Preaching to the Choir: Using Utility Data to Create Relevant Promotions for Energy Efficiency Programs

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ABSTRACT

Electric and gas utilities know exactly who their customers are, where they live, and how much energy they consume. When combined third party demographic and building data, utilities have a rich data set to mine for improved program design and targeted marketing. A major utility in the northeast has developed a segmentation model are testing whether they do respond to programs differently. We have found that older, larger homes consume more gas and newer, larger homes consume more electricity. We divided homes into "Efficiency Opportunities" and "Leading Edge" based on age and size. We divided consumers into three groups by income and purchase of renewable energy. We examined how one segment, "The Choir", responded to a recent direct mail campaign promoting a weatherization program, and found that while they responded at the same rate as the general population, they were less likely to pursue deeper measures. We will use the findings from this study to refine the targeting of future promotional efforts.

Introduction

Eversource, a major electric and gas utility servicing more than 3.6 million customers in Connecticut, Massachusetts, and New Hampshire, has worked over the past several years to segment its commercial customers by energy consumption and line of business. It has oriented its program implementation and design efforts around this segmentation to develop a more strategic approach to engaging its customers (for a more complete discussion of this topic, see *Gaining EE Ground: How the Collective Knowledge of Vendors & Channel Partners Can Accelerate Your Success*). This strategic go-to-market approach has helped the utility to ramp up programs quickly to meet very high energy efficiency goals in Massachusetts and Connecticut. The same utility is seeking to improve the design of its already successful residential programs through deeper understanding of its customers.

In 2013 and 2014 the utility tested the value of improved targeting for residential customer programs. It first conducted a decision tree analysis in which we analyzed which factors are common among those customers in its Massachusetts gas territory who went forward with insulation after having a home energy audit. This analysis found that customers most likely to install insulation used 439.5 therms or more annually, owned homes worth between $302,955 and $1,093,951, and had a loan-to-value ratio (how much equity an owner has in his or her house) of between 63.5% and 87.5%. Based on this analysis, the utility sent direct mail promoting the home energy solutions program to 8,000 residential gas customers who met these criteria ("Best Bets") as well as to a control group of 8,000 randomly selected customers ("Marketing Control"). Another 8,475 residential gas customers who met the identified criteria served as a control and did not receive the marketing materials ("Best Bets Control"). This experiment found that those customers in the target segment installed insulation after their audit at a higher rate than the control (59% to 51%) and that a greater proportion of customers in the

Best Bets segment installed insulation within 90 days than in the statewide average (Goldman and Hastings 2014). In 2014, the decision tree analysis was refined by excluding customers who were not eligible to participate in the program. In this analysis, the utility found that customers who lived in single family homes, had bought their homes in 2008 or later, and whose homes were built before 1998 were most likely to insulate their homes. The utility repeated the targeted marketing experiment. Again we found that those who received the marketing piece scheduled audits at a higher rate, and those who were in the target group insulated their homes at a higher rate than the Marketing Control group. Further, more of the 2014 Best Bets group responded to the marketing than the 2013 Best Bets group. Finally, we found that the marketing cost per audit scheduled was 74% lower for the Best Bets group than the Marketing Control group (Hastings, Goldman, and Rodgers 2015).

This effort proved to the utility that there is significant benefit to targeting its marketing communications. The utility is seeking to build on it by seeking to understand how both customer motivation and home characteristics influence customer participation. It seeks to both make marketing more effective for existing programs through targeting and to design programs to reach customers who may not be participating in existing programs. This paper describes the utility's efforts to analyze residential customer energy consumption, propose a segmentation model, and test one dimension of that model by looking at customer response to a marketing campaign.

Energy Consumption Analysis

In order to understand how energy varies among our residential customers, the utility conducted a quintile analysis of electric and gas customers in single family homes living in eastern Massachusetts. The utility ranked all residential customers by consumption and grouped them into five segments. Each segment equaled 20% of consumption but had unequal numbers of participants (Tables 1 and 2). Quintile 1 customers are those who consume the most energy; Quintile 5 customers are those who use the least energy. Quintiles are calculated independently for electric and gas customers.

Table 1. Eastern Massachusetts Single Family Home Electric Quintiles

	Total Energy Consumption	Number of Customers	% Total Customers	Average Annual Consumption per Customer
Quintile 1	20%	23,450	7%	24,401 kWh
Quintile 2	20%	40,555	12%	14,106 kWh
Quintile 3	20%	55,262	17%	10,335 kWh
Quintile 4	20%	75,069	23%	7,620 kWh
Quintile 5	20%	138,815	42%	4,116 kWh

The utility purchased demographic and housing data for each customer purchased from a third party vendor, and the utility looked at averages for each quintile to try to uncover what differences may exist among the customers. The utility found that age of home, size of home and home value for both electric and gas customers had the greatest variability by quintile. Table 3 summarizes the data for electric customers in Eastern Massachusetts. As consumption increases, size and value of home increase, and age of home decreases.

