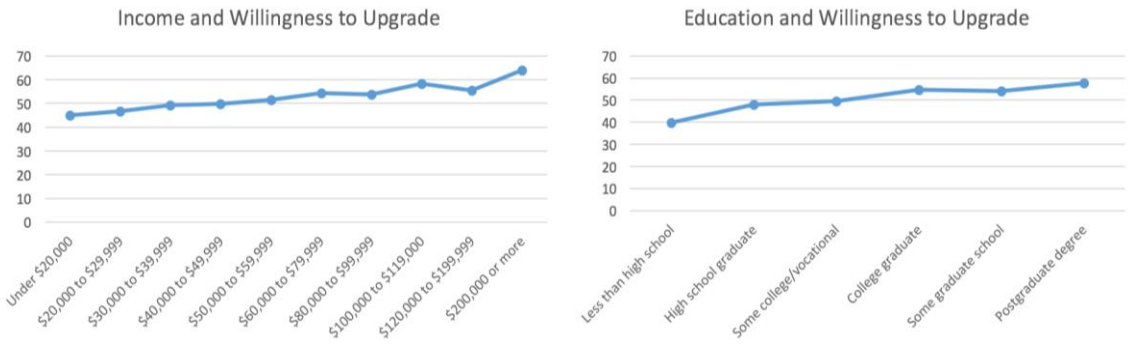


Figure 1. Income and education significantly predict overall stated intention to upgrade across five questions in our online experiment, $F(9, 1{,}860) = 6.59$, $p < 0.001$, $\eta_p^2 = 0.03$, and $F(5,1{,}891) = 8.08$, $p < 0.001$, $\eta_p^2 = 0.02$. Generally, overall willingness to upgrade increased with income and education levels. Participants rated their likelihoods of upgrading their homes in response to five hypothetical situations. Ratings of willingness to upgrade were made along a continuum from 0 (extremely unlikely) to 100 (extremely likely).

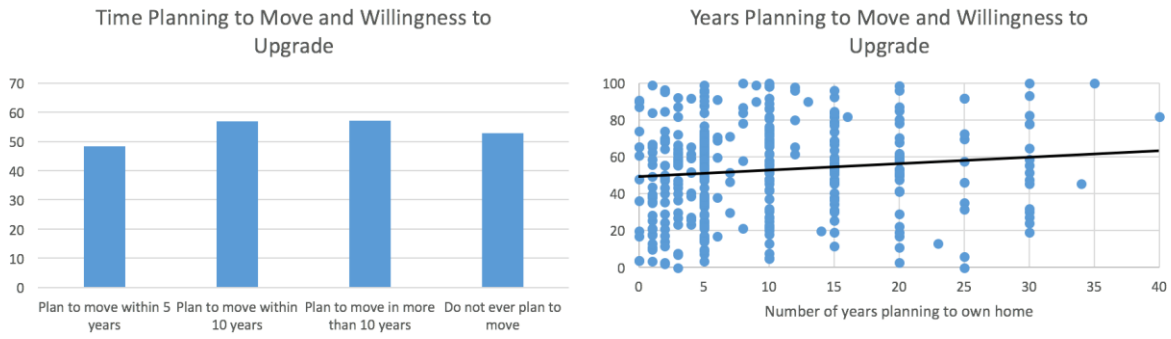


Figure 2. Number of years homeowners plan to remain in their residence is correlated with overall stated willingness to upgrade across five questions in our online experiment. Excluding those who answered "I never plan to move," the correlation between years planning to remain in the residence and likelihood of upgrading is significant, $r = 0.12$, $p = 0.03$.

Age and the number of years that respondents have owned their homes predicted willingness to invest with an inverted-U-shaped pattern. Homeowners in the 30–34-year-old age range were most willing to invest in upgrades, whereas those who were older or younger were progressively less willing. Homeowners who had owned their homes for 6–10 years were most interested in investing, with those owning for less or more time progressively less interested. Figure 3 shows these results.

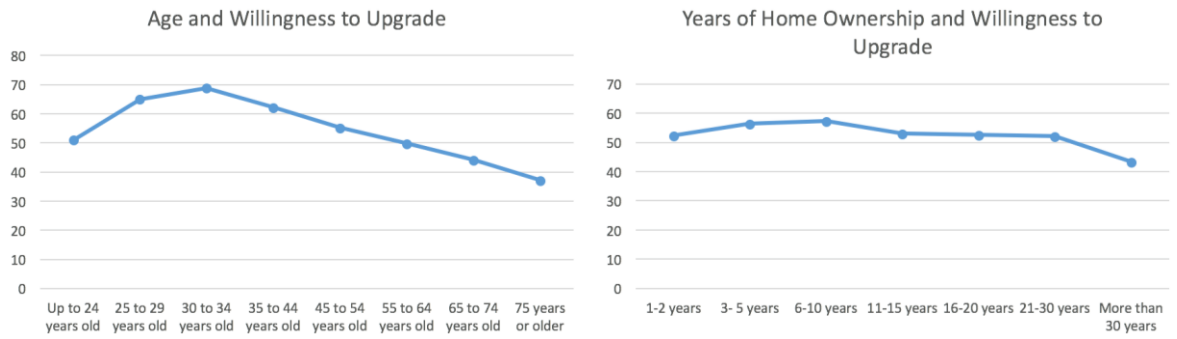


Figure 3. Participants' ages and the years that they have owned their homes significantly predict their overall willingness to upgrade in an inverted-U shaped pattern across five hypothetical situations, $F(7, 1{,}889) = 29.41$, $p < 0.001$, $\eta_p^2 = 0.1$, and $F(6,1{,}885) = 9.36$, $p < 0.001$, $\eta_p^2 = 0.03$. Respondents' ages had a larger effect on willingness to upgrade than most other demographic variables. Ratings of willingness to upgrade were made along a continuum from 0 (extremely unlikely) to 100 (extremely likely).

When respondents' homes were built prior to 1991, they were significantly less willing to invest in upgrades than if they were built in 1991 or later. However a regression analysis revealed that this was more a function of homeowner ages than the age of the home. Homes built in 1991 or later were more likely to be owned by younger homeowners (55 or younger), whereas homes built before 1991 were more likely to be owned by older homeowners. Indeed, younger homeowners were significantly more likely to upgrade than older homeowners, even among homes built as early as 1951.[6]

Respondents with children currently living in the home were significantly more willing to invest in upgrades than respondents without children currently living at home, and males were slightly but significantly more likely to invest in upgrades than females. There was no general difference in willingness to upgrade between homeowners from different US regions (Northeast, South, West, or Midwest). Figures 4 and 5 show these results.

[6] For homes built prior to 1951, we had insufficient numbers of young homeowners to test this meaningfully.

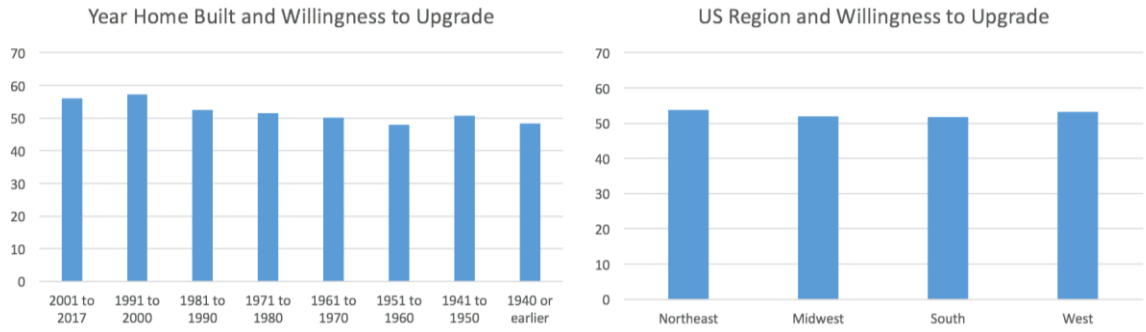


Figure 4. The year in which homeowners' homes were built slightly but significantly predicted the overall willingness to upgrade, $F(7,1,844) = 4.28$, $p < 0.001$. Generally, those with newer homes (built after 1991) were more willing to upgrade than those with older homes (although this may be because of homeowner age). The US region in which the homeowners live did not significantly predict likelihood of upgrading, $F(3,1,895) = 0.59$, $p = 0.62$. Ratings of willingness to upgrade were made along a continuum from 0 (extremely unlikely) to 100 (extremely likely).

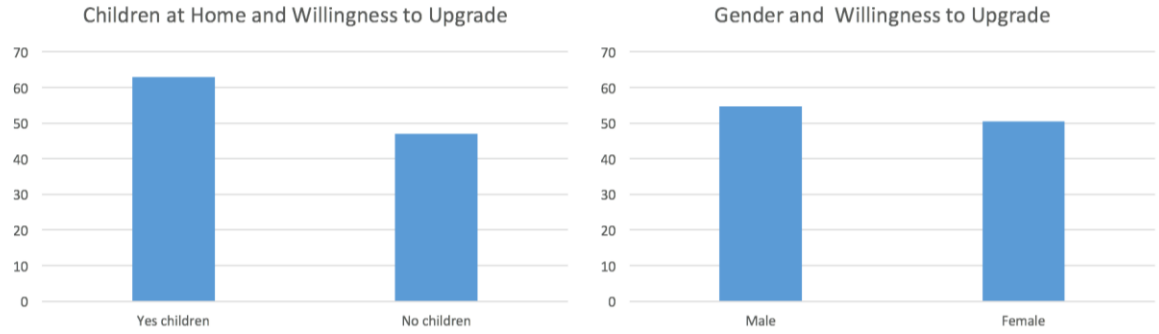


Figure 5. Respondents with children currently living at home were significantly more willing to upgrade their homes than those without children living at home, $t(1,869) = 13.03$, $p < 0.001$. Having children at home had a larger effect on willingness to upgrade than most other demographic variables. Males were also slightly but significantly more willing to upgrade than females, $t(1,863.45) = 3.52$, $p < 0.001$. Ratings of willingness to upgrade were made along a continuum from 0 (extremely unlikely) to 100 (extremely likely).

As figure 6 shows, homeowners who usually vote for Democrats were slightly more willing to invest in upgrades than those who usually vote for Republicans.[7] This finding falls in line with previous research indicating that conservatives are less inclined to reduce their energy usage behavior in response to receiving Opower home energy reports (Costa and Khan 2010). In that study, conservatives more often reported disliking Opower home energy reports, opting out of the program, and not saving energy in response to the program (as compared to political liberals).

[7] Approximately one-third of respondents claimed they vote for other parties, claimed they vote roughly equally for different parties, or preferred not to reveal their voting preferences. Those participants were excluded from the analysis of this question.

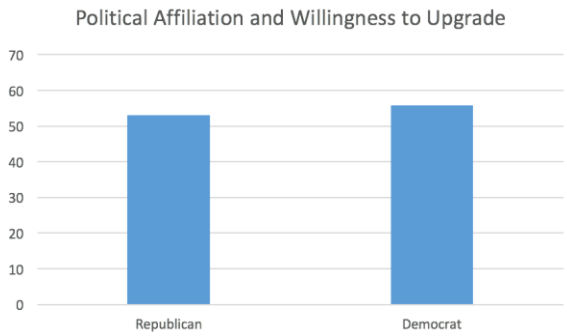


Figure 6. Respondents who normally vote for Democrats were slightly but significantly more likely to upgrade their homes than respondents who normally vote for Republicans, $t(1388) = -1.95$, $p = 0.05$, $d = 0.1$. Ratings of willingness to upgrade were made along a continuum from 0 (extremely unlikely) to 100 (extremely likely).

