

What Price is Right? Applying Willingness to Pay Research Approaches to Weatherization Services

Eileen Hannigan, Tabitha Munson, ILLUME, an E Source Company, Boulder, CO

Ann Clarke, RI Energy, Providence, RI

Kathryne Cleary, Guidehouse, Boston, MA

ABSTRACT

Designing incentive levels for any energy efficiency program requires balancing considerations of program budgets, cost effectiveness, and how much customers are able or willing to pay out of pocket for energy efficiency improvements. This is especially true for weatherization services. Weatherization can provide great benefits to customers in the form of increased comfort and lower energy bills and is increasingly important in the context of electrification. However, weatherization can be expensive, may not be well understood by homeowners, and it must compete with other needs that may be more eye-catching or exciting which makes setting the right incentive level critical.

In our research study, we used two willingness-to-pay research approaches to estimate the out-of-pocket costs at which moderate-income customers of a northeastern utility would be willing to pay for weatherization services for their home. We fielded a survey with over 500 respondents and presented them with background information on weatherization and then questions consistent with both Gabor Granger and Van Westendorp approaches. The two different methods yielded similar conclusions, with most moderate-income customers willing to pay about \$300 out of pocket for weatherization. We also compared responses at different income levels and explored how income changes over time. Finally, we considered these findings in the context of program design recommendations and possible applications to other program types.

Introduction

Market research for consumer products has long used willingness-to-pay studies to understand the optimal price points and build revenue curves to maximize sales and profits. While energy efficiency program designers have only infrequently applied these methods (for example, see Erickson et. al. 2020), these tools could help guide incentive design decisions to benefit both the customer and the program.

Setting incentives levels for energy efficiency programs requires considering program budgets, participation targets, cost effectiveness, and how much customers are willing to pay out of pocket for energy efficiency improvements. This is especially true for weatherization services (air sealing and insulation) which can provide great benefits to customers in the form of increased comfort and lower energy bills and is especially important for controlling heating costs in the context of switching to heat pumps (Wilson 2024). However, weatherization can be expensive, may not be well understood by homeowners, and it must compete with other needs that may be more eye-catching or exciting which makes setting the right incentive level critical.

In our research study, we used two willingness-to-pay research approaches to estimate the out-of-pocket costs at which moderate-income customers of a northeastern utility would be willing to pay for weatherization services for their home. For this research we define moderate-income as having a household income that is 60 to 80% of the State Median Income (SMI). This is the definition of moderate-income that the sponsoring utility used to determine eligibility for past programs. Our research study

specifically targeted this segment to inform targeted program design. In prior years, the sponsoring utility offered enhanced incentives so that moderate-income customers received weatherization services for low or no cost. Weatherization services included in the program included a home energy assessment, insulation, and air sealing. After the program was not approved for 2024, the sponsoring utility was interested in defining the market need and determining appropriate incentive options to inform possible program design in future years.

Methodology

To assess moderate income customers' interest in and willingness to pay out of pocket costs for weatherization, we fielded an online survey that included questions needed to apply two willingness-to-pay methodologies: Gabor Granger and Van Westendorp. We describe these methodologies in more detail in the Willingness-to-Pay section.

Sample Design

Our population of interest was utility customers who are owner-occupants of single-family homes (one to four units) and who are eligible or near-eligible for a moderate-income offering. We conducted all research in English with customers who had an email address on file with the utility. Initially the research team focused on recruiting customers with incomes between 60% and 80% SMI for the survey to align with the eligibility criteria of the sponsoring utility's past moderate-income offering. However, the sponsoring utility did not have a way to flag customers who met the income limits. Finding the limited number of customers who met the income and home ownership criteria while keeping the number of utility customers who would receive invitations to the survey to a reasonable amount presented a challenge. We took two approaches to balance these considerations.

We developed our sample frame with a two-step process. First, we used U.S. Census data to identify census tracts with higher proportions of moderate-income customers. After pulling customer data based on census tracts with more moderate-income customers, we randomly selected a sample of customers who had an email address on file to invite to take the survey.

The survey included screening questions at the beginning of the survey to identify customers who owned their single-family home and had a household income in the target income range. After initial response to the survey was slow, we allowed any respondent with an income up to 110% SMI to complete the survey to ensure adequate data collection.