Table 2. Eastern Massachusetts Single Family Home Gas Quintiles

	Total Energy Consumption	Number of Customers	% Total Customers	Average Annual Consumption per Customer
Quintile 1	20%	9,530	10%	2,034 Therms
Quintile 2	20%	14,149	14%	1,504 Therms
Quintile 3	20%	17,522	18%	1,222 Therms
Quintile 4	20%	21,727	22%	988 Therms
Quintile 5	20%	35,551	36%	659 Therms

Table 3. Eastern Massachusetts Single Family Home Electric Characteristics

	Age of Home	Size (sq. ft.)	Rooms	Value
Quintile 1	1968	3,367	9	$1,087,129
Quintile 2	1964	2,533	7	$696,025
Quintile 3	1960	2,242	5	$583,712
Quintile 4	1957	2,098	4	$513,428
Quintile 5	1951	1,968	3	$443,619

The same analysis for gas customers (Table 4) showed that as consumption increases, size and value of home increase, but age of home increases. That is, among electric customers newer homes consume more energy and among gas customers older homes consume more energy. This is consistent with findings in Connecticut that the greatest opportunity for weatherization savings is found in older homes since they are less likely to have insulation or meet code (NMR 2014). There is also a large difference in home value between electric and gas homes, but this is most likely due to the fact that the utility's electric and gas service territories in Eastern Massachusetts do not overlap to a great degree and the median values in electric towns are generally higher than the median values in the gas towns.

Table 4. Eastern Massachusetts Single Family Home Gas Characteristics

	Age of Home	Size (sq. ft.)	Rooms	Value
Quintile 1	1957	3,002	9	$627,186
Quintile 2	1959	2,241	8	$438,779
Quintile 3	1960	2,073	7	$384,497
Quintile 4	1962	1,966	6	$340,450
Quintile 5	1970	1,852	6	$294,201

Home value is calculated based on size among other variables (BBO 2014), and thus the utility assumed that the two variables are related. Therefore the utility concentrated on exploring the relationship between home size and energy consumption further. That home size and energy consumption are related is not surprising, but further analysis showed that electric and gas consumption per square foot increases as energy consumption per home increases (figures 1 and 2).

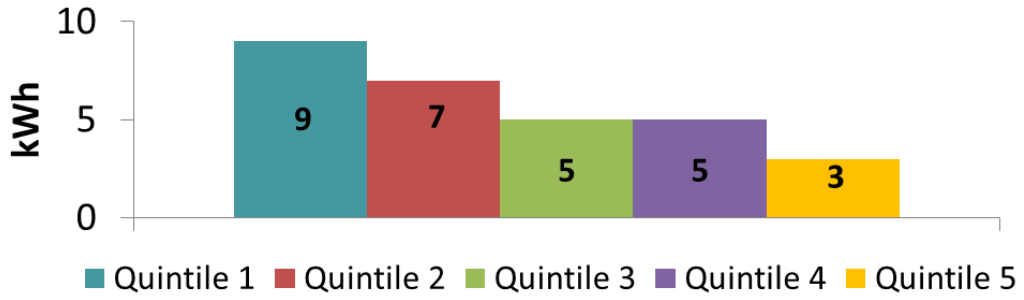

Figure 1. Median Electricity Usage per Square Foot in Eastern Massachusetts Homes