In our series of experiments, the most important demographic factors for predicting overall willingness to invest were age and having children currently living in the home. Both of these factors had medium to large effects on willingness to purchase upgrades.

Participants who indicated that they were more willing to invest in home energy upgrades were also significantly more likely to click a link at the end of the survey directing them to information about where they could find an HPwES contractor to do a home assessment. Thus, even though our measure was largely hypothetical, it nonetheless corresponded with real-world behavior to a degree.

Traditionally, four positional factors have best predicted adoption of energy-saving devices at home: home ownership, socioeconomic status, ownership of new home technologies, and the presence of a household member able to perform household repairs (Costanzo et al. 1986). Beyond these general trends, specific demographics tend to respond to different types of messages. As a rule, tailored messages that target customers' individual concerns, needs, and constraints are more effective than standard undifferentiated messages.

Tailoring Benefits Messages to Customers

As most salespeople and communications professionals will attest, tailoring a pitch to a target audience is the best way to sell a product. The same is true for home energy assessments. In this section, we discuss how specific demographic groups respond to various messages about the benefits of home energy upgrades.

In the Netherlands, one study found that higher-income households respond best to appeals to improved comfort and social responsibility, whereas lower-income households respond best to messages about subsidies and reducing monthly energy bills (Bruel and Hoekstra 2005). Overall, higher-income households are less motivated (or demotivated) by costs, subsidies, and financial reasons for home energy upgrades than lower-income households (Ingle et al. 2014; EMI Consulting 2016).

California homeowners who participated in a demand-side management program and purchased energy efficiency upgrades were more likely to claim that they were motivated by bill savings than nonparticipants were. Nonparticipants tended to claim that they upgraded energy efficiency only when buying a new home, remodeling a home, or replacing appliances; they were primarily motivated to upgrade because they perceived that doing so would increase their home's value (Evergreen Economics 2015).

Researchers in the UK identified five homeowner archetypes corresponding to five different reasons for engaging in energy efficiency upgrades. Each of the following archetypes is best approached with a unique message tailored to his or her motivations:

- *Idealist restorers*. Properties are long-term projects. They prefer do-it-yourself projects to restore their old homes over long periods.
- *Affluent service seekers.* Properties are "a pleasure." They upgrade to increase the luxury of their homes by hiring experts.
- *Property ladder climbers*. Buy and renovate properties as investments or steps to acquiring better properties.
- *Pragmatists*
    - *Pragmatist – functional owners.* Renovations are a hassle.
    - *Pragmatist – aesthetic owners.* Enjoy having a constant stream of home improvement projects, but do so for primarily aesthetic reasons. They would sooner do patch jobs than fix underlying problems.
- *Stalled*
    - *Stalled – lack of finance owners*. Frugal and interested in saving energy just to save money. They will sometimes leave areas of their homes unheated to save energy.
    - *Stalled – pressures of life owners*. Do not have time, emotional energy, or finances to do home energy upgrades.

A similar exercise in California examining HPwES marketing messages also identified five types of homeowners (Opinion Dynamics 2009):

- *Leading achievers*. Respond to environmental messages.
- *Practical spenders*. Respond to financial messages.
- *Striving believers*. Respond to environmental messages directed to renters and owners. They prefer cheaper appliances and are generally middle-income consumers.
- *Thrifty conservers*. Respond to messages about cheap options.
- *Disconnected*. Respond to low-cost efficiency messages in Spanish and English; they care about the environment and finances, but many are unfamiliar with ENERGY STAR.

Norwegian researchers used a different approach to tailored messaging. Rather than tailoring messages to specific target groups or for specific types of renovations, they recommended tailoring messages based on homeowners' phases of decision making (Klöckner and Nayum 2016). At each stage, they found that homeowners perceived different psychological barriers and motivators to upgrading and, therefore, different

messages should be used to move them forward to the next phase. Table 1 shows these barriers and motivators.

Table 1. Barriers and motivators during each decision-making phase

Phase of decision making	Barriers and motivating factors
Phase 1: Not yet interested	Not owning dwelling, not the right time
Phase 2: Deciding what to do	Comfort, living conditions, energy costs
Phase 3: Deciding how to do it	Not able to decide, not the right time, lack of information, energy costs
Phase 4: Planning to implement	Expecting payoff in short time, comfort, availability of contractor, not the right time

Source: Klöckner and Nayum 2016

Our Message Framing Experiments

Although research exists on which benefits are best to highlight during home energy assessments, we found no studies that experimentally tested the use of message framing strategies for encouraging upgrades. Up to this point, our report has examined the message framing strategy of highlighting specific benefits (bill savings, comfort, etc.). We now turn to another strategy: subtly changing how that benefits information is presented, using the principles of behavioral economics and social psychology. An example of this strategy would be to vary the structure and wording of elements within the home energy efficiency assessment reports to change how homeowners perceive the upgrades.

To explore this approach—and address the knowledge gap in the research—we tested benefits frames and subtle message framing strategies through an online message framing experiment. We conducted the experiment with a nationally representative sample of 1,905 US homeowners. Appendix A describes the details of the methods we used to conduct the study; Appendix B shows the text used for the experiment itself. Here, we present the results in two parts: Part 1 describes our testing of various benefits frames, and Part 2 describes our tests of subtle message framing strategies.

PART 1. BENEFIT FRAMES

Overall Effects

In our survey of homeowners, the first framing experiment we conducted involved highlighting various benefits of home energy upgrades to determine which was most effective in encouraging homeowners to upgrade. In the experiment, we asked customers how likely they would be to invest in a $7,500 HPwES upgrades package after they saw one of the six test messages. Participants were randomly assigned to read either a control message similar to that used by DOE in its HPwES marketing materials,[8] or a message about one of the following benefits:

[8] The DOE HPwES message touched briefly on bill savings, comfort, environment, and contractor expertise.

- Bill savings
- Health benefits
- Payback period
- Environmental benefits
- Investment that increases home value
- Comfort benefits

Each targeted benefits message included several bullet points about how or why the benefit matters. All eight messages had the same structure and form, and experts verified the message content.[9]

Overall, the type of benefits that were highlighted made a significant difference in the likelihood of upgrade bundle investments, but, as with most framing effects, the effect was small. Participants rated their willingness to purchase the complete upgrade bundle the lowest when exposed to the control message, which did not highlight any benefits. Also, given the long payback period for this upgrade package (16 years), we were not surprised that the payback message was essentially just as bad as the control message.

Participants were most willing to invest in upgrades after reading messages about health benefits, bill savings, and comfort benefits. All three of these messages performed significantly better than the control message.[10] Interestingly, the current (multi-benefit) message from ENERGY STAR was better than the control message, but not significantly better (nor was it significantly worse) than the health, comfort, or savings message. This may have been because it offered only a surface-level explanation of benefits compared to the other messages. Figure 7 shows the relative effectiveness of each message in encouraging homeowners to indicate they would be willing to invest in the package of upgrades.

[9] For the exact description of how each set of benefits was presented, see Appendix B.

[10] Comfort was borderline significant, based on conventional rules of thumb ($p = 0.06$).

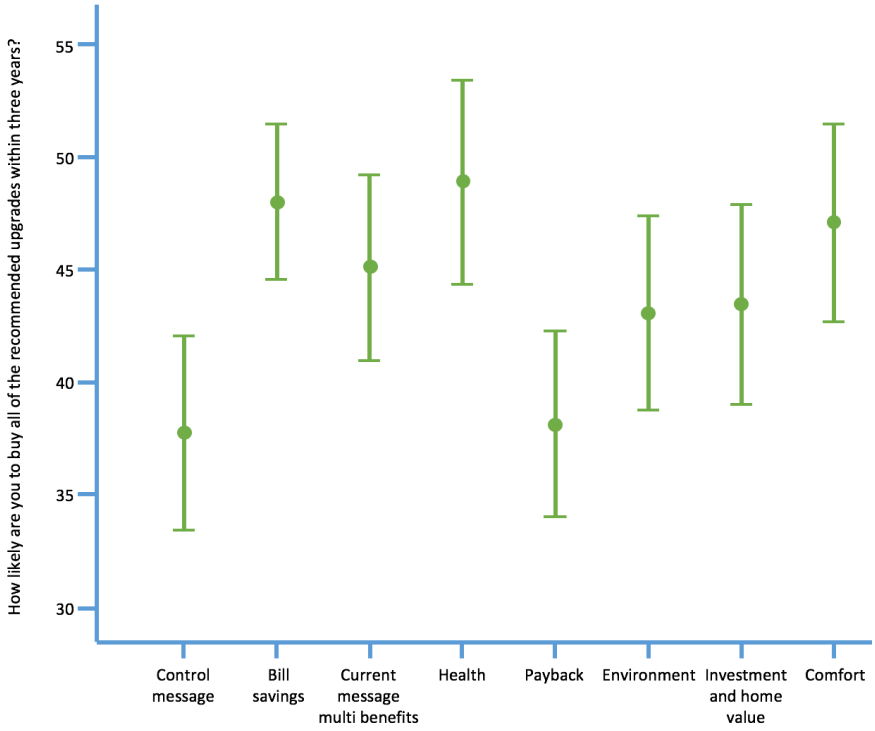


Figure 7. Participants rated willingness to invest (*y*-axis) along a continuum from 0 (extremely unlikely) to 100 (extremely likely). Homeowners were most likely to indicate a willingness to purchase a package of Home Performance with ENERGY STAR upgrades if the message emphasized bill savings, health, or comfort, $F(7, 1{,}881) = 4.1$, $p < 0.001$, $\eta^2 = 0.02$. The green circles represent mean scores, and the error bars represent the 95% confidence intervals of the scores surrounding the mean. When the error bars do not overlap, the difference between means is statistically significant ($p < 0.05$).

Benefit Framing for Particular Subgroups

After studying the overall effects of various benefits frames, we examined several demographic variables to learn if certain benefits worked best for specific demographic groups. In general, health, bill savings, and comfort were the most effective messages, but each worked slightly better with different groups. We discuss each specific group below and summarize our results in table 2.

USED OR PLANNED TO USE HOME PERFORMANCE WITH ENERGY STAR

Participants in our survey who claimed to have used or planned to use HPwES prior to the survey were significantly more willing to invest in the recommended bundle of upgrades. This was a large effect and, therefore, those who claimed to be in this group were much more willing to invest, regardless of the benefits message they received. Participants who

were not in this group (and may not have heard of HPwES) were most persuaded by health and bill savings messages.

AGE

Participants in the 45–54-year-old age range responded best to a bill savings message and somewhat to a health message. Other age ranges did not differ significantly in their responses to any messages.

HOUSEHOLD INCOME

Homeowners in households earning less than $30,000 per year were somewhat persuaded by a comfort message and slightly (but not significantly) by a bill savings message. Households at other income levels did not differ significantly in their responses to any messages.

EDUCATION

Respondents who graduated from high school and earned an associate's degree (or started but did not yet complete a university/college degree) responded best to comfort or health messages. Respondents at other education levels did not differ significantly in their responses to any messages.

REGION

Households in Southern United States responded best to health messages and somewhat to comfort messages. This could potentially be because they were more familiar with the hot and humid conditions that perpetuate mold and mildew growth in homes, and they frequently rely on air-conditioning for cooling and moisture control. Southerners also responded most negatively to the payback message. In the Midwest, the bill savings message was slightly more effective than the others. In the Northeast and West, participants did not differ significantly in their responses to any messages.

CHILDREN AT HOME

Respondents with children living at home responded best to a bill savings message and somewhat to a health message. Respondents without children at home did not differ significantly in their responses to any messages.