In all, we recruited from a total of 22,500 sample cases with valid email addresses and received 1,808 responses.¹ Of those, 531 were eligible completes (homeowners with an income between 0% and 110% SMI). Of the 531 eligible completes, 129 were homeowners with an income between 60% and 80% SMI.

Survey Fielding

We fielded the survey as an online survey using Qualtrics. Customers received an email invitation to complete the survey on a phone, tablet, or computer from August 27th to October 1st, 2024. The research team sent an initial email and up to two reminders asking recipients to complete the survey. Customers who completed the survey were entered into a sweepstakes for one of five \$250 gift cards.

¹ We acknowledge that using only email can introduce demographic bias. Our respondent group had a greater proportion of people over age 65 than the state as whole, was similar in terms of education level, and was slightly more likely to speak English at home.

Analysis

Income groups. Throughout our analysis, we grouped respondents into one of three income categories, as shown in Table 1, below. As noted, due to the initial slow response to the survey, we expanded the eligible income range. However, when we closed the survey, we exceeded our overall target number of completes and had enough completes to analyze subgroups. These groups included low-income (less than 60% SMI), moderate-income (60% to 80% SMI), and higher-income (81% to 110% SMI) respondents. It should be noted that the higher-income group is not a high-income group but is slightly higher than the moderate-income group.

Table 1. Respondents by income group

State Median Income (SMI)	Total eligible completes	Percentage of total
Low-income (Less than 60% SMI)	219	41%
Moderate income (60% to 80 SMI)	129	24%
Higher income (81% to 110% SMI)	183	34%
Total	531	100%

Willingness-to-pay. A key objective of this research was to understand customers' willingness to pay for weatherization. We asked customers about their willingness to pay for weatherization by framing the expense in terms of the out-of-pocket cost that they would be willing to pay. Before presenting respondents with questions related to their willingness to pay, the survey provided a brief description of the weatherization program process, typical full-price cost of weatherization services, and expected bill savings based on earlier evaluations of the utility's weatherization programs and program staff input. The survey described weatherization: "Weatherization is a type of home improvement that can make your home healthier and more comfortable, while also lowering your energy bills. This involves adding insulation to your home and sealing air leaks. Typically, customers save 13% on their energy bills after weatherizing their home. This work is completed by a professional contractor and typically costs \$6,000 for a home in [state]." We explored willingness to pay through two market research methodologies.

Gabor Granger: We used the Gabor Granger method as our primary analytical approach for assessing willingness to pay (Lipovetsky et. al. 2011; Qualtrics n.d.). This method determines the maximum amount someone would be willing to pay (in this case, the out-of-pocket cost for weatherization) through a series of questions in which the price goes up or down depending on their response to the price presented to them. Typically, that information is used to create a price and demand curve, which allows the user to calculate the price point that maximizes revenue. For this study, we calculated the demand curve and utilized that to understand the percentage of respondents that would be willing to pay for weatherization at various out-of-pocket price points.

The survey randomly presented respondents with an initial out-of-pocket cost for weatherization of \$2,500 or \$3,000. The Gabor Granger method uses multiple starting price points to create more variability in the data. The pre-built tool that we used only allowed for two different starting points. Based on their responses, the survey presented respondents with up to three additional price points, with prices increasing or decreasing based on their willingness or unwillingness to pay the preceding price. Some respondents said they were not willing to pay for weatherization at all prices presented to them. These respondents received a follow-up question to ask why they would not be willing to weatherize their home.

Respondents who indicated that the price was still too high or that they would not be willing to pay anything were treated as being willing to pay \$0 in the Gabor Granger analysis.

Van Westendorp: We also used the Van Westendorp method in our analytical approach for assessing willingness to pay (Qualtrics n.d.; van Westendorp 1976). The Van Westendorp method assesses willingness to pay by asking customers a set of four open-ended questions about the out-of-pocket cost at which the customer feels that the weatherization is too inexpensive, about right, or too expensive. We used these responses to provide greater context for the price point calculated by the Gabor Granger method and understand how that fits within the range of price points respondents gave through the Van Westendorp method. Each respondent received the Gabor Granger series of questions first, followed by the Van Westendorp series.