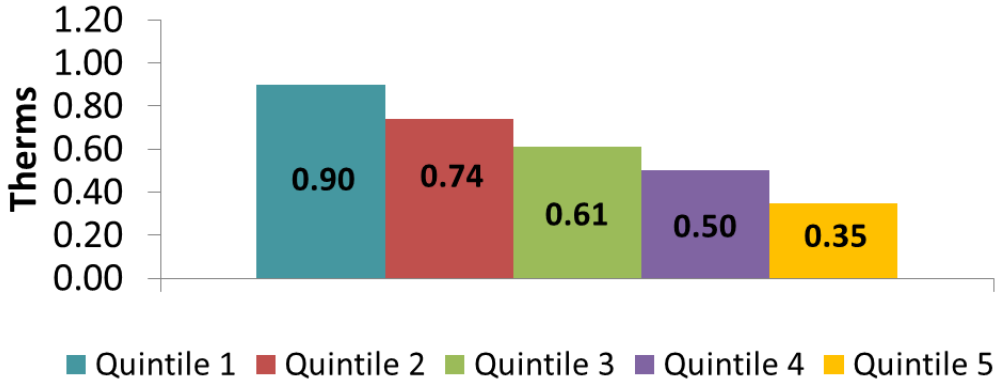

Figure 2. Median Gas Usage per Square Foot in Eastern Massachusetts Homes

The utility assumes heating to have more impact on energy consumption than cooling in its service territory because of the greater number of cooling degree days. In 2014, the year for which energy consumption was studied, there were 5881 heating degree days and 773 cooling degree days in Boston (Bizee Software 2016). The utility also has a special rate code for customers who use electric heat. To better understand what might be driving consumption within Quintile 1, the utility looked at whether these largest consumers were also electric heat customers. The utility has 13,966 heat rate homes in its service territory and 319,185 homes on the standard rate and presumed to have other heat sources. It compared the median consumption for all single family homes to median consumption for Quintile 1 homes and to Subquintile 1 homes. Subquintile 1 customers are the largest fifth of Quintile 1, or the largest 2,342 customers who consume a total of four percent of the energy sold to single family homes. Both the median and Quintile 1 home using electric heat are similar in size and value to the median electric home using other fuels. Subquintile 1 homes with electric heat are larger and use more energy, while Quintile 1 and Subquintile 1 homes among homes with other heat sources are larger and higher in value (Figure 3). Electric heating does appear to be related to high consumption, but the majority of the Quintile 1 or Subquintile 1 homes are not on the heat rate. Therefore it is likely that another factor is driving consumption among the biggest energy users, and this presents an opportunity to explore new programs which could target these customers specifically.