EXPECTATION OF MOVING

Not surprisingly, homeowners who were planning to move within five years were least responsive to a payback message (a message indicating that upgrades would pay off within 16 years). This group was most responsive to a health message. Participants who said that they had no plans to move were most willing to invest after reading the bill savings message. Other homeowners did not differ significantly in their responses to any messages. Table 2 summarizes optimum message frames by demographic group.

Table 2. Message frames that worked best for specific demographic groups

Demographic group	Best benefit frame
Did not previously use or plan to use HPwES	Bill savings* or health*
People aged 45–54	Bill savings* or health#
Households making less than $30k/year	Comfort#
High school graduates with some university or an associate's degree	Comfort* or health*
Households in the South	Health* or comfort#
Households in the Midwest	Bill savings#
People with kids currently in the home	Bill savings* or health#
Republicans	Bill savings#
Moving within five years	Health message*
Not planning to move	Bill savings*

Demographic groups not listed were not significantly influenced by any benefits message. *$p < 0.05$; #$p = 0.05$ to 0.09

PART 2. SUBTLE MESSAGE FRAMING EXPERIMENTS

Beyond a discussion of benefits and barriers that are best to highlight and address, subtle changes in wording and presentation can also influence how homeowners respond to home energy upgrade recommendations. For example, Xcel Energy and Franklin Energy Services proposed creating a cover sheet for their assessment reports that called attention to the single best upgrade (or up to three upgrades) that the homeowner should invest in (Syring 2014). They hypothesized that this would mitigate the problem of choice overload and encourage homeowners to take action. Although the increase in investment was not statistically significant,[11] other applications of this type of subtle technique could produce an effect without changing the cost of energy or the price of installation. In fact, as we now discuss, a small but significant change can be made with a simple change of wording and presentation.

In our online survey experiment, we tested five subtle message framing strategies that could be applied to reports created for homeowners who receive energy assessments. Each strategy was tested by randomly showing participants one message option (of several possibilities). We designed the questions, messages, and answer options to be realistic, and we created them using actual home energy assessments and interviews with experts. For each strategy, the messages were structurally equivalent but differed slightly in wording. By randomly assigning participants to see each message, we could determine if the message caused a change in the willingness to invest.

[11] The small sample size may explain the lack of a significant result.

Each participant answered six experimental questions testing subtle message framing strategies. The strategies were as follows.[12]

The Anchoring Heuristic

Participants were asked how likely they would be to insulate a few parts of their homes (an outside wall, a living room floor, and the attic). Some participants saw a control message; others saw either the cost including rebates (the same cost, after rebates, as the control) or a message that included the costs of already-needed repairs (the same cost after repairs). These framing strategies are similar in that participants are told one price (a mental anchor), and then they are told why that price is reduced, thus making the new price appear better in comparison.

Decision Architecture

Participants were shown a list of home upgrades to choose from. The idea was that people might make decisions by comparing the options presented, rather than purely on each option's individual merits. One group saw a list of six home upgrade items that included two items with much higher savings-to-investment ratios (SIRs) than the others. A second group saw the same list of six items, but with the high SIR options replaced by low SIR options. In both cases, the outcome of interest was the selection of midrange items present in both lists (neither the highest nor the lowest SIR). If homeowners make their decisions by comparing options within a list, then they may be more inclined to invest in midrange upgrades when those upgrades are presented next to less-appealing upgrade options.

Group 1 Options

Item	Cost	Annual savings	SIR
Seal air leaks	$1,015	$142	2.8
Attic improvements	$1,883	$140	2.2
Upgrade and adjust thermostat	$170	$197	12.7
Upgrade water heater	$1,223	$73	0.9
Upgrade lighting	$77	$239	21.9
Refrigerator	$1,336	$69	0.9

No-brainer items

Group 2 Options

Item	Cost	Annual savings	SIR
Seal air leaks	$1,015	$142	2.8
Attic improvements	$1,883	$140	2.2
Upgrade water heater	$1,223	$73	0.9
Cooling system	$3,355	$184	0.8
Heating system	$6,288	$264	0.8
Refrigerator	$1,336	$69	0.9

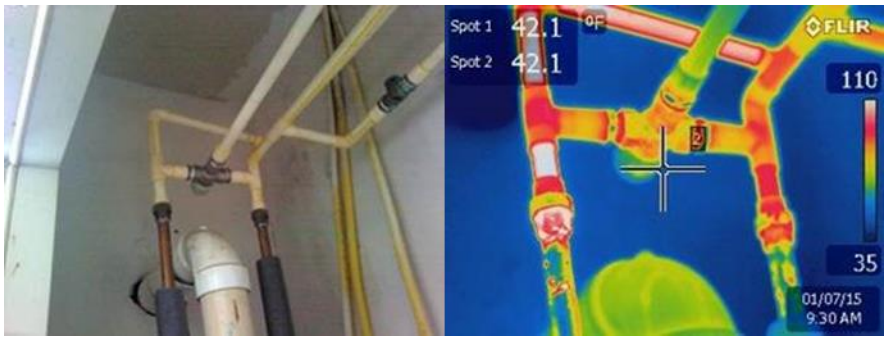
Stretch items

[12] Note that we actually used only the images in the Use of Images subsection in the survey that the participants received. We present the others strictly for descriptive purposes.

Specific Payback Date versus Time-from-Today

This question asked people how likely they would be to insulate their attic. Participants were randomly assigned either to a group in which they were told this upgrade would pay itself off in 9.4 years, or to one of three groups presenting this same time period as a specific date (month-year, day-month-year, or day-of-the-week-month-year).

Use of Images



This question asked participants how likely they would be to insulate the pipes in their homes. In addition to a written description, some participants saw a standard image of the pipes; others saw either a thermal image alone or both images.

Gain or Loss Framing

This question asked participants how likely they would be to invest in a new energy-efficient furnace after seeing bill savings presented as "earning money through savings" (gain frame), "avoiding lost money from potential savings" (loss frame), or simply "saving money" (the standard framing method).

Dropping a Mental Anchor

One reason that homeowners often give for investing in home energy upgrades is that they are planning to do home renovations anyway (e.g., GDS Associates 2013). Unlike other benefits that home energy assessors might cite to sell upgrades (e.g., comfort), this one requires the homeowner to be in a specific state (needing repairs). Therefore we could not include it in the study's benefits framing experiment.

Another reason homeowners frequently cite for investing in energy efficiency upgrades is the availability of rebates (e.g., Gamble 2014). In some ways, the availability of rebates and the need to do repairs are psychologically similar. Both can be presented as a use of the anchoring heuristic. That is, a home energy contractor can set a mental anchor price for homeowners for the costs of upgrades, and then adjust from that anchor by presenting rebates or the costs of needed repairs. This makes the new price seem low (by comparison to the original). That is, the total cost should be perceived as lower if it is reduced by rebates or previously planned repair costs.

Although rebates and pre-existing repair needs are somewhat different, we tested them both against the same control message in this part of the study. In this experiment, participants were randomly shown either (1) a control message in which a home energy assessor recommends insulation upgrades totaling $2,500; (2) a rebates message in which the recommended upgrades still totaled $2,500, but only after "eligible rebates" were included (no explicit dollar amount mentioned), (3) a rebates message in which the recommended upgrades totaled $3,800, but eligible rebates totaled $1,300 (therefore the total was still $2,500); and (4) an "already committed" message in which the recommended upgrades totaled $3,800 but the homeowner had previously committed to doing $1,300 in repairs caused by water damage (and thus the total was still $2,500).

Overall, using the anchoring heuristic showed a small but significant effect. Homeowners in the scenario in which they were asked to imagine that they were already committed to doing repairs were the most likely to invest in upgrades. As expected, the no-anchor group was the least willing to upgrade. Figure 8 shows homeowners' willingness to invest in upgrades in response to each message.

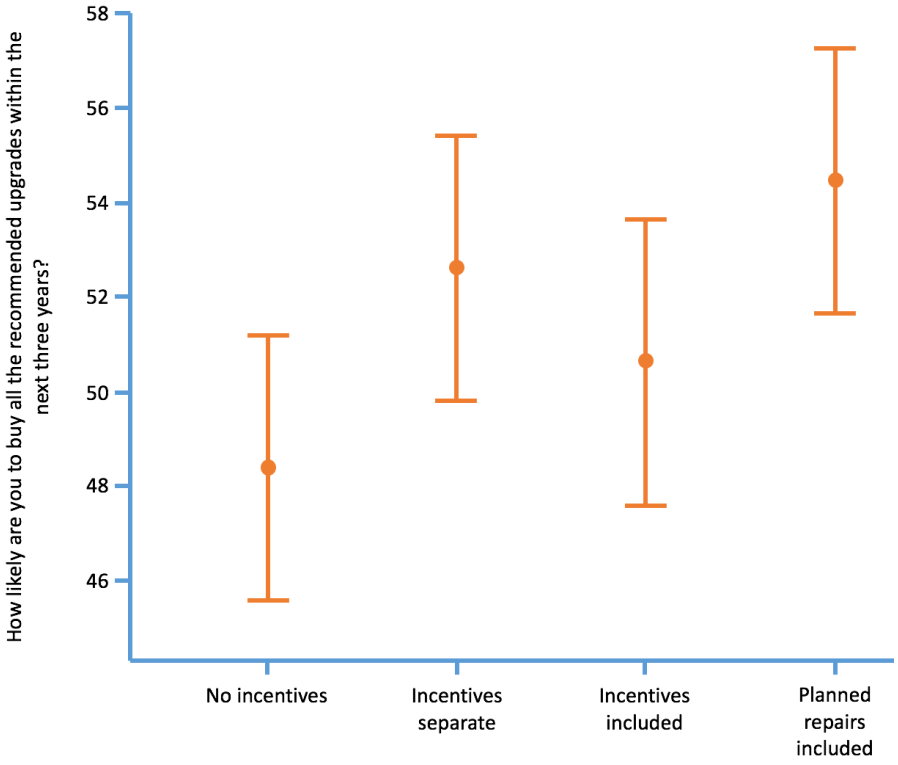


Figure 8. Participants rated their willingness to buy all the recommended insulation upgrades (*y*-axis) along a continuum from 0 (extremely unlikely) to 100 (extremely likely). Homeowners were most likely to indicate a willingness to purchase if they were asked to imagine that they were already committed to doing other repairs, $F(3, 1{,}890) = 3.32$, $p = 0.02$, $\eta_p^2 = 0.01$. The orange circles represent the mean scores, and the error bars represent the 95% confidence intervals of the scores surrounding the mean. When the error bars do not overlap, the difference between means is statistically significant ($p < 0.05$).

Removing "No-Brainer" Items

When people make judgments and decisions about most things, they mentally compare those things to other things they can bring to mind. When considering a home energy improvement such as air sealing, for example, they might compare it to other potential improvements to decide if the cost is affordable. Although air sealing is relatively cost effective and affordable for most homeowners, when compared to lighting upgrades—which are so cost effective as to generally be a no-brainer option—air sealing looks relatively expensive. On the contrary, if the homeowner is considering air sealing in comparison to an expensive heating system upgrade, air sealing is perceived as rather affordable. This is another example of the anchoring heuristic at work.

Perhaps counterintuitively, consumer purchases are not made purely on their own merits, but also in comparison to other potential purchases. This effect was found with a variety of consumer items (Huber, Payne, and Puto 1982). Sometimes, adding an item that is completely inferior (in every way) to a list of consumer options can influence selection of the other items, even if the newly added item is never chosen (Huber, Payne, and Puto 1982). Regarding home energy upgrades, if assessors can influence which comparison items homeowners bring to mind when considering upgrades, they can influence the likelihood of the homeowners investing in those upgrades.