In this study, we report the mean and median values for these responses as well as the price at which 70% of respondents would be willing to pay for weatherization. We recommend using this last value to be inclusive of more moderate-income customers' optimal price points. Moderate-income (using the utility's definition of 60% to 80% of SMI) is a relatively small group of customers to identify and connect with. A lower out-of-pocket cost will help ensure that once moderate-income customers are reached, they can be convinced by the benefits of weatherization and the optimal out-of-pocket costs to participate in the program. The price at which 70% of respondents would be willing to pay for weatherization can inform what level of participation RI Energy could expect where there is some level of out-of-pocket cost required by the customer. We chose this 70% level to balance the competing priorities of setting appealing incentive levels to encourage customers to participate, while also using program funds to reach as many customers as possible by customers contributing some portion of the cost.

Results

Willingness-to-Pay

Table 2 shows the mean and median willingness to pay value for each income category. The confidence interval for the mean value is included, as well.² The first row shows results from the Gabor Granger method and the last four rows show results from the Van Westendorp method. We note statistically significant differences between income levels in the footnotes below the table. The value for moderate-income respondents was statistically significantly different than the value for low-income respondents for the price at which weatherization is too expensive ($p < 0.05$) and for the highest agreed to price ($p < 0.10$).³ While not all the income group differences were statistically significant, we do see trends in responses by income group. Across both methods we see that average willingness-to-pay values trend up with income level. For context, we note that the current weatherization program covers all costs for customers up to 60% of SMI and covers 50% of costs (up to \$10,000) for all other customers. In the past, the program covered all costs for customers up to 80% of SMI.

² Differences between the mean and median occur when the distribution of responses is not normally distributed (i.e., when the highest frequency of responses is in the middle between the minimum and the maximum). In this case, the highest frequency of responses occurs closer to the minimum, which causes the median to be lower than the mean. This means that there are more respondents that reported lower willingness to pay and fewer respondents that had higher willingness to pay. As an example, to help illustrate this point, a similar trend generally exists with income, which is why using metrics such as the State Median Income is better than using the mean income for the state.

³ We also looked at results by different income groupings and determined in consultation with utility program staff to focus on the 60% to 80% moderate income definition.

Table 2. Willingness-to-pay model results

Survey Question	Low-income (Less than 60% SMI)		Moderate Income (60% to 80% SMI)		Higher Income (81% to 110% SMI)	
	Mean (95% CI)	Median	Mean (95% CI)	Median	Mean (95% CI)	Median
Gabor Granger Method						
Highest agreed to price	\$1,023 ^{a, bb} (\$829, \$1,216)	\$313	\$1,381 ^a (\$1,122, \$1,639)	\$1,125	\$1,563 ^{bb} (\$1,335, \$1,791)	\$1,125
Van Westendorp Method						
Questions if weatherization is too good to be true	\$557 (\$430, \$683)	\$100	\$550 (\$428, \$672)	\$250	\$602 (\$491, 714)	\$500
Weatherization is inexpensive, but not so inexpensive that you question the quality of the service or materials	\$727 ^b (\$587, \$866)	\$300	\$840 (\$664, \$1,017)	\$500	\$949 ^b (\$802, \$1,095)	\$625
Weatherization is expensive, but would still consider doing it	\$960 ^{bb} (\$787, \$1,133)	\$500	\$1,259 (\$1,027, \$1,490)	\$900	\$1,502 ^{bb} (\$1,295, \$1,709)	\$1,000
Weatherization is too expensive	\$1,101 ^{aa, bb} (\$899, \$1,303)	\$501	\$1,563 ^{aa} (\$1,288, \$1,838)	\$1,050	\$1,748 ^{bb} (\$1,521, \$1,975)	\$1,500

^a p < 0.10

^{aa} p < 0.05

^b p < 0.10

^{bb} p < 0.05

Figure 1 shows the price curve from the Gabor Granger methodology. The orange dotted line shows the 50th percentile – the price at which half of respondents said they’d be willing to pay that amount or higher (~\$1,000) and half of respondents said they’d be willing to pay a lower amount. The curves go downward until about \$5,000 which was the highest price that only a few respondents indicated that they would be willing to pay. The graph also shows visually that the low-income group had lower preferred price points with the 50th percentile falling about \$300. The differences between the moderate-income group and the higher income group tend to be smaller than the differences between the low-income group and the moderate-income group.