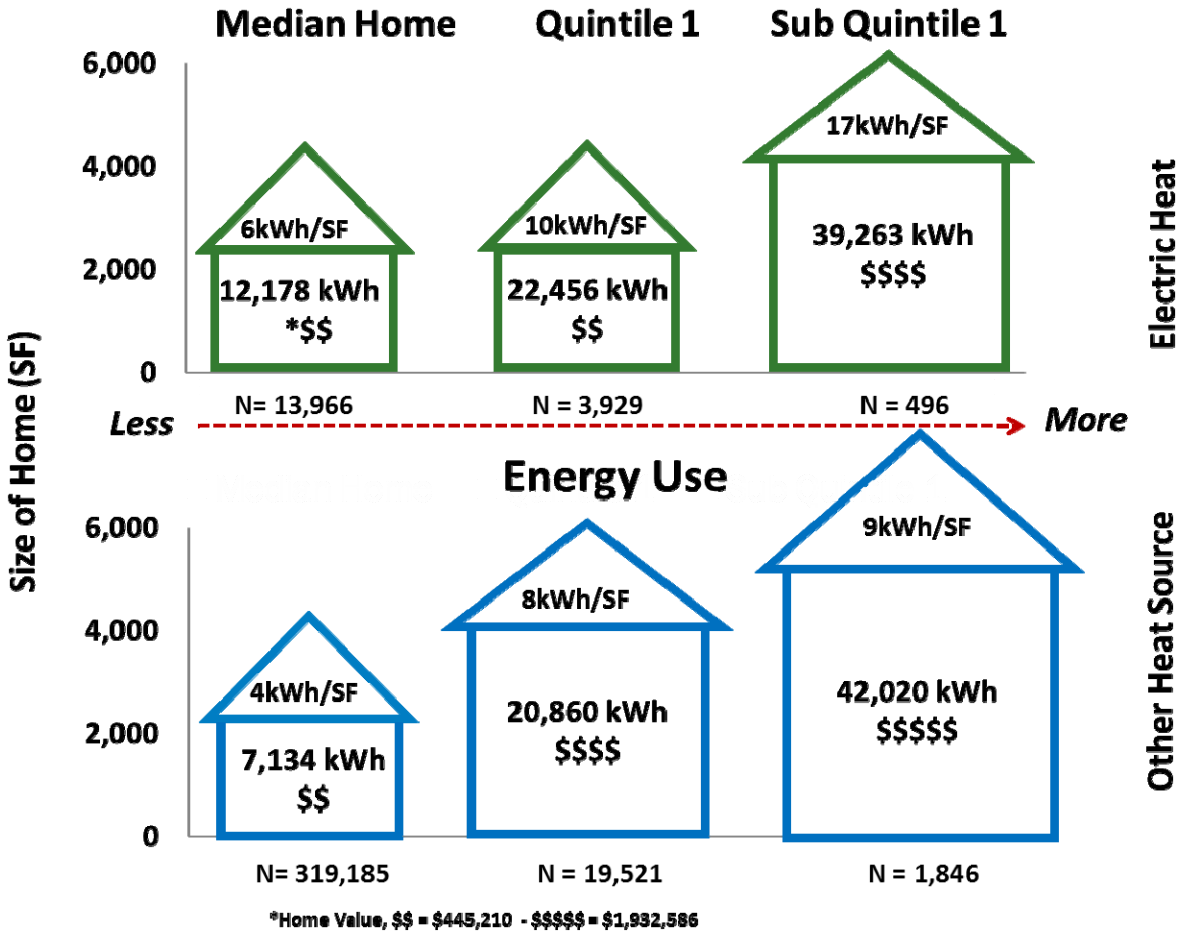

Figure 3. Relationship between home size, value, and consumption comparing homes with and without electric heat.

Program participation also differed among quintiles (Figures 4 and 5). The utility compared overall volume of savings to the overall volume of consumption by electric and gas quintile. Quintile 1 contributed only 7% of electric savings and 9% of gas savings compared to 20% of overall consumption. Quintile 5 contributed 33% of electric savings and 30% of gas savings. This could be in part due to generous rebates for the low income weatherization assistance program in Massachusetts, but it is still striking what large opportunity remains to help Quintile 1 customers save more energy.

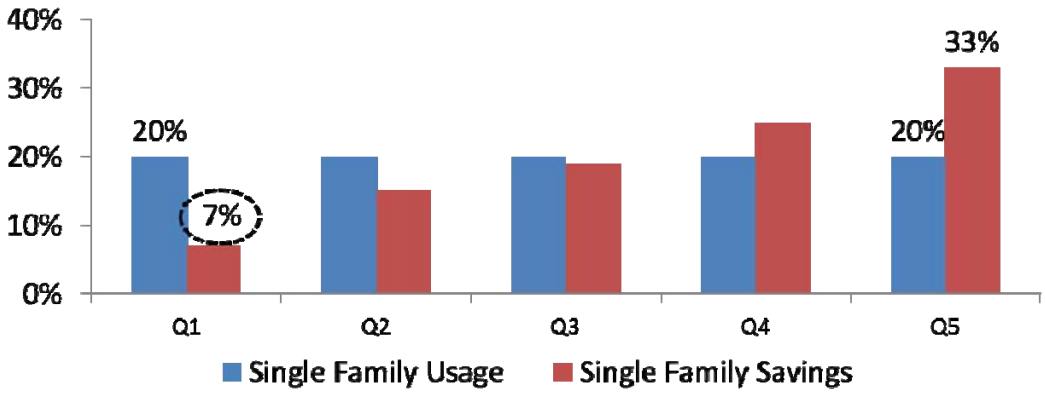

Figure 4. Annual Electric usage compared to annual electric savings by quintile in Eastern Massachusetts

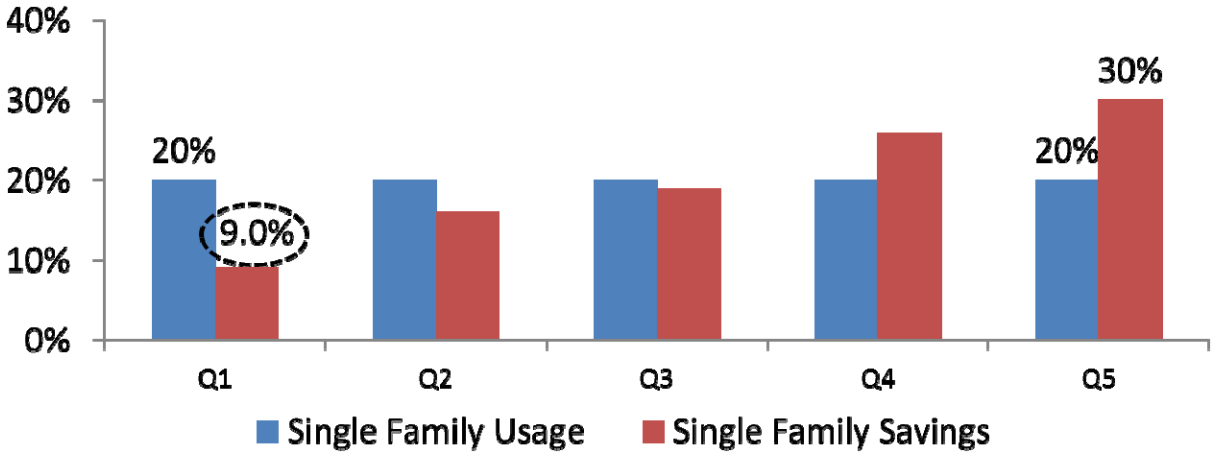

Figure 5. Annual gas usage compared to annual gas savings by quintile for Eastern Massachusetts.