To test this effect in the context of home energy upgrades, we gave participants a list of potential home upgrade options (each with costs, annual savings, and SIR) based on an actual sample home energy assessment conducted by the New York State Energy Research and Development Authority (NYSERDA 2015). We then asked participants to select the options they would be interested in doing. In one condition, the six options included two items (lighting and thermostat upgrades) that were no-brainers—that is, clearly superior (in cost and SIR) to the other four. In a second condition, we replaced these two no-brainer options with two clearly inferior ("stretch") options in terms of cost and SIR: a heating system and a cooling system.

The idea behind this test was that participants look at the list as a whole and are less likely to choose midrange options if clearly superior no-brainer options are on the same list (because the midrange options look expensive in comparison). Likewise, they are more likely to pick midrange options if inferior options are in the list (because the midrange options look like a good deal in comparison). The primary outcome of interest was the rate of investment in midrange home energy upgrades that have neither the highest nor the lowest cost and SIRs.

Overall, participants committed to doing more total upgrades when the two no-brainer items were included in the list (2.48 out of 6) than when there were instead two stretch options in the list (2.10 out of 6). However, if the goal was to increase investment in so-called midrange upgrades, then presenting a list with two stretch options works better than the list with no-brainer options. When participants view a list of more expensive items with smaller SIRs, they are willing to commit substantially more money up front ($4,521.47 versus $1,759.83) and choose to do more midrange upgrades as opposed to just cheap-and-easy upgrades.[13]

Based on this finding, we recommend experimenting with moving no-brainer items, such as lighting upgrades, to a separate section of the assessment report and possibly excluding SIR or other pieces of information that encourage comparison to the main list of substantive upgrades. If homeowners are considering lighting alongside deeper retrofit options, they may perceive deep retrofits as being very expensive and, therefore, less appealing to purchase. Instead, add stretch items to the list of upgrades to make target upgrades appear more appealing in comparison.

[13] We also saw some indication that participants may pay more attention to SIRs than to upfront costs when making these decisions. One item with a higher upfront cost and a high SIR (attic improvements) was nevertheless selected more frequently than others with lower upfront cost but also lower SIRs (water heater and refrigerator), even when the stretch conditions were included. This finding may have been unique to this test and needs further experimentation to confirm. Overall, this element of the assessment report should be tested with more types of cost-benefit metrics presented in multiple different ways to isolate the most important and persuasive configuration of features.

Talking about the Specific Month and Year of Payback

Behavioral economists have demonstrated that people are generally more likely to prefer to receive less money earlier than more money later, but they are also slightly more likely to prefer the later/more option if the payday is given as a precise date as opposed to months-from-today (e.g., Read et al. 2005). To test this effect, we presented participants with a situation in which a home energy assessor recommended insulating the participants' attic. We specified the payback period as either: (1) years-from-today (9.4 years), (2) date as month-year, (3) date as day-month-year, or (4) day-of-the-week-date-month-year.[14]

Overall, the effect was borderline significant and very small. Participants were least willing to invest when they saw the payback period presented as years-from-today (as expected), and they were most willing to invest when it was presented as month-year. Notably, in the survey's benefits section, we found that a payback message was generally not a good way to encourage investment in upgrades (especially when the period was long). Therefore we do not recommend selling upgrades by describing long payback periods to customers. However, if payback periods must be discussed, they should be described as a specific month and year in the future, rather than as years-from-today if possible.[15] Figure 9 depicts homeowners' willingness to invest in attic insulation in response to various payback period messages.

[14] This payback period comes from an actual home energy assessment example by Evinity: www.envinity.com/wp-content/uploads/2014/10/Envinity-Sample-Report.pdf

[15] Customers are less willing to invest in upgrades when they see payback periods presented as very specific dates (e.g., August 17, 2026, or Monday, August 17, 2026). We hypothesize that this may be because, at longer time periods, people become skeptical of the plausibility of this level of certainty. However this explanation requires further testing.

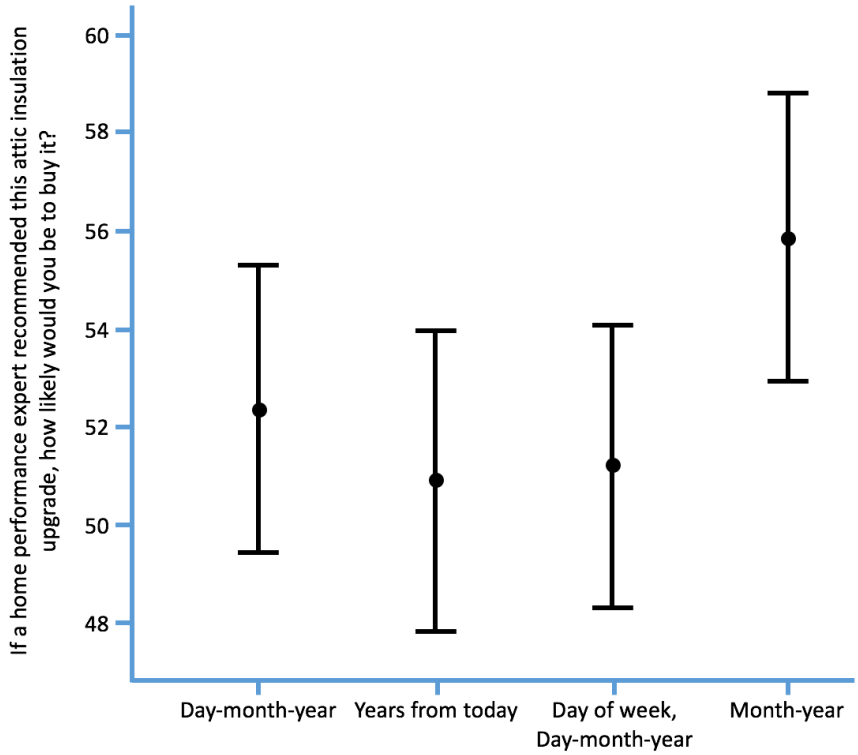


Figure 9. Participants rated their willingness to buy the recommended insulation upgrade (*y*-axis) along a continuum from 0 (extremely unlikely) to 100 (extremely likely). Homeowners were borderline slightly more likely to be willing to purchase insulation if the payback date was presented as month-year than years-from-today, $F(3, 1{,}868) = 2.17$, $p = 0.09$, $\eta_p^2 = 0.003$. The circles represent mean scores, and the error bars represent the 95% confidence intervals of the scores surrounding the mean. When the error bars do not overlap, the difference between means is statistically significant ($p < 0.05$).

Using Images

In general, descriptive images and the ability to visualize the benefits of home energy upgrades should be related to a willingness to upgrade. UK homeowners who received a thermal image of their home in addition to a carbon footprint audit were significantly more likely to install draft proofing and reduce their energy use one year later than were homeowners who received an audit without the photo (Goodhew et al. 2015). Indeed, homeowners find infrared images to be a persuasive component of home energy assessments (Ingle et al. 2014). Nevertheless, including standard images or thermal images in assessment reports is not yet standard practice.

We tested the use of images for one specific type of home energy upgrade. In this experiment, we showed participants a message with an excerpt from an actual home energy assessment report recommending that the homeowners insulate their pipes. The message was presented to participants in one of four ways: without any image; with a standard (nonthermal) image of residential pipes and an explanation of the image; with a thermal image of the same pipes and an explanation of what the colors indicate; and with both the standard and thermal images side by side with an explanation of the thermal image below.

The cost of this upgrade was a fraction of the cost of any other upgrades previously used in other parts of the study ($150 versus thousands of dollars for other upgrades). Therefore homeowners indicated a much higher overall likelihood of investing in this upgrade than others. We chose this scenario because it was a realistic price for a common recommendation. Future research should test whether our results would hold with higher-priced and alternative upgrades.

Surprisingly, the presence of a standard or thermal image did not make a significant difference to the likelihood of investment in this case. Although including the thermal image received the best response and including no image received the worst response, this difference was not statistically significant. We believe that this could be because this particular upgrade had such high uptake to begin with that differences in responses were hard to detect. Previous research on thermal images also suggests that the image may have been ineffective because it was not personally tailored to the respondents' own homes (Boomsma et al. 2016).

We cannot be certain why images did not significantly increase willingness to upgrade pipe insulation in this case; most previous research suggests that thermal images (and images in general) help to make messages more persuasive. In this particular experiment, that was not the case, but we nevertheless recommend using images in most cases. Further testing and analysis needs to be done to determine which upgrade recommendations, in which situations, benefit most from the addition of standard and thermal images.

Framing as a Gain or Loss

Loss aversion refers to the common phenomenon that people are often more likely to act to avoid a loss than to earn an equivalent gain, even when both options are logically the same (Kühberger 1998). However, in some cases, people do the opposite and act to receive a gain more than to avoid a loss (e.g., Detweiler et al. 1999). We tested whether a *gain frame* or *loss frame* was better for selling home energy upgrades.

To test if either of these framings might have an effect on investment in home energy upgrades, we showed participants one of three messages about how (1) purchasing a new energy-efficient furnace earns money in savings; (2) not purchasing an energy-efficient furnace loses money in missed savings; or (3) purchasing an energy-efficient furnace saves money (this is the standard framing; it can be argued to be either gain or loss, depending on perspective). We then asked participants how likely they would be to invest in a new energy-efficient furnace for $1,000 more than a standard model would cost.

There was no overall significant effect of using a loss, gain, or savings framing for selling an energy-efficient furnace. All three frames generally performed equally well for this particular upgrade scenario.

Recommendations for Home Energy Assessment Contractors

Home energy assessors can increase the likelihood of homeowners investing in energy upgrades in numerous ways, ranging from how they conduct the assessment to how they interact with the homeowner to how they present upgrade options.

PROVIDE AN INTERESTING AND ENGAGING EXPERIENCE

Home energy assessors should engage with homeowners to show them something they do not already know. Technical elements of assessments—such as blower door tests, infrared images, personally showing homeowners areas for improvement, and providing tailored assessment reports—help persuade homeowners of the benefits of upgrading in a more personal, visceral way.

LISTEN FIRST, TAILOR SECOND

A key element of the home energy assessment is listening to homeowners. Listening nonjudgmentally and empathizing with homeowners gives assessors an opportunity to understand homeowners' concerns about their home and their motivations for requesting an assessment. Assessors can also learn about what the home means to its occupants and how renovations may affect their daily lives (for better or worse).

These key pieces of information can help inform assessors about which upgrades matter most to the homeowners and how best to explain their benefits. It will also guide the assessors in laying out plans to overcome potential barriers to upgrading. Prior to meeting with homeowners, assessors can tailor their approaches based on previously identified archetypes of home upgraders or homeowners in different stages of deciding to upgrade. After listening to the homeowners' concerns, assessors should tailor their recommendations more specifically to meet them.

EMPHASIZE NONFINANCIAL BENEFITS

The most persuasive benefits of home energy upgrades are bill savings, comfort, health, and the natural environment. If possible, assessors should avoid focusing the conversation entirely on financial benefits or bill savings. Financial factors are so important to homeowners that they can easily dominate the conversation. Unfortunately, if home energy assessors stress financial benefits as key elements of decision making, they limit potential sales to upgrades that are financially cost effective on energy savings alone.

Assessors who educate their customers on the health and comfort benefits of home energy upgrades can encourage them to account for those benefits when doing a mental cost–benefit analysis. Introducing these other benefits also introduces an important emotional component, which can be a key element of decision making. Health and comfort could be particularly persuasive arguments if homeowners have specific health or comfort concerns.

DEVELOP RAPPORT AND HELP HOMEOWNERS THROUGH THE PROCESS

Home energy assessors who are enthusiastic and display good interpersonal skills are more well-liked and more persuasive. Those who go beyond simply providing information about useful upgrades and their costs are the most effective. Guiding customers through decision barriers and transaction barriers can help increase conversion rates. Assessors can learn interpersonal skills with deliberate practice; asking questions and showing a genuine interest in and empathy for their clients increases trustworthiness, credibility, and likeability.