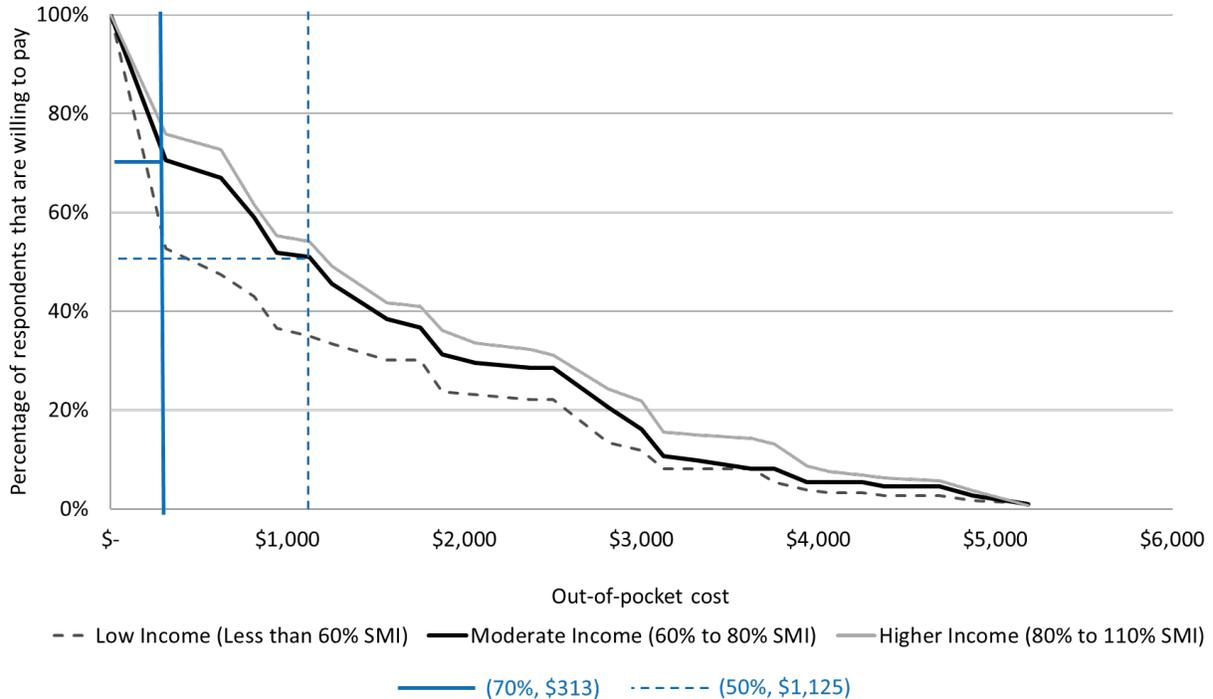


Figure 1. 70th and 50th percentile of values that respondents are willing to pay out-of-pocket for weatherization based on Gabor Granger methodology. *Source: Research team analysis*

The mean and median values can be useful anchor points for assessing differences between income groups and setting incentive levels, depending on program objectives. Program designs need to balance aiming to reach as many customers as possible while working within budget and cost-effectiveness constraints. Moderate income homeowners are a relatively narrow band of customers. In our targeted survey outreach, only 129 respondents out of 1,808 attempted completes (7%) were eligible. Thus, this target population may be a small proportion of the whole customer population. To optimize reaching more customers with an appealing incentive offer, we also calculated the out-of-pocket cost at which 70% of moderate-income respondents would be willing to pay for weatherization. Figure 1 and Table 3 show that the Gabor Granger method found that with an out-of-pocket cost of \$313 or less, 70% of moderate-income customers would be willing to pay for weatherization. This finding is supported by the Van Westendorp method which shows the 70th percentile out-of-pocket cost that respondents would consider weatherization to be expensive but would still consider doing it is \$330.

Table 3. Willingness-to-pay model results – 70th percentile

Survey question	Out-of-pocket cost – 70 th percentile
Gabor Granger Method	
Highest agreed-to price	\$313
Van Westendorp Method	
Questions if weatherization is too good to be true	\$0
Weatherization is inexpensive, but not so inexpensive that you question the quality of the service or materials	\$130
Weatherization is expensive, but would still consider doing it	\$330
Weatherization is too expensive	\$500

Income Variability

Nearly half (47%) of respondents indicated that their income has changed since last year (Table 4). While we do not know exactly how much income changes from year to year, these responses suggest that customers may move in and out of moderate-income status. Among moderate-income respondents, 25% reported that their income is lower this year, suggesting that while they are currently eligible, they may not have been eligible for a moderate-income offering last year. Among higher-income respondents, 23% reported that their income is higher this year, meaning that they may have been eligible for a moderate-income offering last year even though they are currently not eligible. Finally, 28% of low-income respondents reported that their income was higher last year, meaning that they may have been eligible for a moderate-income offering last year. Likewise, customers who currently identify as moderate-income may not be moderate income in the future. However, in the context of the utility’s goal of reaching eligible customers and with the challenge of not having access to perfect data this suggests taking a broader approach to marketing. If a moderate-income offering relies on year-old data to target customers for marketing, this finding suggests that extending the marketing to customers below and above moderate income may be necessary, due to changes that can happen in income.