Residential Segmentation Model

The utility has developed a model segmentation based on the energy consumption analysis above and on the collective experience of its energy efficiency team. This model provides definitions of segments that represent the best guess of its employees about what the meaningful, mutually exclusive, and collectively exhaustive groupings of residential customers will be. These groupings are not oriented around particular programs, such as the weatherization program. Rather the utility is seeking to uncover what groups exist within its service territory in order to better align its energy efficiency and marketing programs to them. An important aspect of this model is that it looks at customers on two different dimensions for every customer: potential in the home and customer motivation.

Savings Potential in the Home

The characteristics of the home should be taken into consideration when deciding what energy efficiency programs to promote to individual customers. A customer could be highly motivated to save energy, but if she or he lives in a new and well-sealed home the utility should not target that customer for weatherization services.

Efficiency Opportunity. Homes in the Efficiency Opportunity group are owner-occupied single family properties with high potential for energy efficiency upgrades. These homes are good candidates for Home Energy Solutions (HES) programs (i.e. no pre-weatherization barriers and cost effective to insulate), have appliances that are ready for replacement, or are in areas that are targeted for gas conversions (in our Connecticut service territory). At present we are using year built as a proxy for efficiency opportunity.

2-4 Family Home. A 2-4 Family home qualifies for the current HES single family programs, but it may be helpful to approach them differently from freestanding homes. These homes could be flagged for further marketing to get all units brought into the program or they could be flagged for special marketing, such as under a special "Triple Decker" (a common architectural style) program in eastern Massachusetts.

Multifamily. A Multifamily home is any property with more than five units. The utility assumes that the person occupying this home cannot freely make decisions that impact all four walls, the roof and major mechanical systems. Whether or not the building is managed by a property management company or a condo association could help determine how we approach these buildings. Ultimate programs may be similar to rental single family homes.

Barriered. Barriered single family homes have one or more challenge that keeps them from being good candidates for HES or major system upgrades. There are two major barriers currently identified: renter occupied single family property or a property where pre-weatherization barriers are present. These could include, but are not limited to, knob & tube wiring, mold, or asbestos, all common problems among older homes in our service territory. For the purposes of this study, it was assumed that homes built before 1940 may have any one of these challenges and were assigned to that segment.

Leading Edge. Leading Edge homes have less potential for weatherization or major system upgrades. They are single family homes that meet the Connecticut Draft Weatherization Standard (DEEP 2015), ENERGY STAR®, or LEED. Until we are able to identify all homes meeting these criteria in our service territory, we will use year built as a proxy.

Customer Motivation

Customers will also be segmented based on what we think are the likeliest motivations to participate: financial savings, improved comfort, or desire to reduce impact on the environment. We are seeking to identify marker characteristics for these groups using message testing, but as an initial hypothesis we are using the following criteria.

The Choir. Members of the Choir are motivated by saving the environment. They may be willing to turn down the heat and to make larger investments in energy efficiency. This group will be identified by participation in green energy supply programs. In our Connecticut and Massachusetts electric service territories, customers have supplier choice. Several options are available to purchase fully renewable electric supply. We assume that customers who have proactively selected such suppliers, in many cases paying higher rates, are motivated to save energy for environmental reasons. Any customer who has opted into one of these suppliers is a member of The Choir regardless of income level or other demographic criteria. Customers

purchasing only gas from the utility do not have green supplier options and cannot be identified in the same way. Therefore, we will look for other markers associated with purchase of green supply and attempt to extrapolate membership in the Choir at a future date**.**

There is a "Green Aware" category in the third party consumer data that the utility purchases. This measure predicts the likelihood of consumer motivation to purchase environmentally friendly products. Interestingly, it was not found to be a significant factor affecting likelihood to move forward in insulation in previous analysis (Goldman and Hastings 2014). It may be that the metric is not specific enough to identify customers with specific energy related motivations. Consumers may have a variety of motivations to make green purchases: they may be concerned about health, about animal welfare, the outdoors (Ottman 2010) or energy related issues such as climate change. It is therefore conceivable that a consumer who shops regularly for organic produce may not think twice about turning up the thermostat or leaving the lights on.