USE SUBTLE MESSAGE FRAMING STRATEGIES

Some evidence from our experiment suggests that subtle message framing strategies may have a small but significant effect. People make judgments and decisions through a process of mental comparison. By subtly influencing the comparisons they make, home energy assessors can affect the perception of upgrade options to be slightly more or less appealing. This can be achieved in several ways.

Home energy assessors who present an initial (high) price for upgrades before lowering through incentives or by including costs of already-needed repairs, increase the appeal of the upgrades. Similarly, when they position no-brainer, easy-upgrade options (e.g., lighting) separate from more expensive upgrades in home energy assessment reports (and instead include "stretch" options), they can make more expensive items (with larger energy savings) seem more appealing.

Additionally, we found that long payback periods are not persuasive for homeowners but, if they must be discussed, they should be presented as the month-year of payback date as opposed to years-from-today.

We also suggest including images—especially infrared images—in assessment reports, provided that they are tailored specifically to the homeowner's residence. Although our particular experiment did not show that thermal images increased willingness to invest at a statistically significant level (possibly because they were not personally tailored), the overall weight of evidence suggests that images are likely to be effective in some situations. More research is needed to delineate in exactly which situations images are most effective.

Training Home Energy Assessors

Numerous resources are available for home energy assessors interested in increasing their conversion rates and improving uptake of their recommended upgrades. The annual National Home Performance Conference and Trade Show offers many sessions and panels on sales and marketing of home energy assessments and upgrades.[16] In addition to this report, assessors or program managers interested in designing a successful home energy assessment program based on the principles of social psychology can refer to the guide written by Fuller et al. (2010).

In 1988, Gonzales, Aronson, and Constanzo, piloted a successful training program for home energy assessors that was evaluated using a quasi-experimental design. In their two-day workshop, Gonzales and colleagues taught assessors the importance of four elements of communication: (1) communicating vividly, (2) personalizing their recommendations, (3) inducing commitment from homeowners, and (4) framing their recommendations in terms of loss rather than gain.[17]

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[16] www.homeperformance.org/sites/default/files/Natl17_eBrochure_3.17.17_2.pdf

[17] It has since been demonstrated that loss framing is not universally better than gain framing, as may be the case for home energy use.

Communicating vividly might mean giving rich case histories of neighbors who use less energy with or referring to them as superconservers. It also involves using vivid language, as in this description of air leakage:

> If you were to add up all the cracks around and under the doors of your home, you'd have the equivalent of a hole the size of a football in your living room wall. Think for a moment about all the heat that would escape from a hole that size. That's precisely why I'm recommending that you install weather stripping . . . . And your attic totally lacks insulation. We call that a "naked attic." It's as if your home is facing winter not just without an overcoat, but without any clothing at all. (p. 1052)

Personalizing the assessment means specifically tailoring reports to customers, such as by referring to their specific utility bills and usage, as opposed to presenting a range of potential savings that are standard for each upgrade.

By *commitment*, the authors refer to helping homeowners take small initial steps (as with the foot-in-the-door strategy). Hence, they suggest that assessors get homeowners involved in the assessment by showing them areas for improvement, such as an uninsulated attic, or enlisting their help in taking measurements, reading meters, and so on.

When following up with customers who received assessments from their program's trained assessors, Gonzales and colleagues found that homeowners were significantly more likely to report planning to invest in upgrades than those in the comparison group with untrained assessors. They were also significantly more likely to report applying for a home energy upgrade loan (which could be applied for only after installing upgrades). However the researchers in this case did not see these successes reflected in statistically significant reductions in home energy use. Other research indicates that this could be due to factors such as changes in occupancy, building size, etc. (Opinion Dynamics 2014). Nevertheless, the program successfully increased the number of homeowners investing in energy upgrades; therefore, it could be used as a model for other programs. More research linking assessor training programs to actual household energy consumption could be useful.

Conclusions and Next Steps

Message framing can have small but significant effects on homeowner decisions to upgrade the efficiency of their residences. Given the impact of upgrade decisions on energy use and the large scale at which home energy assessment programs are applied, this research may have important consequences for nationwide energy efficiency.

With these experiments and this report, ACEEE has taken one step in the development of an effective social-science-based strategy for increasing homeowner investment in energy efficiency. From here, we hope to take the next step of diving deeper into assessment reports and the many different structures, elements, and metrics that are used to convey upgrade messages within them. We will also endeavor to test these message framing strategies in the field with the help of energy assessment professionals and actual homeowners making efficiency investment decisions. Message framing is a promising new direction for maximizing the effectiveness of home energy assessment programs.

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Appendix A. Methods Used for Message Framing Experiments

PARTICIPANTS

We recruited a nationally representative sample of US homeowners through a panel company (Branded Research) and gave each homeowner a small amount of money in exchange for participating. They completed the study online, using a custom survey platform called *Survey Gizmo*. Only participants residing in the continental United States who owned single family detached dwellings or dwellings attached to one other unit were included in the study. We used data from 1,905 participants of the 3,108 who showed interest in the survey. Of the excluded participants, 890 were disqualified because they did not own their residences, did not live in the target type of building, failed all three of the attention check questions, completed the survey in under 200 seconds, or were part of a demographic for which the required quota was reached (region, age, education, or income). An additional 218 participants were excluded because they started, but did not complete, the survey, and 94 participants were excluded because they did not provide quality answers.[18]

The participants were nearly identical to the 2015 US Census results for homeowners living in single detached homes or units attached to only one other unit.[19] They were similar in age, education, income, and region (percentages in each category differed by no more than 8%).

As predicted by the US Census, most respondents were at least 55 years old (28.6% were 55–64, 26.3% were 65–74, and 4% were 75+). Forty-eight percent were male, 97% lived in a single detached home, and 3% lived in units attached to one other. A surprisingly large percentage of participants claimed to have used the HPwES program before taking the survey (22%) and, of those, 75% claimed to have purchased at least one of the recommended upgrades.

We provided all respondents who completed the survey with a list of potential home energy upgrades that they may have purchased. On average, respondents claimed to have done 2.04 upgrades from the list of 9 provided. Homeowners most commonly lived in homes built after 1991 (34%) and most often owned their homes for more than 21 years (32%).

Of the total number of respondents, 38% stated that they usually vote Republican, and 35% stated that they usually vote Democrat. The rest of the sample voted equally for various parties, typically voted for other candidates, or chose not to answer the question.

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[18] Poor-quality answers were defined as a suspicious combination of items (at least two) such as writing nonsense in the open-ended question response boxes, completing the survey in under 300 seconds, answering all questions nearly identically, failing two of three attention check items, or providing answers that were extreme outliers.

[19] www.census.gov/programs-surveys/ahs.html.

PROCEDURE

Our study used a randomized control trial to test specific message framing strategies for home energy efficiency upgrades. Each strategy was based on theories derived from behavioral economics or social psychology.

In the study, each participant was shown six messages, with each message describing different home energy upgrades or upgrade packages. After each message, participants rated how likely they were to invest in that particular upgrade (or upgrade package). Each of the six messages tested a different message framing strategy. We determined which message framing strategy worked best for each message by comparing participants' stated likelihoods to invest in upgrades across frames for the same question.

Testing each strategy involved randomly selecting a message from three to eight options. Each message framing strategy was tested with a different home energy upgrade. We chose to use a few realistic framings for each question (based on actual home energy assessments and interviews with experts) as opposed to exhaustively testing every possible frame for each strategy. This meant that, in some cases, additional questions emerged from the study that could not be answered. Follow-up studies focusing more specifically on these strategies could be helpful for establishing theory and generalizable results.

In summary, the participants answered six experimental questions, followed by a set of demographic questions regarding age, income, education, geographic region, age of house, intention to move, etc. At the end of the study, participants also had the option of clicking a link to get to a page where they could search for an HPwES contractor in their area. This was a basic measure of one type of relevant actual behavior that correlated strongly with answers to the hypothetical investment questions that formed the basis of the study.

The survey included the following components in this order (see Appendix B for the complete survey):

1. Demographics questions to establish eligibility and quotas
    - These questions asked about geographical region, age, income, gender, education level, and dwelling type.
2. Benefits frame question (which benefits of energy efficiency upgrades are best to highlight?)
    - This question asked participants if they would invest in a total package of HPwES upgrades after seeing one of eight possible messages.
    - Frames here included bill savings, health, payback, environment, investment/home value, comfort, current (mixed) benefits, and the no benefits message.
3. Gain or loss framing
    - This question asked participants how likely they would be to invest in a new energy-efficient furnace.
    - Frames here included gain frame, loss frame, and "savings" frame.
4. Decision architecture
    - This question showed participants a list of home upgrades to choose from. If it is true that people make decisions by comparing the options they are

presented rather than by weighing each option's merits on its own, then the list of options people are presented could affect their choices.
    - Framing strategies: One group saw a list of six home upgrade items, including the two items that were clearly better than the rest in terms of cost and SIRs; the other group saw a list of six items with the superior options removed and two clearly inferior options added. The outcome of interest was selection of the midrange items that were present in both lists.
5. Specific payback date vs. time-from-today
    - This question asked people how likely they would be to insulate their attic.
    - Framing strategies: Participants were told that this upgrade would pay itself off in 9.4 years, but this information was framed as either years-from-today or on a specific date (month-year, day-month-year, or day-of-the-week-month-year).
6. Use of images
    - This question asked participants how likely they would be to insulate the pipes in their homes.
    - Framing strategies: In addition to a written description, some participants saw a standard image of the pipes, some saw a thermal image, and some saw both images.
7. Anchoring heuristic
    - This question asked participants how likely they would be to insulate a few parts of their home (an outside wall, a living room floor, and the attic).
    - Framing strategies: Some participants saw a control message, others saw cost after rebates (the same cost after rebates as the control), and others saw a message that includes the costs of already-needed repairs (same cost after repairs).
8. Additional demographics questions
    - These questions included size of home, age of home, duration of ownership, how long they plan to stay in home, estimated monthly energy costs, a list of upgrades they may have done already, and political affiliation.
9. Opportunity to search for a home energy assessor
    - Participants could request a URL for finding an HPwES assessor.

STATISTICAL ANALYSES

Results of this series of experiments have been submitted for publication in an academic peer-reviewed journal. For details on each statistical analysis, access to the data, or questions about details of the procedure, please contact the authors of this report or refer to the forthcoming publication.

The first step in examining the study's results was to determine if answers to each of the primary outcome questions was correlated. After determining that they were correlated, we created a composite variable called overall likelihood of upgrading, and tested its reliability using Chronbach's alpha (the composite variable was a mean of the five combined dependent variables, and it ranged from 0 to 100, just like each of the other dependent variables). We also used a *t*-test to determine if participants who requested information for finding a home energy assessor in their area scored more highly on this composite variable.

