



DELAWARE STATEWIDE RESIDENTIAL BASELINE STUDY

SUMMARY RESULTS AND ANALYSIS

FINAL

Prepared for:

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

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1. EXECUTIVE SUMMARY

1.1 Overview

Opinion Dynamics Corporation and subcontractor Nexant, Inc. (Nexant), have been contracted by the Delaware Department of Natural Resources and Environmental Control (DNREC) to perform a residential end use and saturation study (baseline study) for the State of Delaware. The goal of the study was to document the types of energy consuming equipment in Delaware homes, as well as residents' awareness, attitudes, and knowledge of energy efficiency and conservation behaviors. This report presents the findings from a telephone survey of 500 households as well as in-home energy assessments of 70 single-family homes across the State. The telephone surveys and in-home assessments were completed from March through May 2012.

This study evaluates the characteristics of energy using equipment and building stock present in the residential sector. Opinion Dynamics used its experience performing previous baseline studies, energy efficiency program planning, and evaluations to identify output parameters that will be integral to future resource planning and energy efficiency activities in Delaware.

1.2 Methodology

To accurately meet the objectives of this study, Opinion Dynamics designed an approach which successfully melded the results of a telephone survey of 500 residents with in-home assessments of 70 single-family homes. Both efforts (i.e., telephone survey and in-home assessments) were stratified by a number of important characteristics in order to ensure adequate and statistically reliable representation of important subgroups. These subgroups included rural vs. urban dwelling units and retired vs. non-retired residents. In order to provide the most representative sample possible, both landline and cell phone samples were used. Ultimately, quotas were set to ensure an adequate mix of residents from both the landline and cell phone samples and to ensure that, within each, we reached a representative mix of rural vs. urban and retired vs. non-retired residents.

Telephone survey participants residing in single-family homes¹ were recruited to participate in the in-home assessments. To provide statistically relevant results that can be reasonably applied to the residential population of Delaware, Opinion Dynamics designed the study using a sampling approach to produce telephone survey findings at a precision of $\pm 4\%$ at the 95% confidence level and in-home assessment findings at a precision of $\pm 10\%$ at the 90% confidence level. It is important to note that these precision levels apply to those questions and data points where all in-home assessment (or telephone survey) respondents

¹ 70 single family on-sites delivered 90 $\pm 10\%$ precision. Multi-family was excluded because within the budget achieving precision on each residential housing type was not feasible. Single family is by far, the largest segment of residential customers and the target of much of Delaware's programming.

are included in the analysis. In many cases, we present data that pertains to a particular subset of in-home assessment (or telephone survey) participants. In these situations, the precision level will be lower given the smaller number of observations.

1.3 Overview of Findings

In addition to measuring awareness, attitudes, and knowledge of energy efficiency; Opinion Dynamics was able to characterize the penetration, saturation, operating condition, and efficiency level of major residential end uses. One of the primary purposes of the baseline study was to determine the penetration and saturation of various types of residential lighting, key appliances, and other energy using equipment. Penetration and saturation are defined as follows:

- **Penetration:** A percentage representing the proportion of households who have one or more particular appliance (or other piece of equipment). It is calculated by dividing the number of households with one or more of an appliance (or other piece of equipment) by the total number of households responding to that question.
- **Saturation:** A percentage representing how many of a particular appliance (or other piece of equipment) exist among all households. It is calculated by dividing the total number of a particular appliance (or other piece of equipment) by the total number of households responding to that question. This percentage is at least equal to, but generally higher than the corresponding penetration of a particular appliance, because some households will have more than one of the appliance. The percentage can be greater than 100 percent.

1.3.1 Awareness, Attitudes, and behavior

Saving energy is clearly important to nearly all Delaware residents. On average, telephone survey respondents rated the importance of saving energy at 8.7 on a scale of 1 to 10, with one meaning “not at all important” and 10 meaning “very important.” The vast majority of residents also strongly agree that conserving energy is something they are personally responsible for—it isn’t just some other entity’s (e.g., the government’s) responsibility.

Despite its importance, residents report rather substantial barriers to being more energy-efficient, which tend to be informational (e.g., finding information on energy-efficiency when they need it), lifestyle related (e.g., finding the time to pursue energy-efficiency), and educational (e.g., not having enough knowledge of what energy-efficiency and conservation actions to take).

From this, it would appear that energy-efficiency programs across the state would be welcomed/well received by a group of interested, yet informationally and time challenged residents. Energy-efficiency programs serve to substantially reduce these barriers, which should serve to bring the importance residents place on these issues (which is high) into better alignment with their actions and behaviors (which, due to a multitude of barriers, would appear to be sub-optimal at this time).

1.3.2 Lighting

The average household surveyed in this study has a mean number of 60 light bulbs in use and 7 more in storage. Every household surveyed has at least one incandescent light bulb in use. A majority of households have at least one fluorescent bulb or CFL with penetration rates of 77% and 91% respectively. Thirteen percent of households have at least one LED bulb and 30% of households have at least one halogen bulb. Traditional screw bulbs are the most commonly used CFL bulb type – 89% of all households have at least one CFL screw bulb, compared to 47% with a specialty CFL lighting and 7% with pin based CFL lighting. Alternately, halogen screw bulbs (9%) tend to be less widespread than halogen pin bulbs (20%).

For lighting, saturation information is expressed somewhat differently than for other end-uses. For lighting, we express the saturation of different lighting technologies (e.g., CFLs, incandescent, halogens, etc.) as the percentage of all eligible sockets that contain that technology. An eligible socket is defined as a socket that will accept a medium screw-based light bulb. In the table below, for example, we illustrate that 56% of all bulbs in eligible (medium screw-based) sockets are incandescents, 29% are CFLs, etc.

Table 1-1: Penetration and Saturation of Lighting

	Penetration	% of Eligible Sockets
Home Lighting		
All Incandescents	100%	56%
<i>Screw-based Incandescents</i>	100%	44%
<i>Specialty-based Incandescents</i>	56%	12%
<i>Pin-based Incandescents</i>	1%	0%
All CFLs	91%	29%
<i>Screw-based CFLs</i>	89%	23%
<i>Specialty-based CFLs</i>	47%	6%
<i>Pin-based CFLs</i>	7%	0%
All Halogens	30%	3%
<i>Screw-based Halogens</i>	9%	1%
<i>Specialty-based Halogens</i>	10%	1%
<i>Pin-based Halogens</i>	20%	2%
All LEDs	13%	1%
<i>Screw-based LEDs</i>	1%	0%
<i>Specialty-based LEDs</i>	3%	0%
<i>Pin-based LEDs</i>	10%	0%
All Fluorescent Pins	77%	10%
Exterior Lighting		
All Incandescents	73%	59%
<i>Screw-based Incandescents</i>	66%	50%

	Penetration	% of Eligible Sockets
Home Lighting		
Specialty-based Incandescents	13%	8%
Pin-based Incandescents	0%	0%
All CFLs	36%	26%
Screw-based CFLs	31%	22%
Specialty-based CFLs	4%	4%
Pin-based CFLs	0%	0%
All Halogens	20%	11%
Screw-based Halogens	3%	2%
Specialty-based Halogens	10%	5%
Pin-based Halogens	7%	4%
All LEDs	1%	1%
Screw-based LEDs	0%	0%
Specialty-based LEDs	1%	1%
Pin-based LEDs	0%	0%
All Fluorescent Pins	0%	0%
Storage Lighting		
Screw-based Incandescents	49%	9%
Screw-based CFLs	60%	9%
Specialty-based CFLs	1%	1%
Screw-based LEDs	1%	3%
Screw-based Halogens	13%	4%
Fluorescent Pins	1%	10%

1.3.3 Space Heating and Cooling

Natural gas is the most commonly used fuel for home heating (41%) and nearly three-quarters of the homes use a central forced air furnace. A majority of homes have central air conditioning systems (73%) while roughly half of all homes have programmable thermostats.

Table 1.2 Penetration and Saturation of HVAC Equipment

	Penetration	Saturation
Heating System*		
Source: Natural Gas (n=29)	41%	100%
Type: Central forced air furnace (n=49)	70%	
Age in years (n=67)	11	
Central Air Conditioning System		

Age in years (n=53)	9	73%	81%
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average age for central heating units is 11 years and 9 years for central air conditioning units.			

1.3.4 Water Heating & Efficiency Measures

Storage tank water heaters are by far the most popular (97%) form of water heater within Delaware homes, with just over half (56%) powered by electricity. Low-flow showerheads also appear to enjoy wide spread use.

Table 1.3 Penetration and Saturation of Water Heater and Related Equipment

		Penetration	Saturation
Water Heater*			
Type: Storage (n=71)	97%	100%	113%
Source: Electric (n=41)	56%		
Age in years (n=70)	8		
Low-Flow Showerheads			
Average (n=98)	1.02	81%	140%
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age is 8 years.			

1.3.5 Laundry Equipment

Nearly all Delaware households have clothes washers and dryers (96%). The majority of clothes washers are top-loading (63%), and 65% are recognized as ENERGY STAR qualified.

Table 1.4 Penetration and Saturation of Clothes Washers and Dryers

		Penetration	Saturation
Clothes Washer*			
Type: Front-loading (n=25)	37%	96%	96%
Type: Top-loading (n=42)	63%		
Age (n=64)	6 years		
ENERGY STAR (n=65)	65%		
Clothes Dryer			
Fuel Type: Electric (n=62)	93%	96%	96%
Fuel Type: Natural Gas (n=5)	7%		
*Unless noted as a percentage, all descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age of clothes washers is 6 years.			

1.3.6 Kitchen Equipment and Food Storage

Nearly all homes have a refrigerator and a third (33%) of this group owned at least two refrigerators. The majority (68%) of assessed refrigerators were ENERGY STAR qualified, while only a third (39%) of stand-alone freezers were identified as more efficient models. The majority of both stove tops (69%) and ovens (79%) were powered by electricity. Most homes audited (90%) owned a dishwasher, and at these homes, 68% of the dishwashers were ENERGY STAR qualified.

Table 1.5 Penetration and Saturation of Kitchen Equipment and Storage Items

		Penetration	Saturation
Refrigerator*			
Type: Top Freezer (n=41)	41%	99%	143%
Type: Side by Side (n=39)	39%		
Type: Stand-alone Refrigerator, no freezer (n=10)	10%		
Type: Bottom Freezer (n=7)	7%		
Type: Other (n=3)	3%		
ENERGY STAR (n=95)	68%		
Stand Alone Freezer			
Type: Upright (n=19)	58%	47%	47%
Type: Chest (n=14)	42%		
ENERGY STAR (n=33)	39%		
Stove Top			
Fuel Type: Electric (n=48)	69%	100%	100%
Oven			
Fuel Type: Electric (n=61)	79%	97%	110%
Dishwasher			
Type: Front-down panel door (n=63)	100%	90%	90%
ENERGY STAR (n=59)	68%		
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age of refrigerators is 7.			

1.3.7 Consumer Electronics

Televisions are by far the most common consumer electronic device, with 99% of households reporting ownership. Computers are also fairly common with 91% of households reporting ownership of either a desktop or laptop computer.

Table 1.6 Penetration and Saturation of Consumer Electronics

	Penetration	Saturation
Consumer Electronics		
Televisions	99%	289%
All Computers	91%	140%

1.3.8 Building Envelope

The average home surveyed was 1,872 sq. feet, with the bulk (71%) being single-family detached style homes. Homes across Delaware also appear to be fairly well insulated; however, only attic insulation was directly measured by auditors and of those homes with attic space, 80% were insulated.