Comfort Seekers. Comfort Seekers are motivated by personal comfort and maximizing happiness. They may act to improve the perceived warmth, comfort and value of their homes. They will not act if the action decreases their comfort. They are likely to turn up the thermostat before they put on a sweater. Any customer with a home worth $500,000 or more, with 200% or more of state median income, or with a home of 4000 square feet or more will be targeted with messages encouraging them to save money by saving energy. In this case, the utility assumes that anyone for whom monthly utility bills represent such a small percentage of overall monthly incomes will be less likely to be motivated by messages highlighting the benefits of financial savings. These levels are set high in a reflection of the high cost and high income nature of our service territory and at a level where a monthly energy bill is unlikely to cause a significant concern.

Savers. Savers are motivated by saving money on their bills. They are likely to put on a sweater rather than turn up the thermostat. Any customer with a home worth less than $500,000, with less than 200% of state median income, or with a home of less than 4000 square feet will be targeted with messages encouraging them to save money by saving energy. These levels are set high in a reflection of the high cost and high income nature of our service territory.

Income Eligible. Income Eligible customers have rate codes indicating they can participate in low income programs OR have otherwise qualified for the program. These characteristics can be qualified using information in our customer information systems. Those who make 60% or less of state median income but whose income has not yet been verified will be targeted with messages inviting them to enroll in the program. Income Eligible is pulled out as a separate segment from Savers because they are eligible for special programs.

Conflicted. Conflicted customers are not likely to participate. They may believe that energy efficiency is the right thing to do, but may not have the time or energy to participate. Others in this category simply don't care or may even have negative views towards environmental or global warming related messages. Any customer who has provided direct, negative feedback to the utility about programs such as our home energy report will be included in the conflicted group.

Market Test

We tested whether different groups respond differently to the same message by looking at how prospective members of The Choir responded to a direct mail campaign. In the fall of 2015 a piece of direct mail was sent to over 60,000 homeowners in eastern Massachusetts promoting a home weatherization program. The selected homeowners were dual fuel customers of the utility, eligible for the single family homes program, and not believed to be eligible for the low income weatherization program. After the completion of the campaign, we analyzed the respondents to see if customers who had chosen renewable energy suppliers responded differently (Table 2).

Table 2. Response to Home Weatherization Promotion

			Air Sealing		Weatherization	
	Received Mail	**Audit**	**Proposed**	**Installed**	**Proposed**	**Installed**
Fully Renewable Electric Supply	3,153	78	31	3	35	3
Standard Mix Electric Supply	57,524	1,429	638	102	674	91

The customers electing for fully renewable electric supply comprise only five percent of the total sample, and the number of respondents was small enough that differences between the two customer groups' response may not be statistically representative. The results do however raise some interesting questions. The overall response to the mailing was about the same between both groups: about 2.5% had audits. The conversion rates between audit and installation of air sealing and weatherization was much lower (Table 3) That is, fewer of the customers to whom air sealing and weatherization was recommended went forward with the measures. This result seems counterintuitive, so we examined how the renewable electric supply customers compared with the standard mix customers on the measures previously identified as important: home value, loan to value ratio, length of residency, and age of home (Figures 8 through 11) as well as Green Aware score and income (Figures 12 and 13)

Table 3. Conversion rates

	Audit	**Air Sealing Conversion**	**Weatherization Conversion**
Fully Renewable Electric Supply	2.5%	9.7%	8.6%
Standard Mix Electric Supply	2.5%	16.0%	13.5%

Customers who opted for renewable supply tended to live in homes with lower value, but to have lived in them for a longer period of time. They also had higher equity (that is, lower loan to value ratios) in their homes (Figure 9), perhaps related to the fact that they have lived longer (Figure 10) in lower value homes (Figure 8). The age of their homes seems to follow the same distribution as the rest of the sample (Figure 11). Finally, a greater number of customers who have opted for renewable supply are listed as Behavioral Greens (Figure 12), and a greater number have lower incomes than the rest of the sample (Figure 13).