Table 4. How respondents’ income compares to prior year

	Low income (n=219)	Moderate income (n=129)	Higher income (n=183)
A lot lower this year	12%	9%	11%
A little lower this year	16%	16%	11%
About the same	53%	54%	54%
A little higher this year	15%	14%	20%
A lot higher this year	3%	4%	3%
Prefer not to answer	2%	4%	2%

Discussion

Study Limitations

Willingness-to-pay methods are more commonly used to optimize prices for consumer goods rather than for more complex services. They are used in more straightforward applications where consumers can more easily think about the value they place on and willingness to pay for items such as a

candy bar or pair of shoes. Distinguishing between something that is a good deal or too good to be true is easier with a familiar product than with more complex services like weatherization. Our application of the method assumes that respondents grasp the benefits and costs of the weatherization services. Benefits include both financial savings and other benefits such as health and comfort. The value of the service includes the insulation and materials as well as the labor to install weatherization measures. In a future study, we recommend thorough testing of the description of the program and services received to ensure that respondents have an adequate understanding to reasonably place a value on those services.

Another challenge with this study was reaching enough respondents. Ideally, we would have split our sample and used the Gabor Granger method with half of the sample and the Van Westendorp with the other half to more accurately assess how well responses align. Because we were trying to target a slim subset of the utility population, we asked all customers the same set of questions for both methodologies and in the same order. Due to this approach, the responses to the Van Westendorp questions may have been biased by the price points that respondents saw during the Gabor Granger question set.

Lessons Learned: Moderate Income Weatherization Programs

For this study, we used the 70th percentile as a reference point for recommending an incentive level of about \$300. The choice of the 70th percentile as a reference point was grounded in the program's goal to reach as much of the target population as possible while working within the constraint of not being able to offer the services at no cost. In addition, some consumer research suggests that offering products for free when they have a high incidental cost (e.g. time) causes customers to scrutinize the product more and decreases demand (Fan et al. 2022). When considering incentive levels for energy efficiency programs, other important considerations are any required cost effectiveness tests. Adjusting the incentive level will affect the outcome of some tests (e.g. Utility Cost Test) but not others (e.g. Total Resource Cost test). At the same time, marketing efforts to reach a narrow subset of the population can be expensive so it might be more cost effective to offer a very attractive incentive level to ensure that most customers who are reached through marketing efforts go on to enroll and complete the program.

In our study many customers reported that their income changed from the prior year, suggesting that qualifying status may change from year to year for many customers. Especially for a program that is geared toward a narrow customer segment, program administrators may want to build in flexibility for qualification. For example, this could include allowing customers to use their income level in any of the last three years or allowing customers to use their average income over the last three years to qualify. Another option could be allowing customers to petition for an exception due to a short-term change in income, such as a change in household composition, employment status, or one-time gift.

If the program is unable to build in flexibility around qualifying income criteria, then fluctuating income may be a barrier to customer awareness of the program. Customers may become eligible for the program but not be aware that it exists, or they may be aware that it exists, but their income may change making them ineligible. Programs that use income data to design marketing campaigns should market to a wider range of income levels to account for income changes between data collection and the current program year. Programs should also consider marketing to customers in subsequent years and market to those who did not qualify in the past in case their eligibility has changed.

Lessons Learned: Expanding to Other Programs

As noted, these pricing models may have additional applicability to other program types and, in fact, may be simpler to implement for different types. In the table below we categorize common energy efficiency program by customers familiarity with the device or technology and how complex it is to describe the savings and benefits of the device or technology. For example, kitchen appliances are familiar

technologies to customers with a straightforward cost structure and impact on energy bills. Heat pumps are less familiar to customers, include equipment and installation costs, and depending on customers' heating fuel type, may cause savings on their heating bills but an increase in electricity bills. Within the constraints of an online survey, explaining the bill implications of efficient appliances is easier while explaining heat pumps is more complex.