1.4 Future Program Design Implications

The baseline survey and in-home study results suggest that there is both potential and demand for energy efficiency programs and services in Delaware. While much of the low hanging fruit that made up the majority of early programs in states with more mature energy efficiency portfolios are already widely adopted in Delaware (e.g. clothes washers), many opportunities still exist. Energy efficient lighting, whole house or Home Performance with ENERGY STAR programs, consumer electronics and behavior/educational programs all have potential in the Delaware market.

In general, programs should be developed to provide consumer education along with incentives². Program designers should also keep in mind that the current environment for many technologies are in flux with new products introduced almost daily and unsettled product pricing. For programs to be cost effective in this environment, they will need to be flexible and have the ability to change program approach, product mixes and incentive levels throughout the year as necessary.

Based on the market maturity of certain technologies or measures, program planners may also want to consider taking a market lift³ approach for certain technologies. Market lift programs which provide upstream incentives to retailers/wholesalers/manufacturers, that increase their sales share of equipment above a pre-established baseline, may prove an effective means of capturing savings in the residential lighting and consumer electronics markets.

Markets including the multi-family, residential new construction and home retrofit, which were served in Delaware through American Recovery and Reinvestment Act (ARRA) funding which were administered through the Delaware Sustainable Energy Utility (SEU) and the Department of Natural Resources and Environmental Control (DNREC), had significant

² 2009-2012 Delaware Energy Efficiency Programs EM&V report . Opinion Dynamics. 2012.

³ Higher Savings Goals and the Rebate/Buydown Elephant in the Room: Recognizing When and How to Move On to Market Lift. 2010 ACEEE Summer Study on Energy Efficiency in Buildings. Rick Winch, Eileen Hannigan, and Monica Curtis.

opportunities to capture savings by reducing air leaks, infiltration, and heat transfer through un-insulated or under-insulated attics.

Findings in this study suggest customers understand that their personal actions and behaviors impact the supply of energy resources and that they have the desire to try and reduce the amount of energy used in their homes (59%) with over ninety percent of those surveyed saying they intend to reduce their usage in the next year. Being busy seems to be one of the primary barriers to reducing energy usage in Delaware. Programs that can help ease this barrier are more likely to prove successful than programs that require a high level of interaction. Behavioral programs that offer simple steps customers can take to reduce their usage may prove effective, although these should be undertaken in a manner that leverages customer usage with broader segmentation data that appears later in this report to make sure that these programs are targeting customers who are more likely to take action and who have the greatest potential for savings in a manner that resonates with them.

As programs develop, customer segmentation may be a useful tool to include in the Delaware tool box. By understanding the unique motivations of different types of customers, programs can be effectively targeted. While two-thirds of Delaware residents interviewed in this study cited the potential to save money as the primary reason why they might try and save energy in their home, many more mature programs have found that other drivers including comfort, quality or durability drive consumers towards energy efficiency programs. Less commonly mentioned motivators like reducing dependence on foreign oil and social responsibility may not be ideal platforms for a statewide campaign but may be very effective if targeted towards those customers motivated by these issues.

For example, residents who are less than 30 years of age are more likely to cite protecting the environment (29%) as the number one reason why a person would try and save energy compared those aged 30 to 59 years old (17%), or 60 years or older (12%).⁴

Based on the findings in this study, some common program types might not prove to be a good fit in Delaware. HVAC programs that incentivize high efficiency HVAC equipment would provide little benefit given the high proportion of customers already installing high efficiency equipment at the time of replacement. Further, programs targeting appliances should be avoided given the very high market share and penetration of ENERGY STAR qualified appliances in the state.

Given the high market share for many equipment types (principally HVAC and appliances), early replacement programs are often considered as an alternative program design. However, the challenge with this type of design is that few program administrators have found an effective way to reach a sizeable segment of the population that the program can actually accelerate (i.e., convince to replace a substantial number of years prior to what they would have done in absence of the program). In fact, the most rigorous evaluation studies have found that early replacement programs tend to capture a disproportional number of

⁴ Note that age isn't the only demographic that should be considered when segmenting customers, this is a single illustration that provide an example of how understanding customer demographics can help programs identify and target people with the messages that will resonate with them.

people who had already decided to replace equipment. And, therefore, the programs are not only costly but achieve very little acceleration.⁵

⁵ State of Wisconsin Department of Administration Division of Energy. Evaluation of the Wisconsin Public Service 10 MW Programs, Semiannual Report (FY07 Q3)-Final. May 29, 2007. Section 4: Cool Upgrade and Save Program. Rick G. Winch and Tom Talerico, Glacier Consulting Group, LLC.

2. INTRODUCTION

The Delaware Department of Natural Resources and Environmental Control (DNREC) retained Opinion Dynamics Corporation and subcontractor Nexant, Inc. to conduct a residential baseline study with households across the State of Delaware. The study consisted of a telephone survey of 500 households, as well as in-home energy assessments of 70 single-family homes. The telephone surveys and in-home assessments were completed in March through May 2012.

Baseline research helps program administrators make educated decisions about the energy end-uses and equipment that can be most effectively targeted with energy efficiency programs. Baseline research can also be used to characterize the type and efficiency levels of equipment that are installed in customer homes and businesses. These data serve to confirm program planning assumptions and may also be useful in evaluating energy savings impacts once programs are established. According to the National Energy Efficiency Best Practices Study's Portfolio Best Practices Report, "Objective baseline research reinforces the credibility of the portfolio and its underlying programs with diverse stakeholders and improves the accuracy of savings estimates, cost effectiveness calculations, and goals."⁶

This study evaluates the characteristics of energy using equipment and building stock present in the residential sector. Opinion Dynamics used its experience performing previous baseline studies, energy efficiency program planning, and evaluations to identify output parameters that will be integral to future resource planning and energy efficiency activities in Delaware.

This report presents the findings of both survey efforts and is organized as follows.

Introduction and Methodology: Sections 2 & 3 provide background about the study and this report and present the data collection and analysis methodology.

Energy Consuming Equipment. Section 4 summarizes and analyzes the data collected in the study. Subsections, as warranted, consist of graphs, tables, and brief descriptions of the most important findings. The seven subsections address the following equipment categories:

Section 4.1: Lighting

Section 4.2: Space Heating and Cooling

Section 4.3: Water Heating and Related Efficiency Measures

Section 4.4: Laundry Equipment

Section 4.5: Kitchen Equipment and Food Storage

Section 4.6: Consumer Electronics

⁶ National Energy Efficiency Best Practices Study. Volume P1: Portfolio Best Practices Report. Itron Inc. 2008. Pg. P1-48.

Section 4.7: Building Envelope

Awareness, Attitudes, and Behavior: Section 5 summarizes key aspects of the telephone survey that focused on Delaware residents' awareness of and attitudes toward energy efficiency and conservation. It also captures information on the extent to which levels of awareness and attitudes toward efficiency are reflected in actual consumer behavior

Profile of Respondents: Section 6 provides the demographic characteristics of the 500 people who participated in the telephone survey as well as the 70 households that received an in-home assessment.

Appendix A – Survey Instruments: This section contains the in-home screener, the in-home data collection form, as well as the quantitative telephone survey fielded to residential residents.

3. METHODOLOGY

The DNREC residential baseline study consisted of two types of data collection activities: in-home visits/assessments and a quantitative telephone survey with Delaware residents. The following sections outline the methodology used for both components of the study.

Telephone Survey

Opinion Dynamics conducted a telephone survey of Delaware residents as part of the baseline study. The survey was designed to collect information about residents' homes and the energy-using equipment within them. The survey focused on lighting, with particular emphasis on establishing a baseline for CFL awareness and self-reported penetration and saturation, all toward the goal of providing point estimates against which to measure future program performance (i.e., program-induced changes in CFL awareness, penetration, and saturation over time). In addition to lighting, the telephone survey collected basic information about the presence of various types of end-use equipment, such as central heating and air conditioning, consumer electronics, and appliances. Finally, the survey collected information regarding Delaware residents' attitudes toward and knowledge of energy efficiency, and key demographics.

At the end of each telephone survey, occupants of single-family dwellings were recruited for in-home visits/assessments.

Sample Design & Precision

An important aspect of the sample design was to ensure adequate representation of both urban and rural dwelling units. In order to address this need, each zip code within Delaware was assigned a rural or urban designation. Zip codes with a population density of 250 or fewer people per square mile were designated as rural, while zip codes with population densities over 250 people per square mile were designated as urban. In total, 67 zip codes were identified, with 25 designated as rural, 40 designated as urban, and 2 eliminated from the study (these two were zip codes dedicated to the University of Delaware).

The telephone survey was stratified by a number of important characteristics in order to ensure adequate and statistically reliable representation of important subgroups. These subgroups included rural vs. urban dwelling units and retired vs. non-retired residents. In order to provide the most representative sample possible, both landline and cell phone samples were used. Ultimately, quotas were set to ensure an adequate mix of residents from both the landline and cell phone samples and to ensure that, within each, we reached an adequate mix of rural vs. urban and retired vs. non-retired residents.

The 500 telephone survey completions provide a precision of $\pm 4\%$ at the 95% confidence level. It is important to note that these precision levels apply to those questions and data points where all telephone survey respondents are included in the analysis. In many cases, we present data that pertains to a particular subset of telephone survey participants. In these situations, the precision level will be lower given the smaller number of observations.

Response Rate

The survey response rate is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. We calculated the response rate using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR).⁷ For various reasons, we were unable to determine the eligibility of all sample units through the survey process and chose to use AAPOR Response Rate 3 (RR3). RR3 includes an estimate of eligibility for these unknown sample units. The formulas used to calculate RR3 are presented below. The definitions of the letters used in the formulas are displayed in the Survey Disposition table.

$$E = (I + R + NC) / (I + R + NC + e)$$

$$RR3 = I / ((I + R + NC) + (E*U))$$

We also calculated a cooperation rate, which is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the percentage of participants who completed an interview out of all of the participants with whom we actually spoke. We used AAPOR Cooperation Rate 1 (COOP1) which is calculated as:

$$COOP1 = I / (I + R)$$

Respondents were classified as ineligible mostly because the given phone numbers were not working, or were simply wrong numbers.

The final survey dispositions are presented below.

Table 3-1: Survey Dispositions

Disposition	Total
Completed Interviews (I)	500
Eligible Non-Interviews	4547
<i>Refusals (R)</i>	3513
<i>Mid-Interview terminate (R)</i>	103
<i>Respondent never available (NC)</i>	774
<i>Language Problem (NC)</i>	157
Not Eligible (e)	4317
<i>Fax/Data Line</i>	208
<i>Non-Working</i>	3037
<i>Wrong Number</i>	232
<i>Business/Government</i>	409
<i>Cell Phone</i>	189
<i>Duplicate Phone Number</i>	11
<i>No Eligible Respondent</i>	54

⁷ Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys, AAPOR, 2009. http://www.aapor.org/Standard_Definitions/1818.htm

Disposition	Total
Unknown Eligibility Non-Interview (U)	9395
No Answer	5246
Answering Machine	3238
Busy	80
Not Attempted or Worked	748
Call Blocking	83
Total Participants in Sample	18759

Weighting

Table 3-2 compares population data for the stratification variables of interest to information from the 500 completed telephone surveys. On all dimensions—rural vs. urban, retired vs. non-retired, cell phone only usage—the characteristics of survey participants closely match those found in the overall Delaware residential population. Given this, there was no need to weight the survey data.