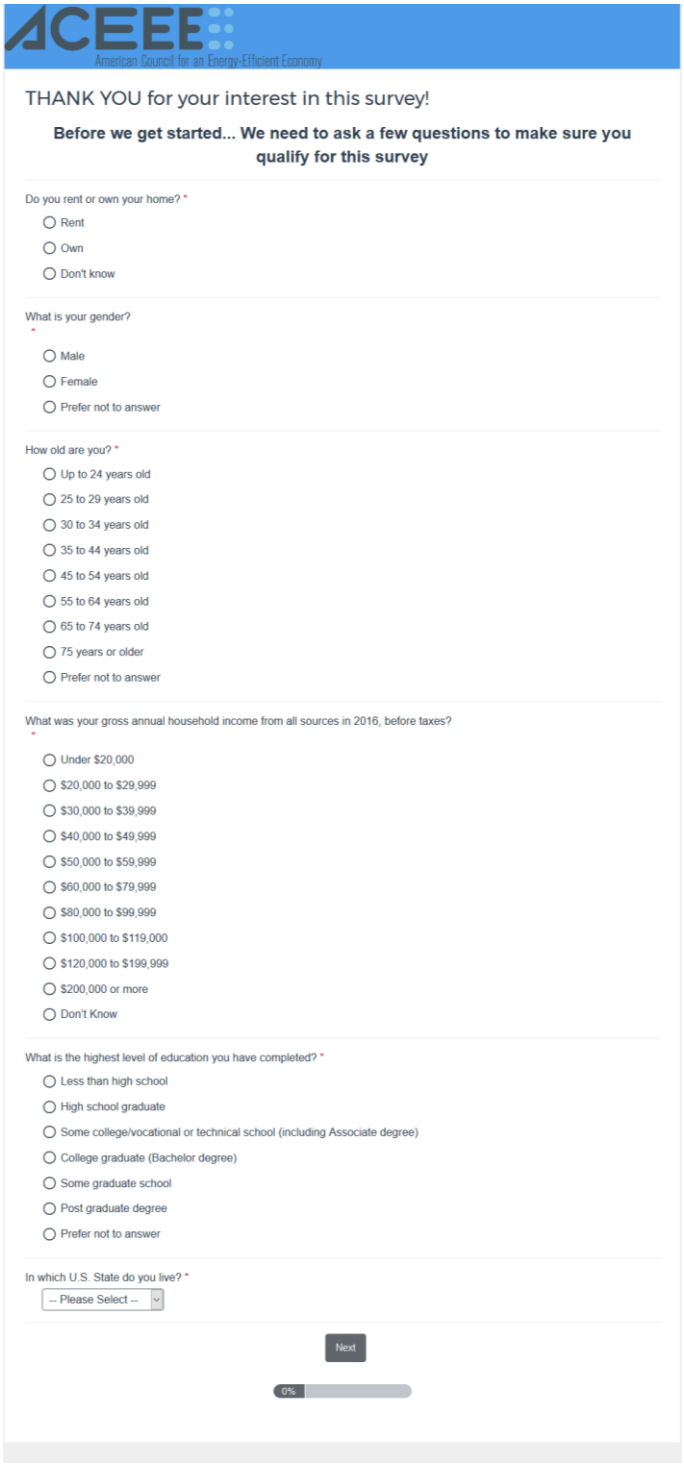
We then conducted exploratory analyses on the new *overall likelihood of upgrading* composite variable. We assessed the measured demographic variables categorically to match US Census data categories (e.g., we measured the age of respondents using categories of "up to 24 years old," "25–29 years old," etc., rather than using a continuous variable such as "please provide your age in years"). We then tested to see if these demographics predicted overall likelihood of upgrading. We used a one-way analyses of variance (ANOVA) for each of the 12 demographic variables (gender, age, type of home, income, education level, year home built, years of ownership, time planning to move, children at home, size of home, and political affiliation). Given the size of our sample, we felt that this number of exploratory ANOVAs was justified.

Next, we tested each message framing strategy's ability to predict self-reported interest in upgrading. Again, we did this using ANOVAs for each question with a continuous dependent variable (that is, all but the decision architecture question). The ANOVA allowed us to determine if the framing strategy generally affected participant responses; plot-plus-error-bar graphs and post-hoc tests allowed us to determine which framing strategies were most effective.

For the benefits framing question, we also conducted exploratory analyses to examine whether the effectiveness of different benefits frames varied for specific demographic segments of our sample. To do this, we plotted the data and conducted separate ANOVAs for each subsample of the population (age brackets, income levels, etc.).

The dependent variable for the decision architecture question was categorical; participants checked the items they would choose to upgrade from a list. Therefore the results of this test were measured using chi-square tests of frequencies of each item, as well as ANOVAs to test differences in total numbers of items chosen.

Appendix B. Online Message Framing Survey Experiment



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THANK YOU for your interest in this survey!

Before we get started... We need to ask a few questions to make sure you qualify for this survey

Do you rent or own your home? *
- Rent
- Own
- Don't know

What is your gender? *
- Male
- Female
- Prefer not to answer

How old are you? *
- Up to 24 years old
- 25 to 29 years old
- 30 to 34 years old
- 35 to 44 years old
- 45 to 54 years old
- 55 to 64 years old
- 65 to 74 years old
- 75 years or older
- Prefer not to answer

What was your gross annual household income from all sources in 2016, before taxes? *
- Under $20,000
- $20,000 to $29,999
- $30,000 to $39,999
- $40,000 to $49,999
- $50,000 to $59,999
- $60,000 to $79,999
- $80,000 to $99,999
- $100,000 to $119,000
- $120,000 to $199,999
- $200,000 or more
- Don't Know

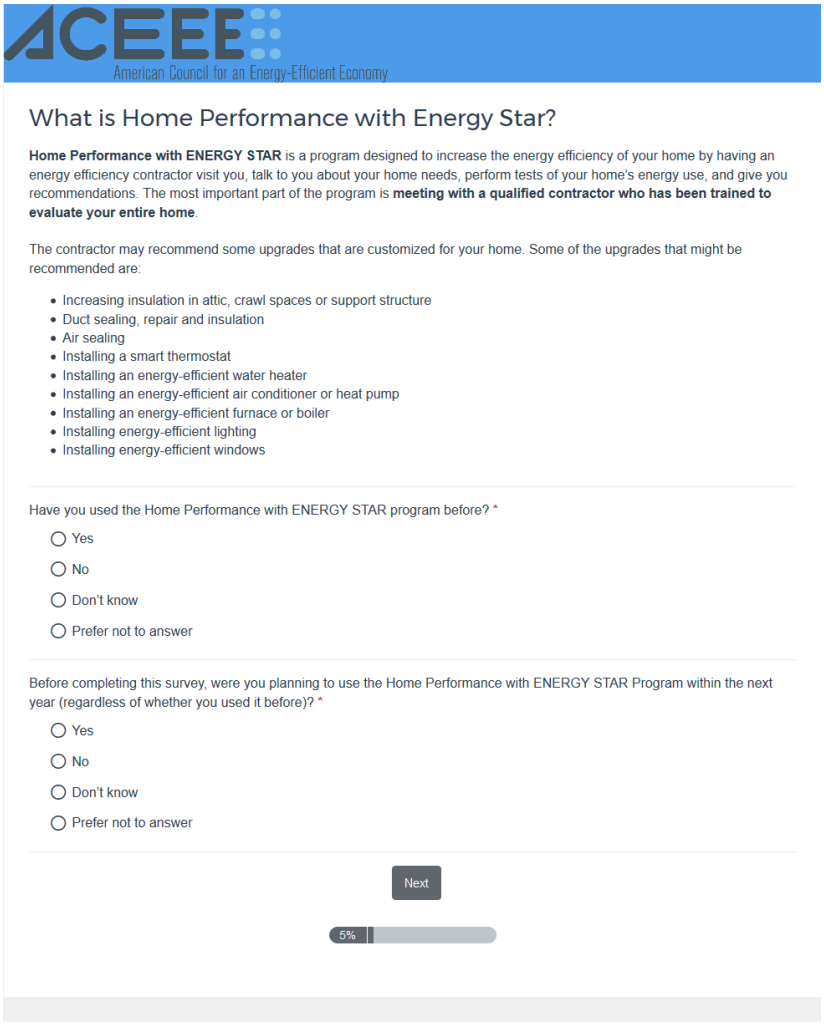
What is the highest level of education you have completed? *
- Less than high school
- High school graduate
- Some college/vocational or technical school (including Associate degree)
- College graduate (Bachelor degree)
- Some graduate school
- Post graduate degree
- Prefer not to answer