Programs that incentivize devices/technology that are familiar to customers and are simpler to explain energy bill implications may be better candidates for survey-based willingness-to-pay research. In Table 5 we offer the authors' assessment of familiarity and complexity by energy efficiency measure type.

Table 5. Familiarity and complexity by measure type

Measure type	Familiarity with device/technology	Complexity of contextualizing savings/benefits
Refrigerator/dishwasher	High	Low
Dehumidifiers/air purifiers	High	Low
Smart thermostats	High	Low
Central Air Conditioners	High	Low
Furnaces	High	Medium
Induction cooktops	Low	Low
Electric vehicles	Medium	High
Heat pumps	Low	High
Weatherization	Low	High
New home construction	Low	High

Willingness-to-Pay Methodological Considerations

In our study, we used both the Gabor Granger and Van Westendorp methods to assess willingness-to-pay. As noted, ideally, we would have split our sample and used one method for each subsample to compare results. Each method offers advantages and disadvantages for consideration depending on the familiarity of the product, depth of information needed, and size of the target population. We summarize these considerations in Table 6.

Table 6. Willingness-to-pay methods: Advantages and challenges

Methodology	Advantages	Challenges
Gabor Granger	<ul style="list-style-type: none"> • Simpler approach by providing a specific price point for customers to react to. • Helpful for products that are less familiar to customers where customers might not know typical prices. 	<ul style="list-style-type: none"> • Respondents might be likely to “satisfice” by agreeing to a price point that they would not actually agree to in reality.⁴ • Ideally have a larger number of respondents – more is better to hone in on price points.

⁴ “Satisficing” happens when respondents provide quick, “good enough” answers rather than carefully thinking about responses. This is especially likely to happen when survey questions are more difficult to answer and require more thinking (Krosnick 1991).

Methodology	Advantages	Challenges
	<ul style="list-style-type: none"> Facilitates assessing price elasticity to show the impact on sales from changes in price from the optimal point. This approach could be more advantageous for items with higher volume of sales such as appliances. Can be combined with a revenue curve to identify an optimal price point. This might be more applicable in mid-stream rebate programs. 	<ul style="list-style-type: none"> The revenue curve is less applicable in low-to-moderate income EE programs. We did not use a revenue curve in this study.
Van Westendorp	<ul style="list-style-type: none"> Provides a range of acceptable pricing. Provides richer information by identifying price points at which customers feel a price is “too good to be true” and “expensive but would still consider doing it”. 	<ul style="list-style-type: none"> If respondents are unfamiliar with the technology, responses might be unreasonable. For example, respondents might have difficulty valuing the cost implications of energy efficient home construction. Ideally have a larger number of respondents – more is better – to find ideal price points.

Conclusions

Our study demonstrates that pricing research methods used in consumer products research can be a useful tool for thinking strategically about rebate levels and out-of-pocket costs for energy efficiency. We caution that these models are one input into program design as “what price is right” will also depend on a host of other factors that may include program budgets, participation goals, cost-effectiveness metrics, equity considerations, and community decarbonization goals. However, understanding customers’ willingness-to-pay is a lever that can help drive demand in service of those other goals.

Applying these methodologies to energy efficiency improvements requires some specific considerations. Based on our experience, we make the following recommendations for applying the methodology:

1. Identify and prioritize program goals first to set research objectives and identify subpopulations of interest. This includes identifying the role of budget, cost effectiveness, priority populations, and policy considerations in meeting program goals and metrics.
2. Plan for a large sample size, especially if trying to reach a specific subsegment of the market. This might require additional budget for recruitment or incentives. In this study we tried to reach a specific income range of homeowners which presented challenges for attaining a large number of responses. Planning for a large sample size will also allow randomization within the survey if using multiple methodologies.
3. Test definitions of the energy efficiency improvement to ensure confidence in the responses and how customers are valuing the product. Some energy efficiency improvements are not products or technologies that many people are encountering or thinking about on daily basis.
4. Reading and understanding definitions of improvements may be time consuming and a high cognitive load for respondents so keep the rest of the survey brief. We minimized other questions on our survey to ensure that respondents completed the survey.
5. Recognize that there isn’t a single right answer. We made a recommendation based on the 70th percentile to balance program goals of reaching as many people as possible with a need to have

some co-pay. The “right” price is the one that helps program implementers balance all their competing priorities.

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