Table 3-2: Telephone Survey Weighting

Variables of Interest	Percentage	
	Population	Survey
Rural*	18%	20%
Urban*	82%	80%
Retired**	14%	17%
Cell phone Only***	21%	20%

*Delaware zip codes with population densities over 250 people per square mile were designated as urban. Those of 250 or fewer were designated as rural.

**The population statistic listed is the % of Delaware Residents (2010 U.S. Census Quick Facts) age 65+. This census data indicates that 15% of the U.S. population that are 65+ are still in the workforce. However, an unknown % of people under age 65 are retired. We assumed that these two percentage offset one another.

***The population statistic is an extrapolation of Delaware data (July 2009-July 2010) based on the Center of Disease Control's National Health Interview Survey from July 2009-July 2010 to December 2011.

In-Home Visits

At the end of the telephone survey, occupants of single-family homes were recruited to participate in the in-home visit/assessments. The purpose of the in-home assessments was to capture data on energy consuming equipment, including installed quantities of electric and gas consuming equipment and appliances, efficiency levels for equipment and appliances, building shell characteristics (e.g., insulation levels), and CFL penetration and saturation. All participating residents received a VISA gift card for \$75 as an incentive to participate in the study.

Nexant, Inc. (Opinion Dynamic's subcontractor on this study) managed the in-home data collection component of the study. The in-home visits were conducted by trained auditors in April and May of 2012. Overall, we conducted a total of 70 in-home visits.

Sample Design & Precision

Similar to the telephone survey, the sampling plan for the in-home assessments was designed to ensure an adequate mix of urban vs. rural and retired vs. non-retired residents. Quotas were set to ensure an adequate mix of in-home visits across each of these important subgroups. The 70 in-home assessments provide a precision of $\pm 10\%$ at the 90% confidence level. It is important to note that these precision levels apply to those questions and data points where all in-home assessment respondents are included in the analysis. In many cases, we present data that pertains to a particular subset of in-home assessment participants. In these situations, the precision level will be lower given the smaller number of observations.

Weighting

On all dimensions—rural vs. urban, retired vs. non-retired, cell phone only usage—the characteristics of in-home visit participants closely match those found in the overall Delaware residential population. Given this, there was no need to weight the assessment data.

Data Analysis

For both survey efforts, the Team used two types of tests to determine the significance of differences observed between comparison groups:

- **Proportions** were compared using the independent z-test for proportions/percentages.
- **Means** were compared using the two-tailed independent t-test for means (unequal variances).

Percentages based on the telephone survey data illustrated in figures and tables, as well as discussed in the text are typically based on all 500 responses to the survey, but some questions were asked only of some respondents and the percentages were calculated using these different bases. As with the 70 in-home assessments, the base for each percentage is shown with each graph or table. Where meaningful, “don’t know” responses are included in our analysis of both surveys. For all other cases, valid percents are presented. Differences among sub-groups are discussed only when statistically significant.

Penetration and Saturation

A primary purpose of both the telephone survey in-home assessments was to determine the penetration and saturation of key energy end-use equipment within Delaware homes. These two concepts are defined as follows:

- **Penetration:** A percentage representing the proportion of households who have one or more particular appliance (or other piece of equipment). It is calculated by dividing the number of households with one or more of an appliance (or other piece of equipment) by the total number of households responding to that question.

- **Saturation:** A percentage representing how many of a particular appliance (or other piece of equipment) exist among all households. It is calculated by dividing the total number of a particular appliance (or other piece of equipment) by the total number of households responding to that question. This percentage is at least equal to, but generally higher than the corresponding penetration of a particular appliance, because some households will have more than one of the appliance. The percentage can be greater than 100 percent.

In this report, penetration levels are generally displayed in tables with saturation levels, where available, presented in a separate column to the right of the penetration column. These tables can be found at the end of each section.

4. ENERGY CONSUMING EQUIPMENT CHARACTERISTICS

This section outlines the characteristics of homes within the State of Delaware. In particular, this section presents installed quantities (penetration) of electric and gas consuming equipment and appliances, efficiency levels for this equipment, building shell characteristics (e.g., insulation levels), and CFL penetration and saturation among other measures. The section contains data from both the in-home visits and telephone surveys where applicable and is divided into eight subsections: 1) lighting, 2) space heating and cooling, 3) water heating, 4) laundry, 5) kitchen equipment and food storage, 6) consumer electronics, and 7) building envelope and other equipment.

4.1 Lighting

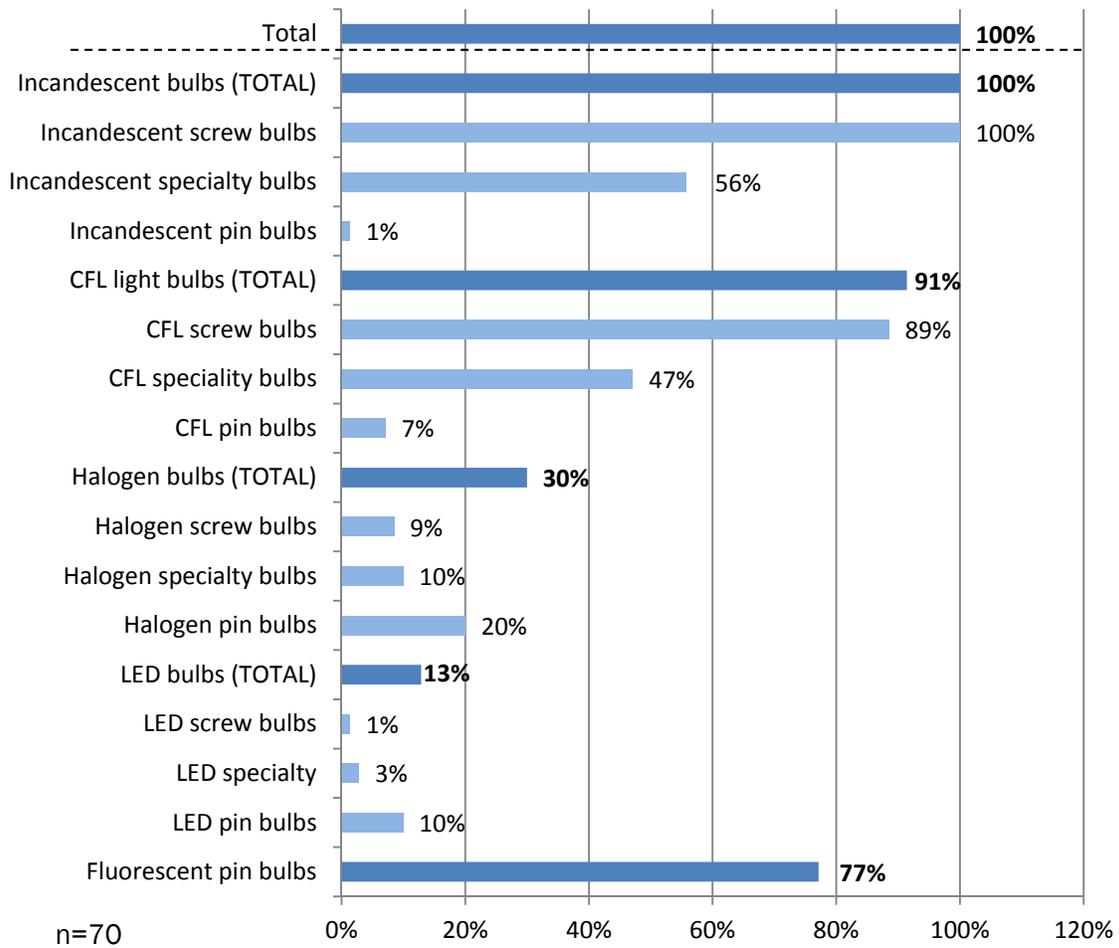
This section presents lighting penetration and saturation data for Delaware households. Lighting data were collected for Delaware residents from two sources, a phone and on-site survey. On-site data collection was recorded on a room by room basis, by type of lighting technology and bulb type. All data are based on light bulbs currently in use unless explicitly stated otherwise.

For lighting, saturation information is expressed somewhat differently than for other end-uses. For lighting, we express the saturation of different lighting technologies (e.g., CFLs, incandescent, halogens, etc.) as the percentage of all eligible sockets that contain that technology. An eligible socket is defined as a socket that will accept a medium screw-based light bulb. In Figure 4-2, for example, we illustrate that 56% of all bulbs in eligible (medium screw-based) sockets are incandescents, 29% are CFLs, etc.

The average household surveyed in this study has a mean number of 60 light bulbs in use and 7 more in storage. The median number of bulbs in use is 53. Every household surveyed has at least one incandescent light bulb in use. A majority of households have at least one fluorescent bulb or CFL with penetration rates of 77% and 91% respectively. Thirteen percent of households have at least one LED bulb and 30% of households have at least one halogen bulb. Traditional screw bulbs are the most commonly used CFL bulb type – 89% of all households have at least one CFL screw bulb, compared to 47% with a specialty CFL lighting and 7% with pin based CFL lighting. Alternately, halogen screw bulbs (9%) tend to be less widespread than halogen pin bulbs (20%).

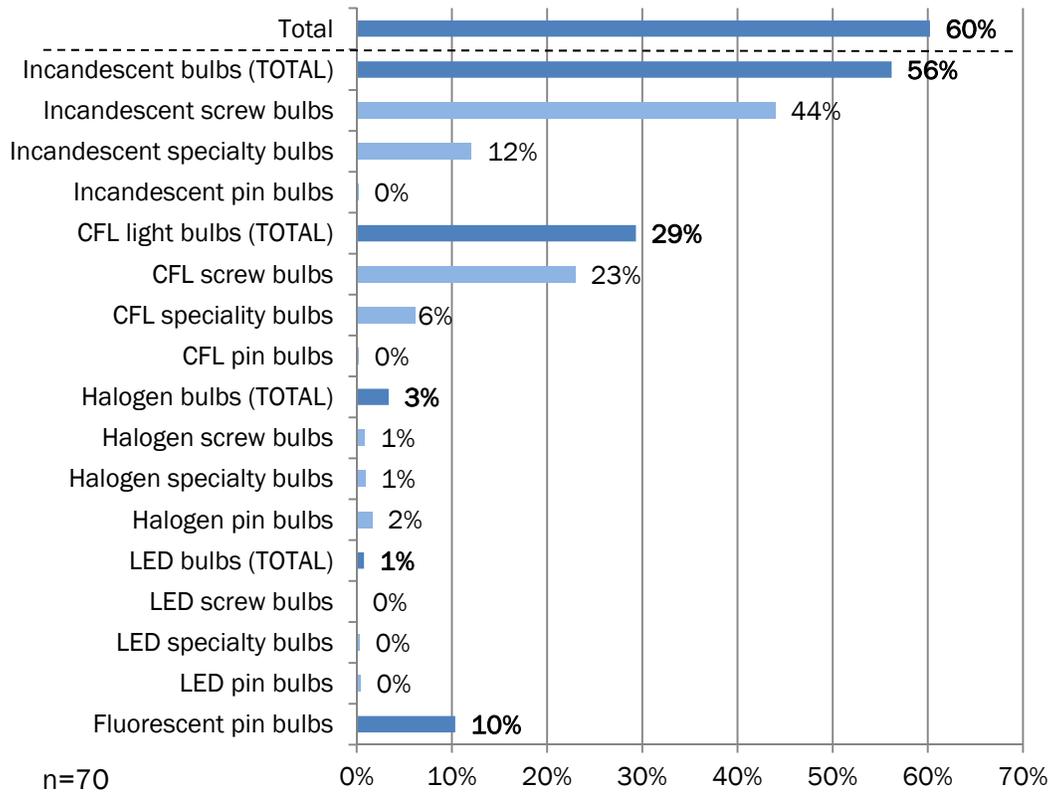
In an average home, 56% of all light bulbs are incandescent. The saturation rate of CFLs and fluorescent lights is much lower than incandescent bulbs at 29% and 10% of lights bulbs respectively. Three percent of bulbs in use are halogen while less than 1% are LED bulbs.