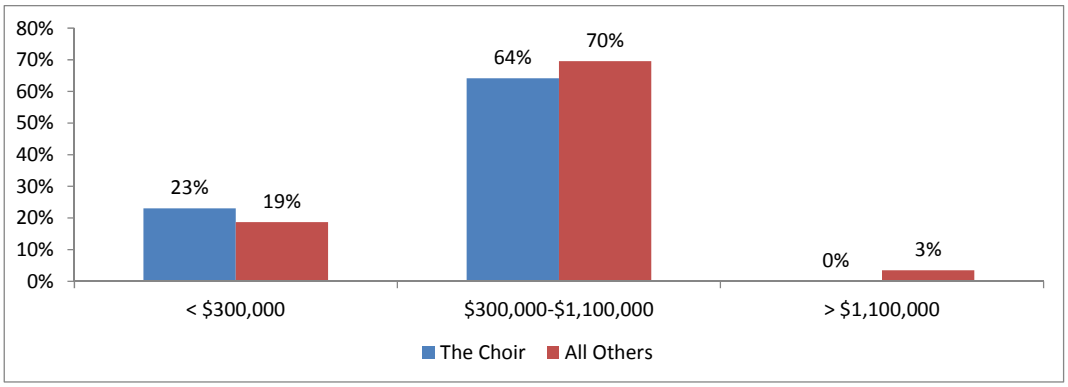

Figure 8. Estimated home value for audit recipients by segment

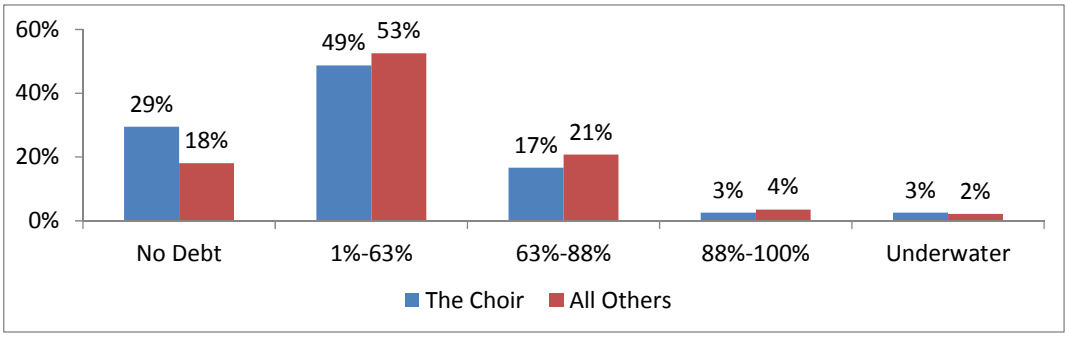

Figure 9. Loan to value ratio categories for audit recipients by segment

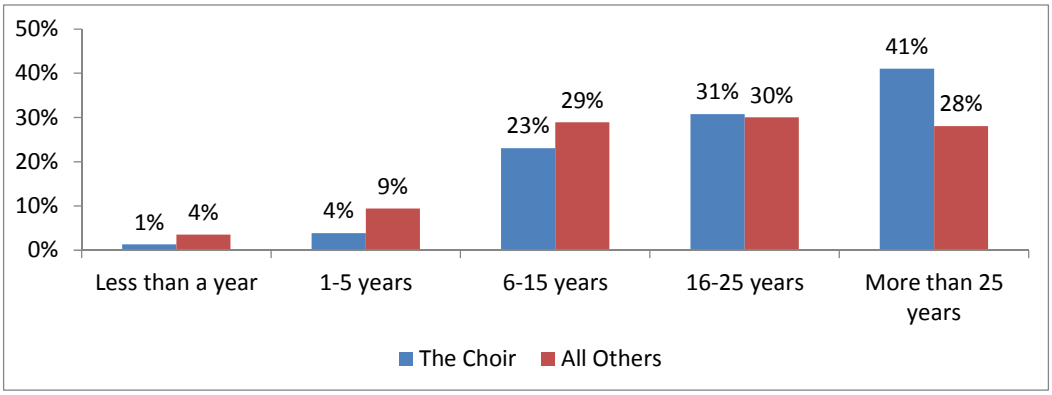

Figure 10. Length of residence for audit recipients by electric supply choice

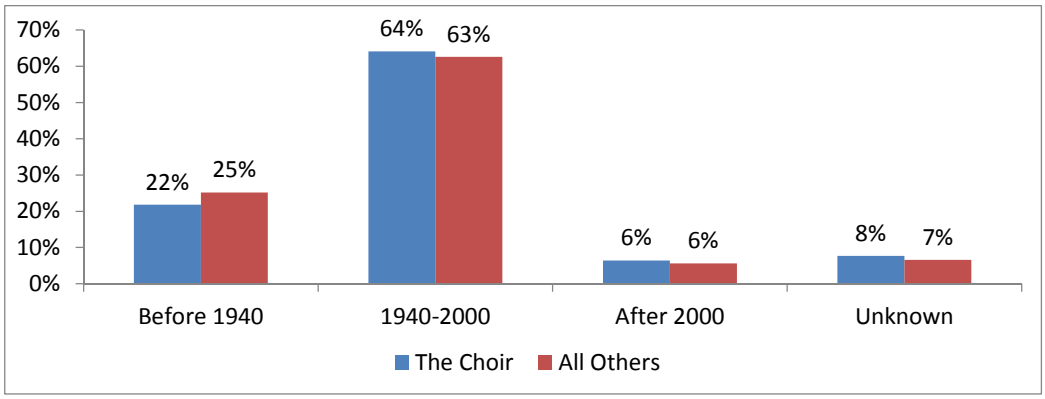

Figure 11. Age of home for audit recipients by segment.