In which U.S. State do you live? *
-- Please Select --

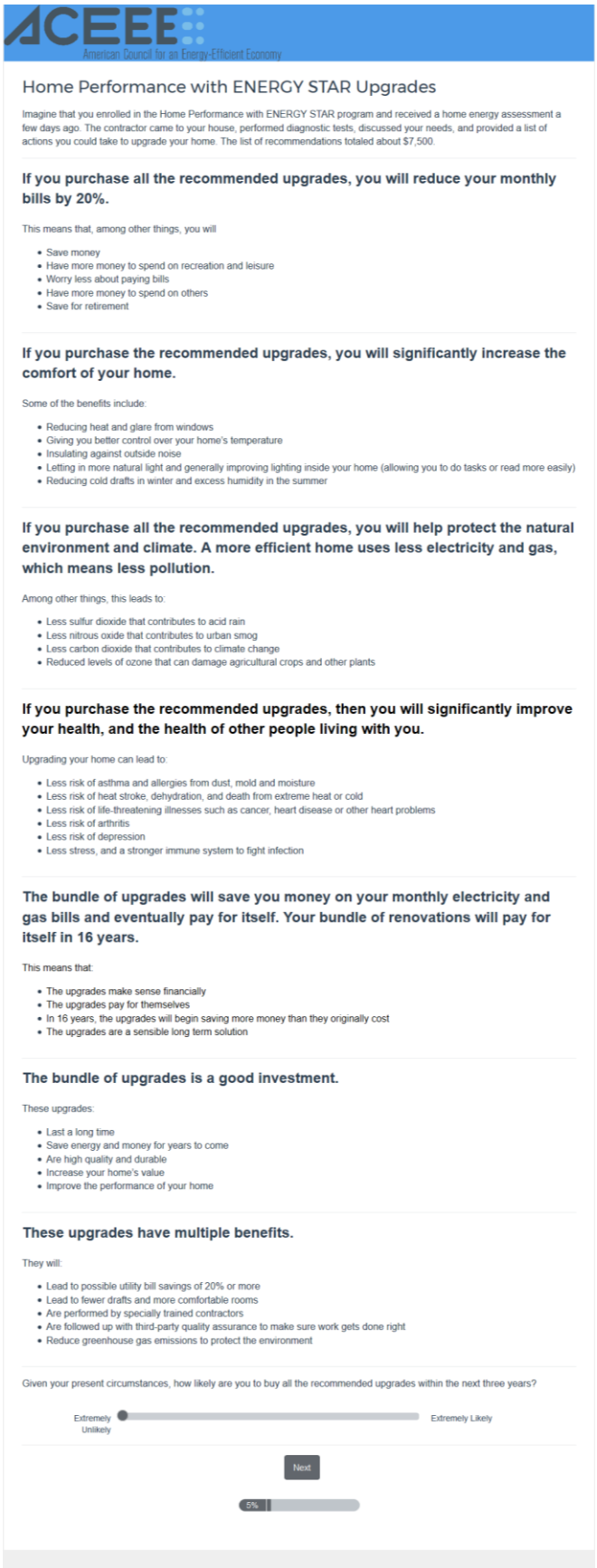
Next

0%

- Preliminary screening questions

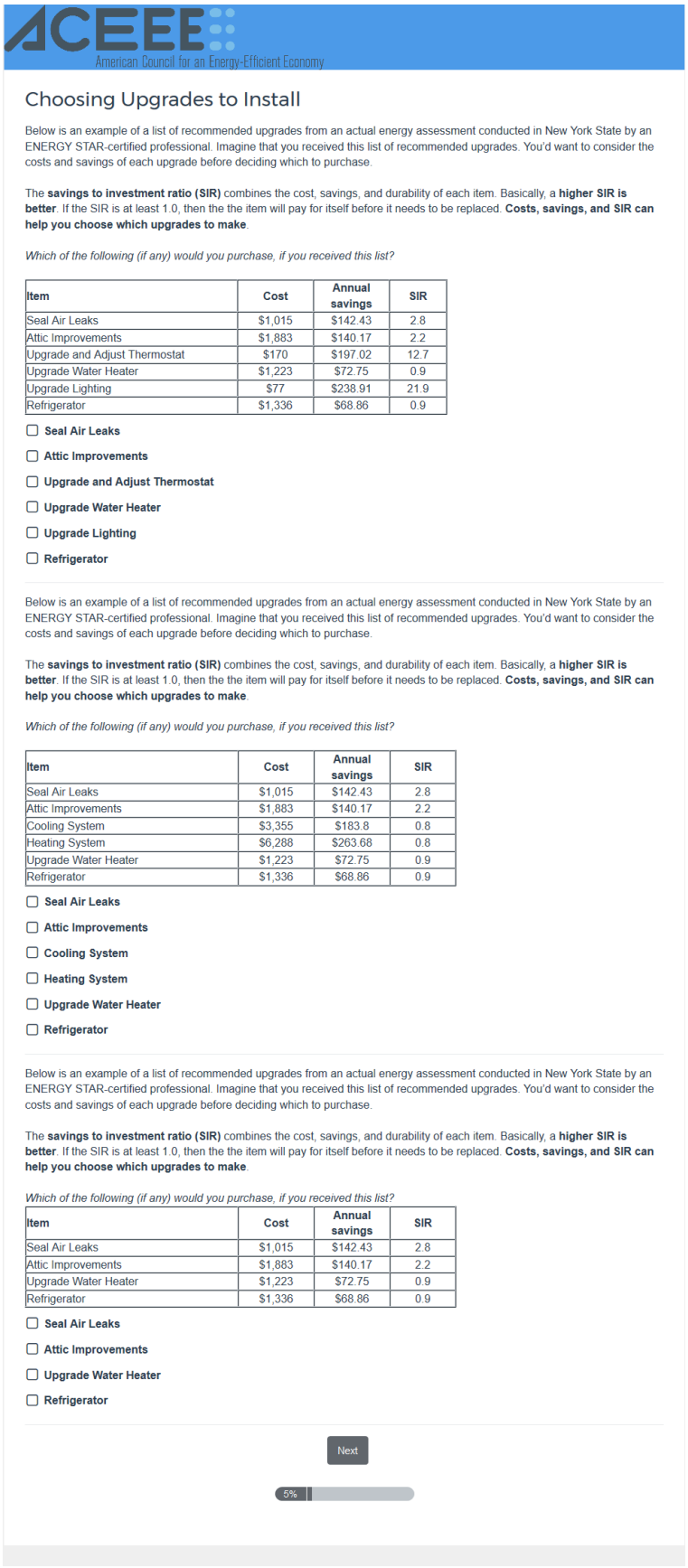


- Explanation of Home Performance with ENERGY STAR™



- In this section, respondents saw one of these seven messages (or no message at all) before being asked how likely they would be to invest. We kept messages constant in form, style, and structure. We created them in consultation with home energy experts and actual Home Performance marketing materials.

- In this section, respondents saw one of these three messages before the question. This one tests loss versus gain frames (versus the standard "savings" frame).



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Choosing Upgrades to Install

Below is an example of a list of recommended upgrades from an actual energy assessment conducted in New York State by an ENERGY STAR-certified professional. Imagine that you received this list of recommended upgrades. You'd want to consider the costs and savings of each upgrade before deciding which to purchase.

The **savings to investment ratio (SIR)** combines the cost, savings, and durability of each item. Basically, a **higher SIR is better**. If the SIR is at least 1.0, then the the item will pay for itself before it needs to be replaced. **Costs, savings, and SIR can help you choose which upgrades to make**.

Which of the following (if any) would you purchase, if you received this list?

Item	Cost	Annual savings	SIR
Seal Air Leaks	$1,015	$142.43	2.8
Attic Improvements	$1,883	$140.17	2.2
Upgrade and Adjust Thermostat	$170	$197.02	12.7
Upgrade Water Heater	$1,223	$72.75	0.9
Upgrade Lighting	$77	$238.91	21.9
Refrigerator	$1,336	$68.86	0.9

☐ **Seal Air Leaks**
☐ **Attic Improvements**
☐ **Upgrade and Adjust Thermostat**
☐ **Upgrade Water Heater**
☐ **Upgrade Lighting**
☐ **Refrigerator**

Below is an example of a list of recommended upgrades from an actual energy assessment conducted in New York State by an ENERGY STAR-certified professional. Imagine that you received this list of recommended upgrades. You'd want to consider the costs and savings of each upgrade before deciding which to purchase.

The **savings to investment ratio (SIR)** combines the cost, savings, and durability of each item. Basically, a **higher SIR is better**. If the SIR is at least 1.0, then the the item will pay for itself before it needs to be replaced. **Costs, savings, and SIR can help you choose which upgrades to make**.

Which of the following (if any) would you purchase, if you received this list?

Item	Cost	Annual savings	SIR
Seal Air Leaks	$1,015	$142.43	2.8
Attic Improvements	$1,883	$140.17	2.2
Cooling System	$3,355	$183.8	0.8
Heating System	$6,288	$263.68	0.8
Upgrade Water Heater	$1,223	$72.75	0.9
Refrigerator	$1,336	$68.86	0.9

☐ **Seal Air Leaks**
☐ **Attic Improvements**
☐ **Cooling System**
☐ **Heating System**
☐ **Upgrade Water Heater**
☐ **Refrigerator**

Below is an example of a list of recommended upgrades from an actual energy assessment conducted in New York State by an ENERGY STAR-certified professional. Imagine that you received this list of recommended upgrades. You'd want to consider the costs and savings of each upgrade before deciding which to purchase.

The **savings to investment ratio (SIR)** combines the cost, savings, and durability of each item. Basically, a **higher SIR is better**. If the SIR is at least 1.0, then the the item will pay for itself before it needs to be replaced. **Costs, savings, and SIR can help you choose which upgrades to make**.

Which of the following (if any) would you purchase, if you received this list?

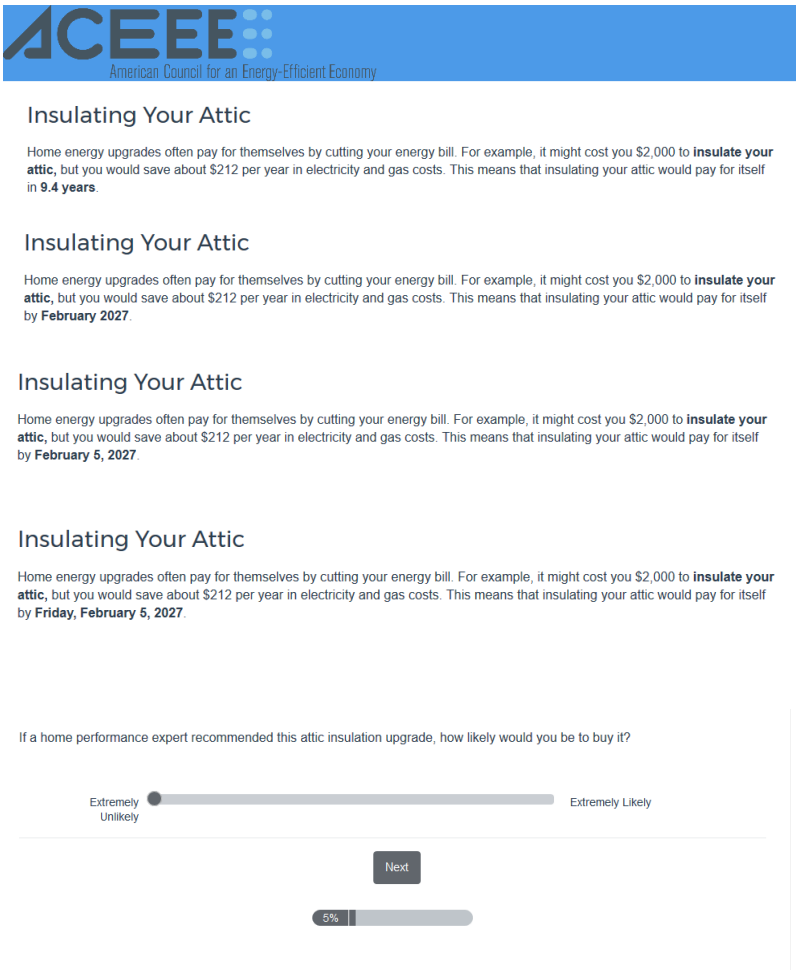
Item	Cost	Annual savings	SIR
Seal Air Leaks	$1,015	$142.43	2.8
Attic Improvements	$1,883	$140.17	2.2
Upgrade Water Heater	$1,223	$72.75	0.9
Refrigerator	$1,336	$68.86	0.9

☐ **Seal Air Leaks**
☐ **Attic Improvements**
☐ **Upgrade Water Heater**
☐ **Refrigerator**

Next

5%

- In this section, the respondent saw one of these three messages. The list is slightly different for each. The upgrades of interest are those with neither the highest nor the lowest savings-to-investment ratio. In the current study we analyzed only the first two messages.



- In this section, the respondents saw one of these four messages. This section tests whether framing the payoff date in different formats can affect the likelihood of investing.

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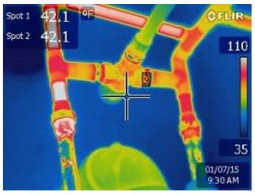
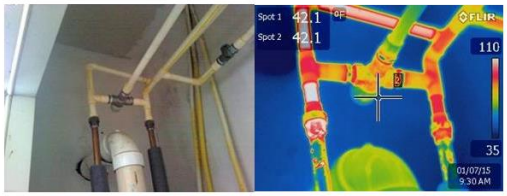
Insulating Plumbing Fixtures

Water and space heating uninsulated pipes in a resident unit



Thermal Image of water and space heating piping in a resident unit (red = heat escaping)



Thermal Image of water and space heating piping in a resident unit (red = heat escaping)

This is an example of an actual recommendation from a home energy assessment:

> Effective insulation covering hot water pipes improves efficiency and can raise water temperature at the faucet by 2°F – 4°F. This also helps conserve water since you won't have to wait as long for hot water at a faucet or shower head.
>
> Insulate all accessible exposed hot water pipes – including the first three feet of cold water pipe as it enters the water heater. You may also want to insulate all of the cold water lines to reduce sweating in warm weather.

Insulating all of the recommended pipes would cost $150.

How likely are you to insulate your pipes?