Figure 4-1: Lighting Penetration*



*Penetration is defined as the percentage of households that have at least one bulb of a particular type.

Figure 4-2: Lighting Saturation Rate*



*Saturation is defined as the percentage of total household bulbs that are a particular bulb type. The numbers reported here are the average household saturation rates.

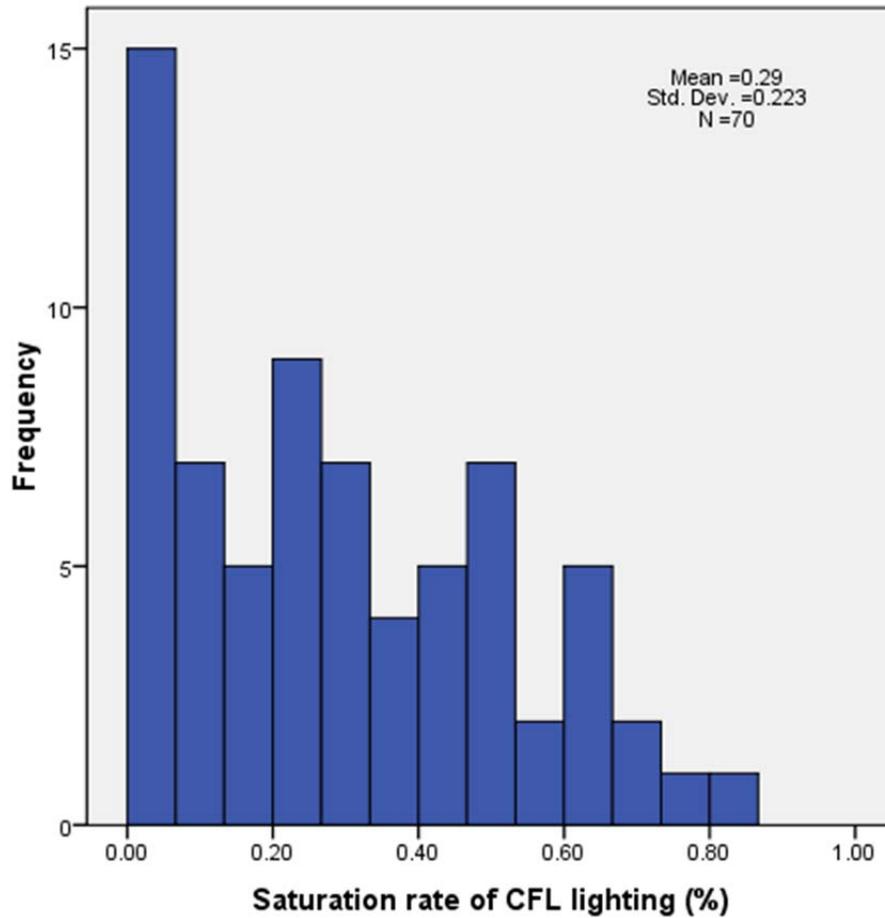
The average household surveyed in Delaware has 60 light bulbs in use of which 35 are incandescent, 16 are CFL bulbs, six are fluorescent pins, and two are halogen bulbs.

CFL Technology

The market for CFLs in Delaware is far from saturated, despite there being relatively substantial adoption of the technology in homes. While incandescent bulbs are the predominant type of lighting used in Delaware, comprising 56% of all light bulbs used in the average household, only a single household surveyed in our in-home visits only used incandescent bulbs. Overall, incandescent bulbs are the majority of bulbs in 60% of the visited households.

Figure 4-3 displays the saturation of CFLs in Delaware. Although 91% of households have at least one CFL in use, less than a third (29%) have more than a handful installed. Twenty percent of households use CFLs for a majority of their lighting needs. These households tend to be homes that owned, larger than 1,500 sq. feet, and occupied by elderly residents (60 years of age and over) with at least some college experience.

Figure 4-2: Saturation Rate of CFL Lighting



Penetration as well as saturation of CFL technology varies by residence type, as well as demographic characteristics of household residents. Table 4-1 presents the differences in penetration and saturation of CFL lighting technology among various customer subgroups.

Table 4-1: CFL Penetration and Saturation by Household Characteristics

	CFL Penetration	CFL Saturation
Total	91%	29%
Home Ownership		
Rent (n=9)	11%	32%
Own (n=61)	79%	29%
Home Size		
<1,500 sq. feet (n=9)	18%	33%
1,500+ sq. feet (n=42)	82%	35%
Education		
Less than a college degree (n=10)	14%	33%
College degree + (n=60)	86%	29%
Age		
<30 years old (n=4)	6%	27%
30-59 years old (n=39)	56%	29%
60+ years old (n=27)	39%	31%
Income		
<\$15,000 to \$30,000 (n=8)	13%	29%
\$30,000 to \$75,000 (n=21)	35%	28%
\$75,000 to \$150,000+ (n=31)	52%	26%
Number of people in household		
1 person in household (n=7)	10%	30%
2-3 people in household (n=44)	63%	31%
4+ people in household (n=19)	27%	25%

*Penetration is defined as the percentage of households that have at least one bulb of a particular type. Saturation is defined as the percentage of total household bulbs that are a particular bulb type. The numbers reported here are the average household saturation rates.

The types of bulb sockets and shapes varied across the homes visited in this study. Incandescent screw-based bulbs are installed in approximately two-thirds of sockets, while CFL screw-based bulbs are found in only a third of sockets. Halogen screw-based bulbs are only in 2% of sockets and LEDs are in less than 1%.

Table 4-2: Socket Type by Bulb Type

Bulb Type	Socket Types		
	Screw Bulbs	Specialty Bulbs	Pin Bulbs
Incandescent (n=70)	64%	59%	2%
CFL (n=64)	34%	35%	3%
Halogen (n=21)	2%	4%	11%
LED (n=9)	0%	0%	4%

Lighting Knowledge and Placement

While onsite data collection is the best way to verify the installation of CFL light bulbs, we also used the telephone survey of residential residents to collect this information. In particular, we asked residents with some knowledge of CFLs about the presence of this type of bulb in their home. As the findings below indicate, slightly fewer Delaware residents reported having CFLs when asked on the phone than we found during the in-home visits. Over three-quarters of survey respondents (84% compared to 91% onsite) report having at least one CFL installed in their home.

Based on the telephone survey, among those that have CFLs installed, the average number of CFL bulbs inside or outside of the home is 12.3. Residents with incomes above \$75,000 as well as residents living in homes with 2,000 sq. feet or more were significantly more likely to have more CFLs installed than their respective counterparts. On average, home owners have an average of 12.5 CFLs compared to 10.6 among renters. Further, those who make at least \$75,000 a year have an average of 15.1 CFLs installed while those making less than \$30,000 have 8.3 CFLs installed in their home.

We also asked residents about their awareness of LED bulbs. Three quarters of those surveyed (77%) reported having heard of using LED light bulbs as a replacement for standard light bulbs. Again, slightly more Delaware residents reporting having installed an LED light bulb when asked on the phone than we found during the in-home visits. In this case, just less than a third of survey respondents (31% compared to 13% onsite) report having at least one LED bulb in their home.

During in-home assessments, auditors also catalogued the number of light bulbs found in storage and in the exterior areas of the home. The majority of homes surveyed (77%) had light bulbs in storage. Nearly all light bulbs in storage were identified as screw-based bulbs (98%). On average, auditors found 7.3 CFL light bulbs in storage compared to 5.7 incandescent bulbs in storage.

Table 4-3: Number of CFLs Installed and In Storage

Quantity of CFLS	Installed	In Storage
None	9%	22%
1-2	10%	15%
3-5	6%	15%
6-10	17%	24%
11-15	19%	15%
16-20	13%	6%
21 or more	27%	4%
MEAN	16.47	7.28

As demonstrated in the table above, 22% of Delaware residents do not have any CFL bulbs in storage. Over a quarter of the homes visited (27%) had 21 or more CFL bulbs installed while only 4% had as many bulbs in storage. Residents who own their home have a larger number of CFL bulbs in storage (7.8 average) than renters (4.3 average). Overall, the

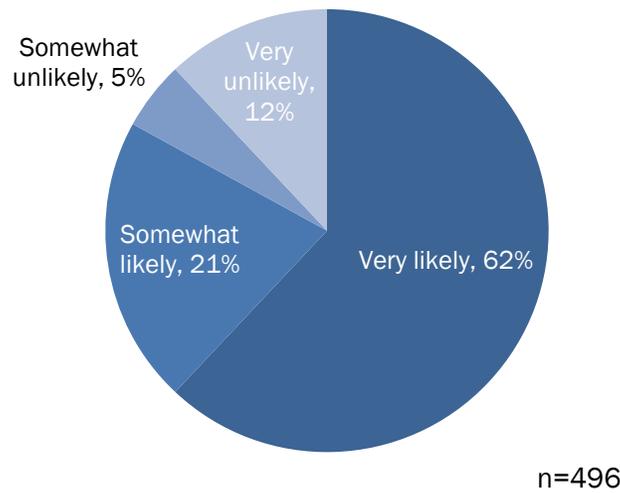
average Delaware resident has an average of 7.3 CFLs in storage to replace bulbs as they burn out.

Auditors also assessed exterior lighting. Only 68 homes out of the 70 visited possessed exterior lighting. Of homes with exterior lighting, penetration rates were higher for incandescent bulbs (73%) compared to CFL lighting (36%), halogen bulbs (20%), and LEDs (1%). Saturation rates for exterior lighting were also consistent with rates found for interior lighting. Here, saturation rates for incandescent bulbs were somewhat higher at 59%, while saturation rates for CFL bulbs were slightly lower at 26%.

CFL Purchase Potential

In terms of purchasing behavior, residents surveyed by telephone reported great interest in purchasing CFLs. Eighty-two percent of the residents surveyed by telephone reported they are either somewhat or very likely to purchase a CFL the next time they buy a light bulb.