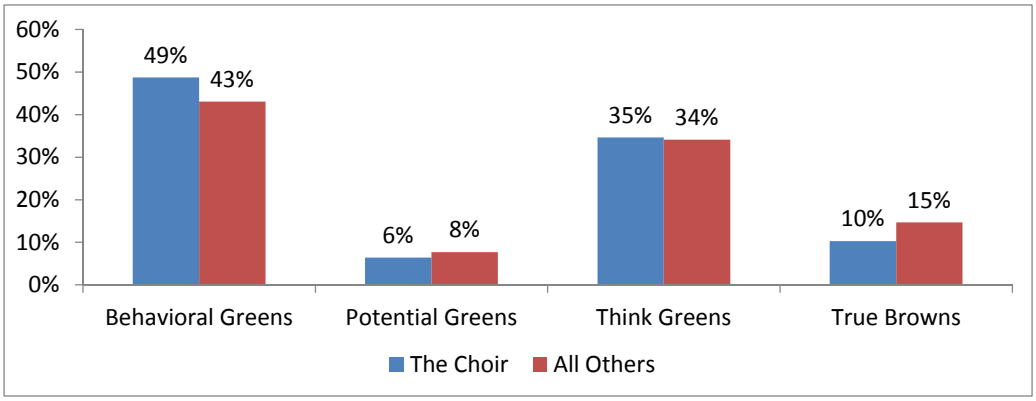

Figure 12. Green Aware score for audit recipients by segment.

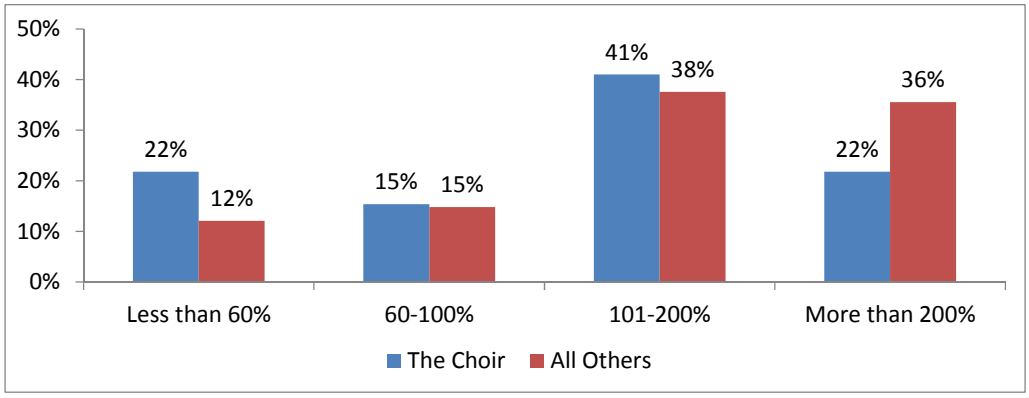

Figure 13. State median income index for audit recipients by electric supply choice

Conclusions

Home characteristics seem to have more weight in determining up take of weatherization and air sealing metrics than presumed environmental motivation. The sample is small, and further testing is needed to make this conclusion more robust. What is most surprising is that though members of the Choir responded to a marketing campaign at the same rate as the rest of

the population, they converted from home energy audits to deeper measures such as air sealing and weatherization at *lower* rates than the rest of the population.

As stated above, we have found in other studies that length of residence can be a determining factor in participation. In past focus groups, we have received the insight that moving personal possessions out of the attic can be an inhibitor from acting on deeper measures. Since those opting for renewable supply tend to have lived in their homes for longer periods of time, they may have more possessions to move. These and other factors may be overcoming an inherent desire to reduce the impacts of energy consumption as indicated by opting for renewable energy supply and participating in the audit. There may be other opportunities for new program design in this case such as including services to pack and move items stored in the attic as a part of the home weatherization process. Alternatively, other measures may be more attractive to members of the Choir and therefore should be more directly promoted to them.

Such interactions and nuances need to be further examined. The next step will be email campaigns to test whether different groups of customers will respond to differently to different messages. The results of this test will be used to refine the definitions of the segments for future marketing efforts.

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