Extremely Unlikely — Extremely Likely

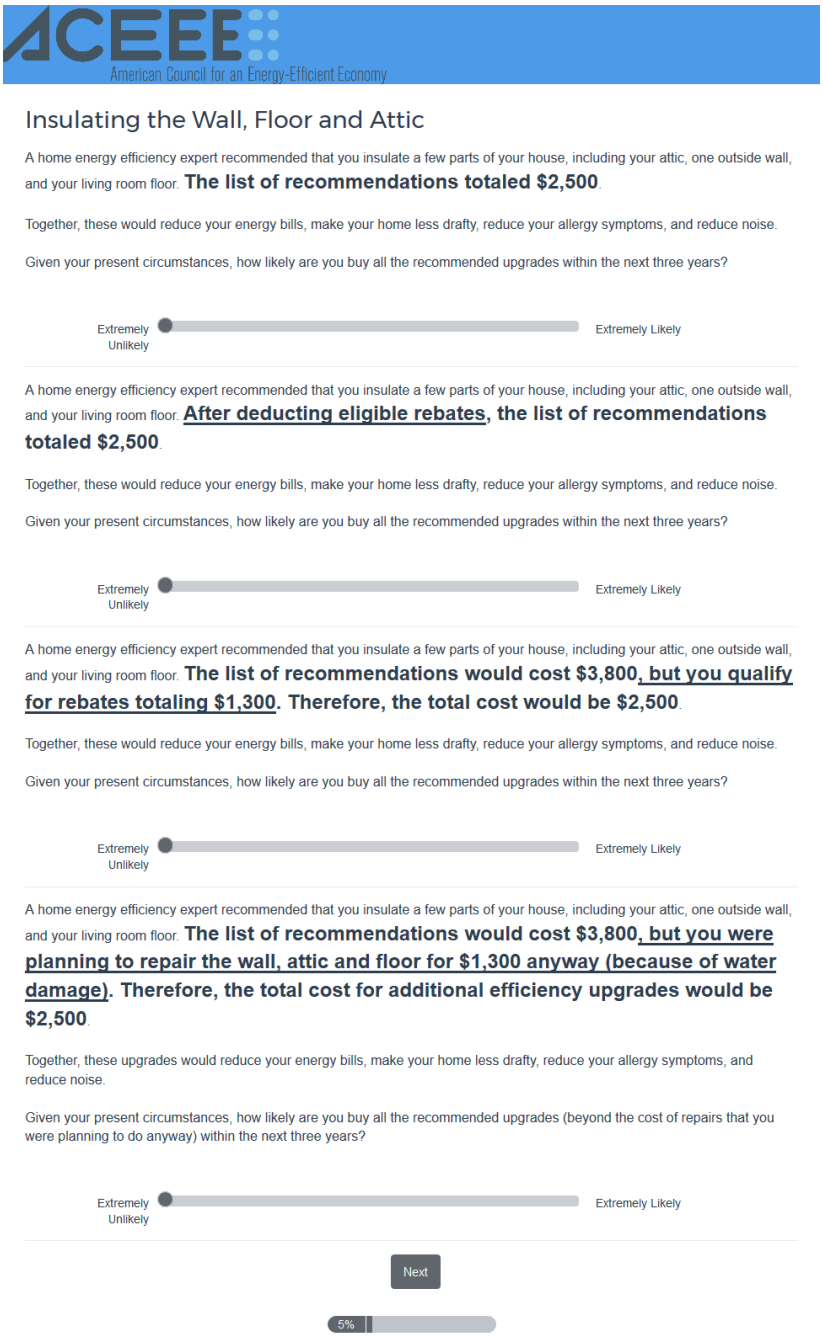
Are you still paying attention? Please indicate that you are paying attention by moving the slider *all the way* to the right, next to "Yes" or we may have to disqualify you from this survey.

No — Yes

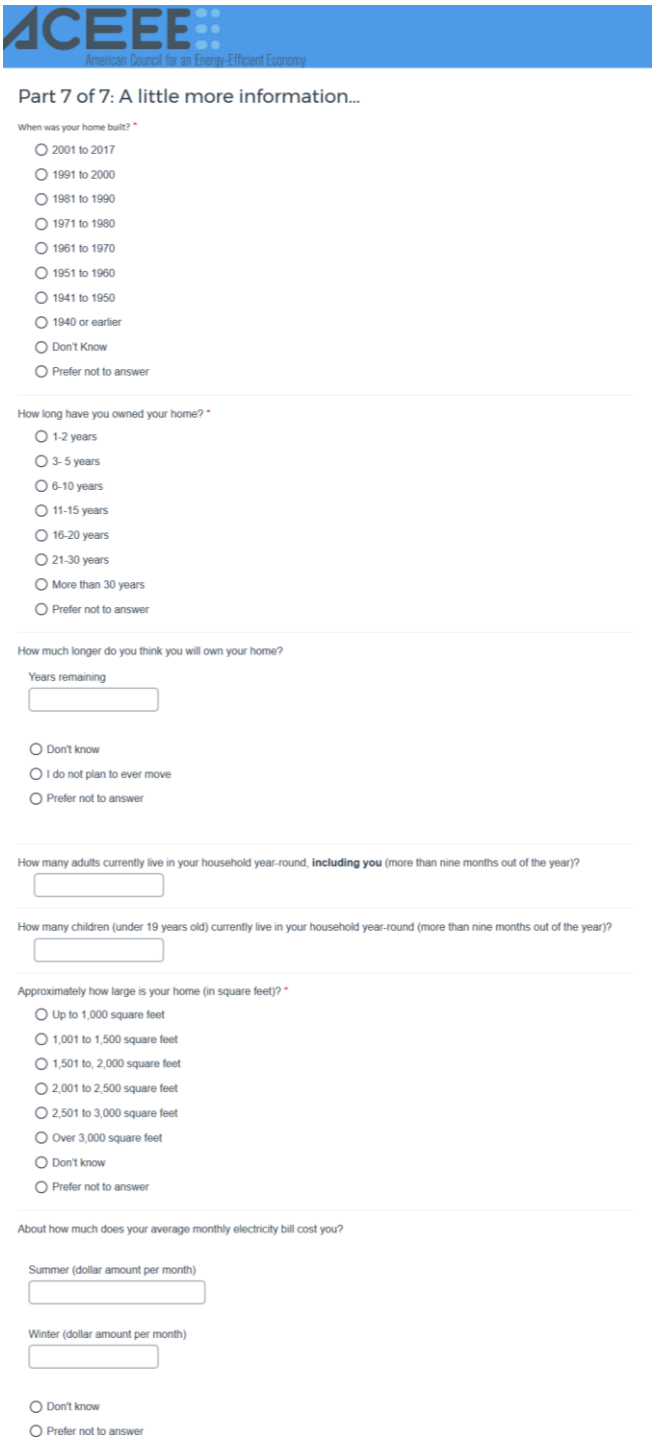
Next

5%

- This section tests the effectiveness of adding an image. Respondents saw either (1) no image, (2) a standard image, (3) a thermal image, or (4) both images.



- In this section respondents saw one of these messages. The first one is a control; each of the others each has to do with anchoring, i.e., using mental heuristics in which we set a higher expectation of cost and then reduce it.



ACEEE
American Council for an Energy-Efficient Economy

Part 7 of 7: A little more information...

When was your home built? *
- 2001 to 2017
- 1991 to 2000
- 1981 to 1990
- 1971 to 1980
- 1961 to 1970
- 1951 to 1960
- 1941 to 1950
- 1940 or earlier
- Don't Know
- Prefer not to answer

How long have you owned your home? *
- 1-2 years
- 3- 5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-30 years
- More than 30 years
- Prefer not to answer

How much longer do you think you will own your home?

Years remaining

- Don't know
- I do not plan to ever move
- Prefer not to answer

How many adults currently live in your household year-round, **including you** (more than nine months out of the year)?

How many children (under 19 years old) currently live in your household year-round (more than nine months out of the year)?

Approximately how large is your home (in square feet)? *
- Up to 1,000 square feet
- 1,001 to 1,500 square feet
- 1,501 to, 2,000 square feet
- 2,001 to 2,500 square feet
- 2,501 to 3,000 square feet
- Over 3,000 square feet
- Don't know
- Prefer not to answer

About how much does your average monthly electricity bill cost you?

Summer (dollar amount per month)

Winter (dollar amount per month)

- Don't know
- Prefer not to answer

- Final demographic questions

About how much does your average monthly gas bill cost you?

Summer (dollar amount per month)

Winter (dollar amount per month)

- ◯ My house doesn't use gas
- ◯ The cost of gas is combined with electricity on my bill
- ◯ Don't know
- ◯ Prefer not to answer

Over the past five years, have you completed any projects to reduce the amount of heating fuel or electricity your home uses? Please check all that apply

- ☐ Added Insulation
- ☐ Air sealing / duct sealing (i.e., sealing cracks around doors, windows or other areas of homes; sealing small holes in the ducts that carry warm or cool air to different areas of your home)
- ☐ Replaced heating equipment / furnace
- ☐ Replaced cooling equipment / AC
- ☐ Replaced appliances
- ☐ Installed energy efficient lighting (CFLs, "twisty" bulbs, LEDs)
- ☐ Installed solar PV or solar hot water
- ☐ Replaced windows with double- or triple-paned windows
- ☐ Other(s) - Write In (Required) Please enter an 'other' value for this selection. * This question is required. *
- ☐ None
- ☐ Don't know
- ☐ Prefer not to answer

Have you had an in-person energy assessment done on your home? (This involves an expert coming to your home to inspect it and provide suggestions for how to improve your home's energy efficiency) *

- ◯ Yes
- ◯ No
- ◯ Don't know
- ◯ Prefer not to answer

To make sure that you are not a robot, please mark this question "Yes."

- ◯ Yes
- ◯ No
- ◯ Don't know
- ◯ Prefer not to answer

Which party do you usually vote for in federal or state elections? *

- ◯ Republican
- ◯ Democrat
- ◯ Libertarian
- ◯ Green
- ◯ Other
- ◯ I vote equally for different parties
- ◯ I do not vote
- ◯ Prefer not to answer

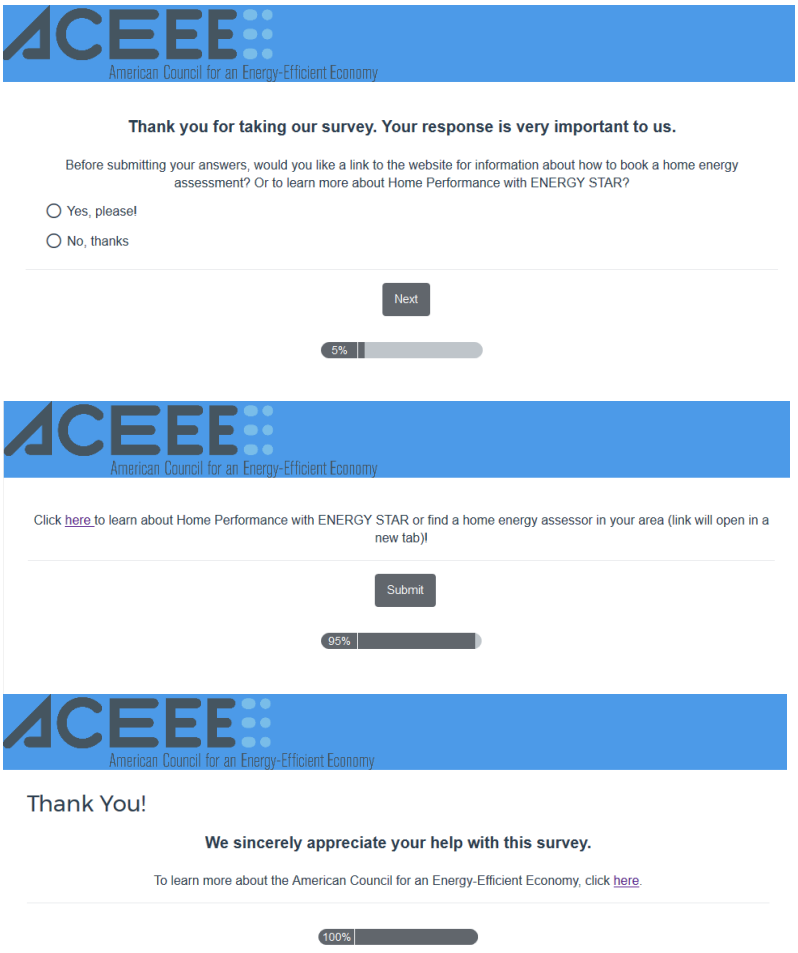
Zip Code

Characters used: **0** (minimum 5).
Characters used: **0** out of 5.

Do you have any other comments about your answers or this survey that you would like to add?

Next

5%



- At the end, we offer participants an opportunity to look for a home energy assessor in their area. This is a basic measure of behavior.