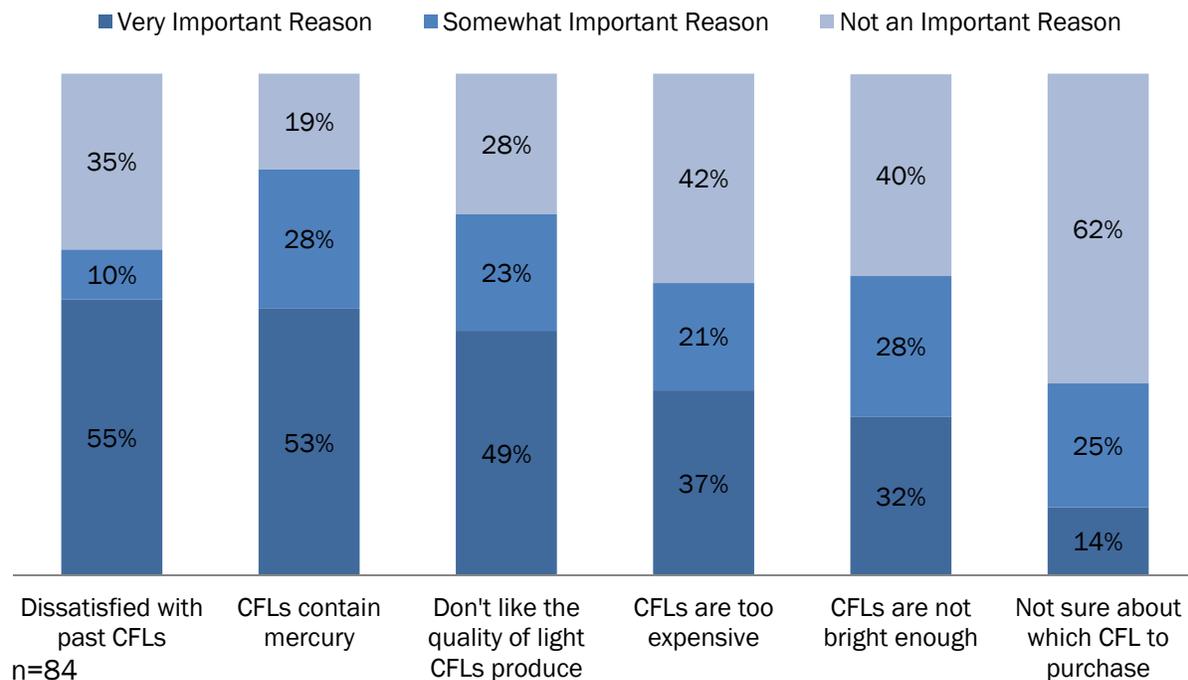
Figure 4-4: Likelihood to Purchase a CFL during Next Light Bulb Purchase (Phone)



Note: Don't know and refused responses are not included in this analysis.

Of those who reported being unlikely or very unlikely to purchase a CFL bulb, the most commonly reported reason (55%) was that the respondent was dissatisfied with past CFL purchases. Over half of the respondents surveyed (53%) were also concerned about mercury contained within CFLs.

Figure 4-5: Most Important Reasons for NOT Purchasing CFLs



When auditors asked residents about how many times per year that they replace light bulbs, nearly half (46%) reported engaging in bulb replacement once per year. Nearly all of the respondents surveyed by auditors during in-home visits (94%) reported plans to replace any incandescent light bulbs with CFLs.

Program Considerations

The baseline survey and in-home study results suggest that there is potential for savings from incentives on energy efficient lighting purchases. However, incentives should be provided along with consumer education so that customers are satisfied with their purchase and savings are long term. We recognize that the suggestion to consider incentives could, on the surface, appear to be in conflict with the finding that a high percentage of customers (82%) state that they are “somewhat” or “very” likely to purchase a CFL the next time they buy a light bulb (presumably in absence of an incentive). However, the suggestion is made in light of past research that demonstrates a weak relationship between environmental intentions and actual behavior (i.e., the majority of customer’s stated “intentions” do not translate into actual behavior)⁸. Therefore, we believe that incentives continue to be a viable option to consider when seeking to increase the purchase rate of energy efficient residential lighting options.

⁸ A number of such studies have shown correlation coefficients (intention to behavior) of less than 0.3. These studies include: 1) Barr, S. (2007). Factors influencing environmental attitudes and behaviors. *Environment and Behavior*, 39, 435-473; and 2) Soonthonsmai, V. (2001). Predicting intention and behavior to purchase environmentally sound or green products among Thai consumers: An Application of the theory of reasoned action (UMI No. 9315947).

Program designers should also keep in mind that the current environment for high efficiency lighting is in flux with new products introduced almost daily and unsettled product pricing. For programs to be cost effective in this environment, they will need to be flexible and have the ability to change program approach, product mixes and incentive levels throughout the year as necessary.

Program approaches should include investments in consumer education. Different lighting technologies do not perform equally well in all situations. Consumers are often confused about the best bulb for a given lighting situation. Bad experiences with prior CFLs remains a barrier to purchase with 50% of those not likely to purchase CFLs stating that bad past experience with CFLs has soured them on the product. Other barriers that will need to be addressed include mercury concerns (48%), and light quality (46%). The expense of CFLs is an important reason for just over one-third (35%).

In the future lighting programs may also want to consider taking a market lift approach, As the cost of products decrease and savings diminish (as a result of EISA or increased baseline efficiency) the ability to cost effectively increase the saturation of CFLS in this sector could potentially become a challenge. Market lift programs which provide upstream incentives to retailers/wholesalers/manufacturers, who increase their sales share of equipment above a pre-established baseline, may prove an effective means of capturing savings in the 56% of sockets that still contain incandescent lighting.

As EISA phases out traditional incandescent bulbs, consumers will have three main bulb options for standard screw-based sockets: CFLs, LEDs, and halogens. CFLs and LEDs are the most efficient and programs can still play a role in encouraging customers to choose these technologies over the new EISA-compliant but less efficient halogen bulbs. EISA does not affect specialty or pin-based bulbs so programs can also play a role in the continued spread of more efficient alternatives for these bulbs. Most importantly, the probable impact of EISA is one that continues to be highly debated across the energy-efficiency industry. Therefore, at a minimum, it will be important to track the impact on CFL stocking practices (among retailers) and purchases among customers. At this time, it appears save to say that many industry experts believe that utility or state sponsored lighting programs can continue to play a role in this market⁹.

Summary

Penetration of incandescent and CFL lighting is quite high regardless of the location of the bulb either within or outside the home. Saturation of CFL lighting was higher than expected, but could continue to grow. LED lighting was found less often and with less frequency than halogen or fluorescent pin bulbs. Table 4-4 shows the penetration and saturation rates for lighting.

⁹ EISA and Future Residential Lighting Programs. Laura Moorefield. For ENERGY STAR Lighting Partner Meeting, 2009.

The U.S. Replacement Lamp Market, 2010-2015, and the Impact of Federal Regulations on Energy Efficiency Lighting Programs. Seth Craigo-Snell. August 2010. [\(Is the footnote for this one missing? Or is ti part of the footnote 1?\)](#)

Table 4-4: Penetration and Saturation of Lighting

	Penetration	Saturation
Home Lighting		
All Incandescents	100%	56%
<i>Screw-based Incandescents</i>	100%	44%
<i>Specialty-based Incandescents</i>	56%	12%
<i>Pin-based Incandescents</i>	1%	0%
All CFLs	91%	29%
<i>Screw-based CFLs</i>	89%	23%
<i>Specialty-based CFLs</i>	47%	6%
<i>Pin-based CFLs</i>	7%	0%
All Halogens	30%	3%
<i>Screw-based Halogens</i>	9%	1%
<i>Specialty-based Halogens</i>	10%	1%
<i>Pin-based Halogens</i>	20%	2%
All LEDs	13%	1%
<i>Screw-based LEDs</i>	1%	0%
<i>Specialty-based LEDs</i>	3%	0%
<i>Pin-based LEDs</i>	10%	0%
All Fluorescent Pins	77%	10%
Exterior Lighting		
All Incandescents	73%	59%
<i>Screw-based Incandescents</i>	66%	50%
<i>Specialty-based Incandescents</i>	13%	8%
<i>Pin-based Incandescents</i>	0%	0%
All CFLs	36%	26%
<i>Screw-based CFLs</i>	31%	22%
<i>Specialty-based CFLs</i>	4%	4%
<i>Pin-based CFLs</i>	0%	0%
All Halogens	20%	11%
<i>Screw-based Halogens</i>	3%	2%
<i>Specialty-based Halogens</i>	10%	5%
<i>Pin-based Halogens</i>	7%	4%
All LEDs	1%	1%
<i>Screw-based LEDs</i>	0%	0%
<i>Specialty-based LEDs</i>	1%	1%
<i>Pin-based LEDs</i>	0%	0%
All Fluorescent Pins	0%	0%

	Penetration	Saturation
Home Lighting		
Storage Lighting		
Screw-based Incandescents	49%	9%
Screw-based CFLs	60%	9%
Specialty-based CFLs	1%	1%
Screw-based LEDs	1%	3%
Screw-based Halogens	13%	4%
Fluorescent Pins	1%	10%

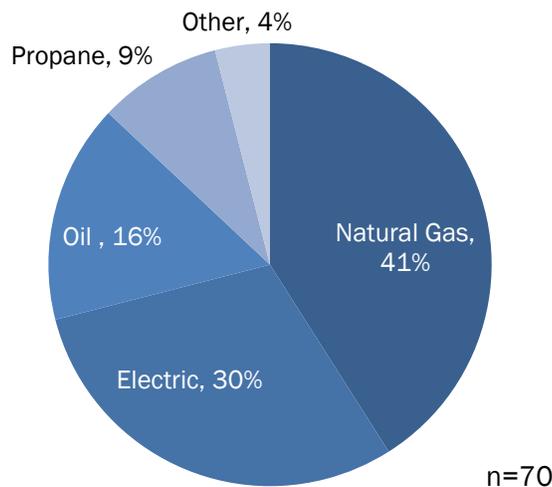
4.2 Space Heating and Cooling

Space Heating

All homes surveyed in Delaware have a space heating system. Of the households where the heating fuel could be identified, most primary heating systems (41%) are heated with natural gas.

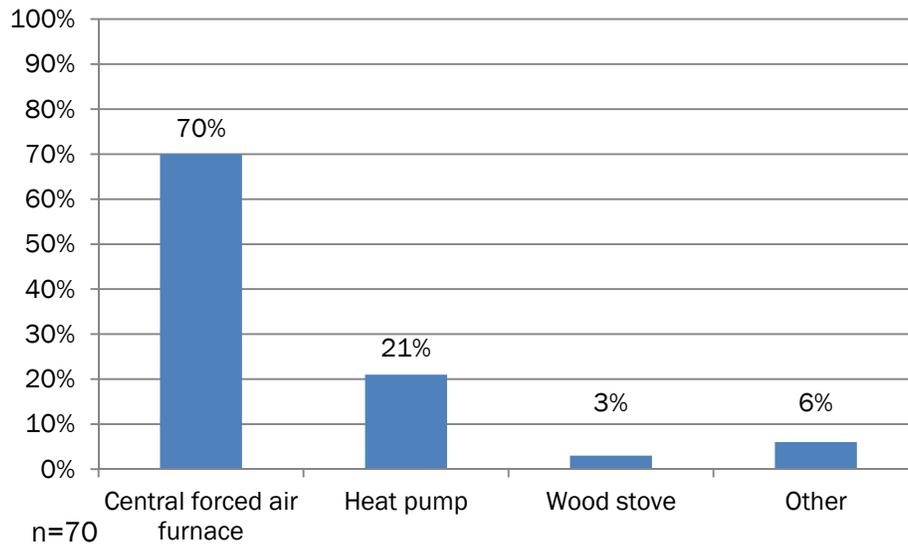
Households in Delaware use a variety of other fuel types. Nearly a third (30%) use electric heat, 16% of homes are heated primarily by oil, and another 9% use propane.

Figure 4-6: Primary Heating System Source



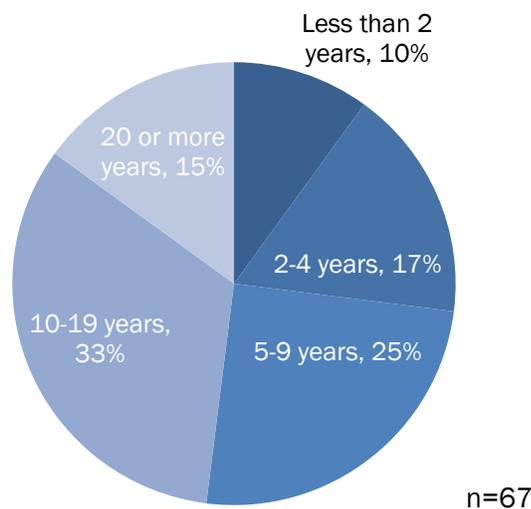
Central forced air furnaces are the most prevalent type of primary heating systems in Delaware (70%). Twenty-one percent of homes use heat pump, 3% use a wood stove, and 6% use another heating system, like a hot water or steam boiler, electric baseboards, or geothermal heat pump.

Figure 4-7: Types of Primary Heating Systems



The average age of the system was 11 years. Of the primary heating systems for which the age could be determined, two-thirds (63%) are less than ten years old, 22% are between 10 and 19 years old, and 15% are 20 years and older.

Figure 4-8: Age of All Primary Heating Systems



Over half (58%) of the homes surveyed in this study did not have a maintenance contract on their central heating unit.

Auditors could not assess the efficiency levels of the majority of primary heating systems (90%). One common occurrence is that auditors do not have access to the unit at close enough proximity to confirm the efficiency level. Additionally, some systems likely did not have the efficiency level information indicated on the unit. Of the primary heating systems for which the efficiency levels could be determined, only three are efficient, with Annual Fuel

Utilization Efficiency (AFUE) of 91% and over, and four are inefficient systems (less than 80% AFUE).

Only ten percent of the homes visited possessed electric space heaters, which could have resulted from the period of time in which the study was conducted within Delaware homes. Among those interviewed by phone, 37% reported owning an electric space heater and the saturation rate was 56%.

In nearly all of the homes (94%) visited, auditors found thermostats. Over half (53%) of the thermostats were programmable and of that group 84% were set. All of the assessed thermostats had some type of programming controls. The most common control type including both heating and cooling options (57%), while 21% featured heating, cooling, and fan control options.

Cooling

The majority of homes visited with a cooling system (73%) have a central air conditioning (CAC) system. CAC systems are more common in homes that are owned and homes where residents report household incomes above \$75,000.

Fourteen percent of households visited had a secondary cooling system. More than eight in ten households (86%) visited had at least one ceiling fan. The average number of ceiling fans per household is 4.3.

Over half of CAC systems (64%) are ten years or older in age. Forty percent are less than five years old and 28% of systems are five to nine years old. The average age of a CAC system is 9 years. Over half of the homes (54%) audited do not have maintenance contracts for their CAC system.

Largely as a result of the timing of the study, auditors were unable to determine the number of room air conditioners in use among homes visited in Delaware. Of those interviewed by phone, the penetration rate of room air conditioning units was 23%, while the saturation rate was 48%.

Contractor Surveys

In addition to survey data and in-home assessments, 12 HVAC contractors who participated in the Home Performance with ENERGY STAR program were interviewed¹⁰. The purpose of the interviews, which were highly qualitative, was to assess the degree to which energy-efficient HVAC equipment might already be selling in the Delaware market. This information is particularly relevant when planning future rebate programs as these programs typically seek to influence customers—at the time they have already decided to replace their HVAC equipment—to upgrade to higher efficiency equipment. Therefore, the baseline against which to design program rebate levels (and ultimately judge the success of such efforts) is not what is currently installed in most homes or the minimum federal efficiency standard. Rather, it is the efficiency level of equipment that is currently selling in the marketplace

¹⁰ These contractors were drawn from the rebate-only portion of the program database. Prior to selecting the sample, all contractors who appeared to be BPI certified were removed from the database in an attempt to identify and then call contractors who only had involvement with equipment installations.

which is often already above federal minimum standards (and well above what is currently installed in most homes).

Because the data is highly qualitative, it should only be construed as indicative of a potentially robust market for energy-efficient HVAC equipment across Delaware. While the information is from a small subset of contractors who had some involvement with the program, their collective program-related (i.e., rebated) sales were a small fraction of their overall sales (i.e., about 7% of furnaces and 3% of central air conditioners sold by these contractors appear to have received a rebate¹¹). This means that the program is unlikely to be the primary influence on their sales splits by efficiency level. Nevertheless, this is both a small number of contractors and a group that was exposed to the program. And, therefore, the results need to be viewed cautiously. At best, they indicate that further investigation of current sales splits by efficiency level should be undertaken before any HVAC-related rebate program is offered in the future.

As indicated in the table below, the contractors we interviewed noted that nearly all of their forced air furnace sales are high efficiency units (i.e., condensing units with AFUE ratings of 90% or higher), with almost 70% falling in the 92 to 94.9% efficiency range. If this information were found to be representative of the entire Delaware market, the obvious implication is that a program—designed to spur further efficiency at the time that customers decide to replace their furnaces—would likely suffer from very high levels of freeridership.

Table 4-5: 2011 Furnace Sales by Efficiency Level (n = 12)

Efficiency Level (AFUE*)	Total Sales	
	Units	Percent
Less than 90% AFUE	73	4%
90 to less than 92% AFUE	48	2%
92 to less than 95% AFUE	1,270	69%
95% AFUE and higher	460	25%
Total	1,851	100%

*AFUE = Annual Fuel Utilization Efficiency

Similar to forced air furnaces, the contractors we interviewed indicated that the vast majority of their central air conditioning sales (74%) are at least SEER 15 or higher. Like furnaces, the implication is that central air conditioning rebates may not be—should these data be found to be representative of sales across Delaware—a cost-effective program offering.

¹¹ We cannot be completely sure of these percentages because after the rebate-only portion of the program ended, only the BPI certified contractor who worked on a given home was recorded in the program database. Therefore, these HVAC contractors may have continued to install equipment through the program, but not have their name associated with individual customer records.

Table 4-6: 2011 Central Air Conditioning Sales by Efficiency Level (n=12)

Efficiency Level (SEER*)	Total Sales	
	Units	Percent
13 to 14.9 SEER	431	26%
15 to 15.9 SEER	642	40%
16 SEER or higher	551	34%
Total	1,624	100%

*SEER = Seasonal Energy Efficiency Rating

Similar to forced air furnaces and central air conditioners, the contractors we interviewed indicated that the vast majority of their heat pump sales (69%) are at least SEER 15 or higher. However, unlike furnaces and central air conditioning, these contractors' rebated sales represented nearly 25% of their annual sales. Thus, the potential for the program to have influenced the results illustrated in the table below are considerably higher. Nevertheless, it would appear to be prudent to further investigate this issue before resurrecting a rebate program dedicated to this technology.

Table 4-7: 2011 Heat Pump Sales by Efficiency Level (n=12)

Efficiency Level (SEER, EER, HSPF)*	Total Sales	
	Units	Percent
<14 SEER, 12 EER, 8.2 HSPF	15	2%
Up to 15 SEER, 12.5 EER, 8.5 HSPF	185	29%
Up to 16 SEER, 13 EER, 8.5 HSPF	210	32%
16 SEER+, 13 EER, 8.5 HSPF	238	37%
Total	648	100%

*SEER = Seasonal Energy Efficiency Rating

*EER = Energy Efficiency Ratio

*HSPF = Heating Seasonal Performance Indicator

It should be noted that these findings are not that unusual. We know, for example, that the market for high efficiency HVAC equipment, in various Midwest states¹², has grown

¹² In 2008, for example, the market share of high efficiency furnaces (i.e., condensing furnaces with AFUE ratings of 90% or higher) in Illinois, Michigan, and Ohio ranged from 52 to 73 percent with volumes of high efficiency central air conditioners sold exceeding 65,000 units. Source: Higher Savings Goals and the Rebate/buy-Down Elephant in the Room: Recognizing When and How to Move on to Market Lift. 2010 ACEEE

considerably over the last 5+years. Despite these improvements, overall home energy use continues to rise, primarily due to the increased use of consumer electronics (e.g., cell phone chargers, video game systems, etc.) and more devices per home (e.g., multiple refrigerators, televisions, etc.).

Program Considerations

With respect to HVAC-related energy use, the implication as they relate to program approaches in Delaware, appears to be that the primary issue is not delivering energy-efficient treated air (be it cooling or heating) to the home. Rather, based on the findings outlined in section 4.7 emphasis should be placed on keeping that treated air in the home once delivered by reducing air leaks, infiltration, and heat transfer through un-insulated or under-insulated walls and attics. This implies that programs, such as Home Performance with ENERGY STAR, that tend to take a comprehensive view of a home—with an emphasis on shell measures and other home improvements—hold more promise for delivering energy savings in Delaware than do standard HVAC incentive programs.

Because of the high saturation of high efficiency furnaces and central air conditioners, future programs should consider including equipment with advanced energy saving technologies like Electronically Commutated Magnetic Motors (ECM) which are high efficiency brushless DC motors that use a magnet rotor to maintaining a high level of efficiency at all speeds. ECM motors are not currently standard components of all high efficiency HVAC equipment although some manufacturers are starting to include them as standard in the highest efficiency levels. Focus on these types of technologies in future programs can limit the risk of free-ridership that is often seen in HVAC programming in states with high adoption of high efficiency equipment, such as Delaware where 94% of units in homes are already 92 AFUE or higher units.

Based on the contractor surveys we completed, it also appears that Delawareans generally purchase more efficient air conditioners, (74% purchasing 15 or higher SEER units). Given this caution should also be taken when considering CAC programs. Generally, in states with cooler climates, the cooling load hours limit the cost effectiveness of CAC rebate programs, this may be exacerbated by the high percentage of customers who seem to already be making the more efficient choice when it comes to home cooling.

Summary

As expected, penetration of home heating and cooling equipment is fairly high across items addressed in this section. Every home audited possessed a heating system with the most common type being fueled by natural gas (41%). Nearly three-quarters of the homes visited used a central forced air furnace. A majority of homes (73%) audited had central air conditioning systems. Less than half of the visited held maintenance contracts for either their heating system (42%) or central air conditioning system (46%). Most homes (94%) visited owned a thermostat and roughly half (53%) were programmable. Table 4-12 shows the penetration and saturation rates for all HVAC equipment pieces featured in this section.

Table 4-8: Penetration and Saturation of HVAC Equipment

		Penetration	Saturation
Heating System*			
Source: Natural Gas (n=29)	41%	100%	100%
Source: Electric (n=21)	30%		
Type: Central forced air furnace (n=49)	70%		
Type: Heat pump (n=15)	21%		
Age in years (n=67)	11		
Maintenance Contract? (n=66)	42%		
Space Heater**			
	-	37%	56%
Central Air Conditioning System			
Age in years (n=53)	9	73%	81%
Maintenance Contract? (n=56)	46%		
Room Air Conditioning **			
	-	23%	48%
Ceiling Fan			
	-	86%	366%
Thermostat			
Programmable? (n=85)	53%	94%	121%
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average age for central heating units is 11 years and 9 years for central air conditioning units. ** Taken from Phone Survey results.			

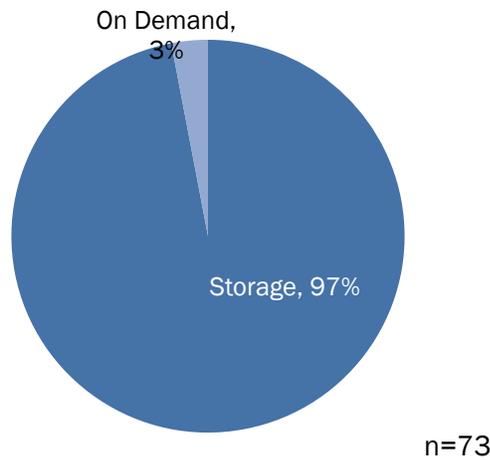
4.3 Water Heating and Related Efficiency Measures

The following sections present findings related to the assessed characteristics of water heating equipment and efficiency measures of households within the state of Delaware.

Not surprisingly, all Delawareans have a water heater in their home. Additionally, auditors found seven percent of households in Delaware have an additional water heating system. Larger homes of more than 2,000 square feet are more likely to have a secondary water

heating system than smaller homes. Furthermore, nearly all water heating systems in Delaware have stand-alone storage tanks (97%).

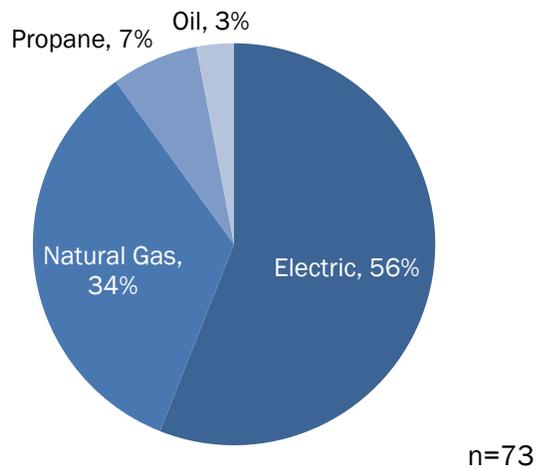
Figure 4-9: Water Heater Type



Water Heating System Type

Electricity is most commonly used to fuel water heating systems (56%), followed by natural gas (34%).

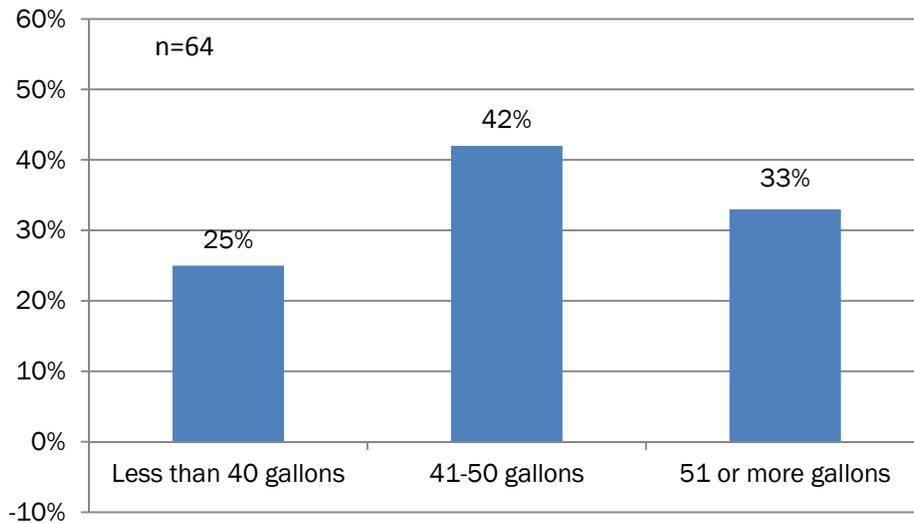
Figure 4-3: Water Heater Fuel Type



Water Heating System Characteristics

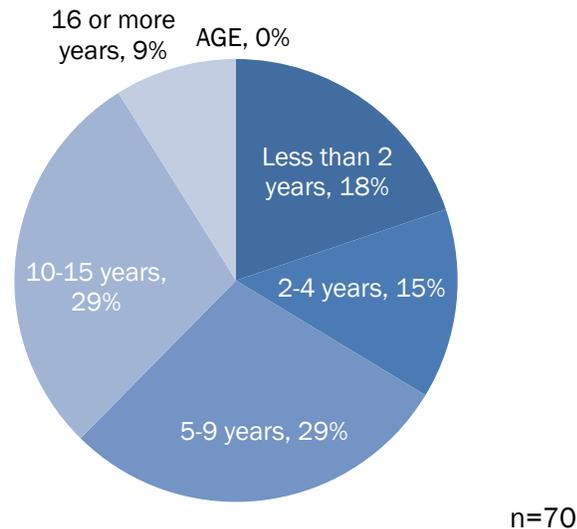
The majority of water heaters (42%) hold between 41-50 gallons of water. The average water heater capacity is 53 gallons.

Figure 4-11: Capacity of Water Heaters



Among those water heaters where age could be assessed, the majority of water heaters (58%) are between 5-15 years old and the mean age is 7.7 years.

Figure 4-4: Age of Primary Water Heater



The bulk of water heaters (85%) assessed were determined to be ENERGY STAR qualified. In terms of other associated efficiency measures for home water heaters, very few water heaters were found to have tank wrap (12%). A third (32%) of the water heaters assessed by auditors were found to have insulated piping. Of those with insulated pipes, the average length of insulation was 31 inches.

Incidence of Energy Efficiency Measures

Compared to water heating energy efficiency measures, water conservation measures are more common throughout Delaware. Among the households that could be assessed, 70% have faucet aerators, and 81% of homes have low-flow showerheads. The mean number of installed aerators and low-flow showerheads are 1.2 and 1.0, respectively.

Program Considerations

Delaware has a higher than average penetration of electric water heaters (with the rest of the region averaging 18%¹³ compared to the 56% found in Delaware). A relatively low percentage of these units had pipe insulation and tank wrap. Across the nation, there are a plethora of walk through audit programs that include the direct installation of low flow water savings devices. The high penetration of electric water heaters provides opportunity for energy savings associated with reduced water usage, however the penetration of low flow devices in Delaware may limit options for these types of direct install offerings. Programs that address water heater temperature settings, tank and pipe insulation and high efficiency heat pump water heaters should be explored in Delaware. Where natural gas service is available, fuel switching programs that encourage conversion from electricity to natural gas may be an option.

Summary

As expected, penetration of home water heaters is quite high across all items addressed in this section. The results presented here also show a marked movement towards the use of other water efficiency measures like faucet aerators. While there is a slight lag in adoption of low-flow showerheads compared to faucet aerators, 81% of the homes visited in this study had a low-flow showerhead. Table 4-9 shows the penetration and saturation rates for water heaters, faucets, and showerheads.

¹³ From the 2005 Residential Energy Consumption Survey (RECS) for Mid Atlantic: (http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/hc8waterheating/pdf/tablehc11.8.pdf)

Table 4-9: Penetration and Saturation of Water Heater and Related Equipment

		Penetration	Saturation
Water Heater*			
Type: Storage (n=71)	97%	100%	113%
Type: On Demand (n=2)	3%		
Source: Electric (n=41)	56%		
Source: Natural Gas (n=25)	34%		
Size in Gallons (n=64)	53		
Age in years (n=70)	8		
ENERGY STAR (n=66)	85%		
Insulated Pipes (n=71)	33%		
Tank Wrap (n=69)	12%		
All Faucets			
Average (n=247)	1.13	100%	353%
Faucets with Aerators			
Average (n=169)	1.15	70%	241%
All Showerheads			
Average (n=132)	1.03	100%	189%
Low-Flow Showerheads			
Average (n=98)	1.02	81%	140%
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age is 8 years.			

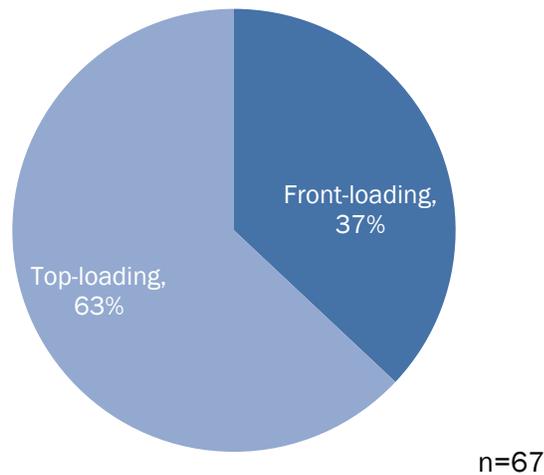
4.4 Laundry Equipment

The penetration of clothes washers and dryers in Delaware is very high. Ninety six percent of residents have a washer and a dryer. Almost none (1%) of the washers and dryers owned by Delawareans are combination units. Not surprisingly, residents with higher incomes are more likely to own a washer or a dryer.

Clothes Washers

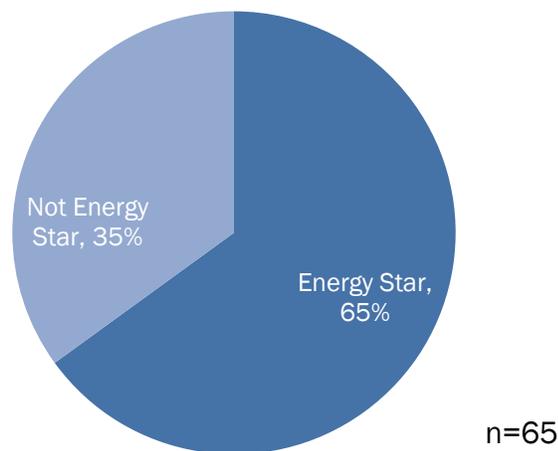
Top loading washers are more prevalent (63%) than front loading washers (37%). The average age of clothes washers in operation was 6 years.

Figure 4-13: Distribution of Top-Loading and Front-Loading Clothes Washers



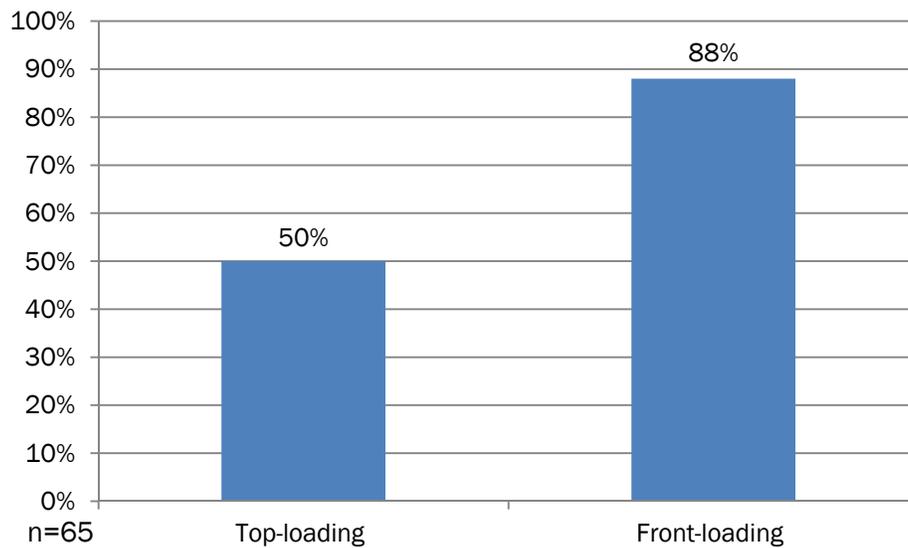
To get the most accurate estimate possible, auditors did not ask residents if their appliances were ENERGY STAR qualified appliances. Rather, the presence of such an appliance was determined based on the auditors' ability to visually detect the label and/or a manual showing the ENERGY STAR label.

Figure 4-14: Penetration of ENERGY STAR Clothes Washers



Most (65%) of the clothes washers in operation were identified as ENERGY STAR qualified appliances. Notably, the vast majority (88%) of front-loading clothes washers were identified as ENERGY STAR qualified, while about half of the top-loading washers were ENERGY STAR qualified.

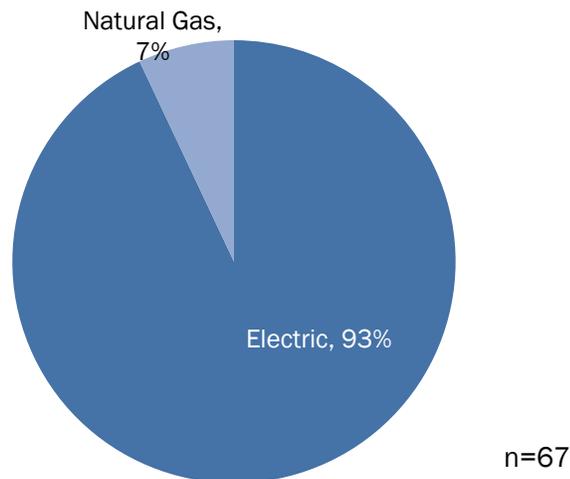
Figure 4-15: ENERGY STAR Ratings by Clothes Washer Type



Clothes Dryers

Ninety-six percent of households in Delaware have clothes dryers installed for their private use only. Among these households, 7% use natural gas to power a clothes dryer while 93% use electricity.

Figure 4-16: Fuel Type for Private Dryers



Program Considerations

Given the high penetration of ENERGY STAR washers and low savings available for clothes dryers there does not appear to be opportunity for laundry equipment rebate programs in Delaware. This is in line with what we see across most of the country, where high market

shares for ENERGY STAR washers make it difficult to cost effectively support standard rebate programs for these technologies.

Summary

As expected, penetration of clothes washers and dryers are high across Delaware. Auditors found clothes washers and dryers in 96% of Delaware households. The majority of clothes washers are top-loading (63%) and were recognized as ENERGY STAR qualified appliances (65%). Among front-loading washers, 88% were recognized as ENERGY STAR qualified appliances. Table 4-10 shows the penetration and saturation rates for clothes washers and dryers.

Table 4-10: Penetration and Saturation of Clothes Washers and Dryers

		Penetration	Saturation
Clothes Washer*			
Type: Front-loading (n=25)	37%	96%	96%
Type: Top-loading (n=42)	63%		
Age (n=64)	6 years		
ENERGY STAR (n=65)	65%		
Clothes Dryer			
Fuel Type: Electric (n=62)	93%	96%	96%
Fuel Type: Natural Gas (n=5)	7%		
*Unless noted as a percentage, all descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age of clothes washers is 6 years.			

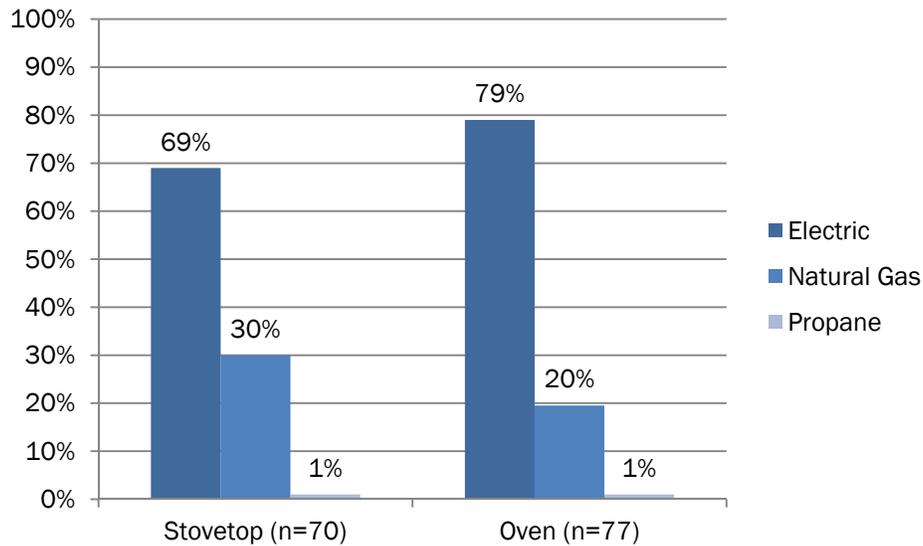
4.5 Kitchen Equipment and Food Storage

Cooking Appliances

Not surprisingly, nearly all households visited in Delaware have an oven and a stove.¹⁴ Electricity is the more common fuel type for both ovens (79%) and stoves (69%). The bulk (70%) of the homes visited possessed combination units, those with both a stove and an oven.

¹⁴ No distinction was made between stand-alone stovetops and ranges (ex. an appliance that has both a stovetop and range).

Figure 4-17: Stove and Oven by Fuel Type



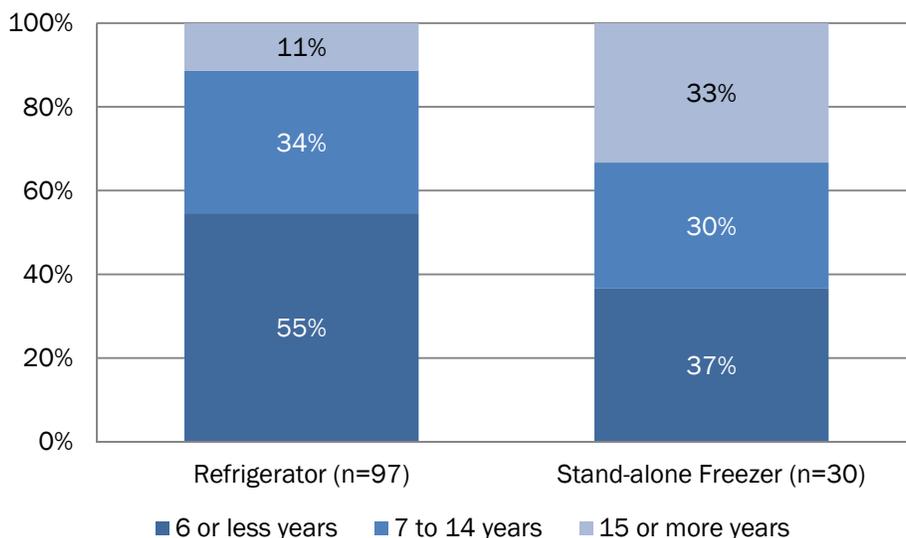
Refrigerators and Freezers

Virtually all homes audited have at least one refrigerator in operation. Among this group, thirty-three percent have two units and an additional 6% use three refrigerators. Residents living in homes with less than 1,500 square feet had only one refrigerator.

Only 47% of households audited own a stand-alone freezer. Among this group, less than a percent had more than one stand-alone freezer. Not surprisingly, larger residences, such as 1,500 sq. feet and over, tend to have a freezer and multiple refrigerators.

Typically, it can be difficult for auditors to assess the age of certain kitchen appliances. Nevertheless, auditors were able to confirm the age of 97% of refrigerators and 91% of stand-alone freezers. Stand-alone freezers tended to be older with the average age of a unit being eleven years, while the average age of refrigerators was seven years. Forty-five percent of refrigerators were no more than fourteen years old. Conversely, 37% of stand-alone freezers were at least 15 years of age or more.

Figure 4-18: Age of Primary Refrigerator and Stand-Alone Freezer



The average capacity in cubic feet of refrigerators was 21. Stand-alone freezers were somewhat smaller with an average capacity in cubic feet of 14.

Auditors found that a third of refrigerators (32%) and two-thirds of stand-alone freezers (61%) did not have an ENERGY STAR label. As previously mentioned, the presence of ENERGY STAR appliances was based on auditors’ ability to visually detect the label and/or a manual showing the ENERGY STAR label. Homeowners were not asked directly about the presence of ENERGY STAR appliances as it is often difficult to accurately recall this information.

Other Kitchen Appliances

The penetration of dishwashers are also fairly high. Dishwashers were found by auditors in 90% of visited homes. Overall, home owners are more likely to have a dishwasher than those who rent. Additionally, residents of larger homes, such as 1,500 sq. feet and over, are more likely than their counterparts to have a dishwasher.

To get the most accurate estimate possible, auditors did not ask homeowners about the presence of ENERGY STAR appliances. Rather, the presence of such an appliance was determined based on auditors’ ability to visually detect the label and/or a manual showing the ENERGY STAR label. Using this rule, auditors found that 68% of the dishwashers assessed in this study were ENERGY STAR qualified. Of the assessed dishwashers, two-thirds are six years old or less (65%), with the average age of a dishwasher at 7 years.

Program Considerations

As mentioned above in the laundry discussion, ENERGY STAR qualified appliances have a high market share nationally and in Delaware. Because of this, it would be ill advised to include rebate programs for these technologies in energy efficiency portfolios. Further,

products like ENERGY STAR qualified refrigerators and freezers provide very little energy savings when compared to their non-qualified counterparts.

There is a fairly high saturation of refrigerators in Delaware (143%) suggesting that many homes have a second operating unit being used for ancillary food storage. Refrigerator and freezer recycling programs can provide significant energy savings if they are able to reduce the net number of refrigerators in participant homes (i.e. a home goes from having 2 operating units to 1). The challenge with this is that programs often find it difficult to remove only those units that were not likely to be removed in absence of programming.

Summary

As expected, penetration of kitchen equipment and storage items is quite high across all items addressed in this section. Nearly all homes visited possessed a refrigerator and a third (33%) of this group owned at least two refrigerators. The majority (68%) of assessed refrigerators were ENERGY STAR qualified, while only a third (39%) stand-alone freezers were identified as more efficient models. All homes surveyed owned stove tops and the bulk (97%) owned ovens. The majority of both stove tops (69%) and ovens (79%) were powered by electricity. Most homes audited (90%) owned a dishwasher and of homes with this appliance, 68% were ENERGY STAR qualified. Table 4-11 shows the penetration and saturation rates for refrigerators, stand-alone freezers, stoves, ovens, and dishwashers.

Table 4-11: Penetration and Saturation of Kitchen Equipment and Storage Items

		Penetration	Saturation
Refrigerator*			
Type: Top Freezer (n=41)	41%	99%	143%
Type: Side by Side (n=39)	39%		
Type: Stand-alone Refrigerator, no freezer (n=10)	10%		
Type: Bottom Freezer (n=7)	7%		
Type: Other (n=3)	3%		
Capacity in Cubic Feet (n=55)	21		
Age in years (n=97)	7		
ENERGY STAR (n=95)	68%		
Stand Alone Freezer			
Type: Upright (n=19)	58%	47%	47%
Type: Chest (n=14)	42%		
Capacity in Cubic Feet (n=11)	14		
Age in years (n=30)	11		
ENERGY STAR (n=33)	39%		
Stove Top			
Fuel Type: Electric (n=48)	69%	100%	100%
Fuel Type: Natural Gas (n=21)	30%		

		Penetration	Saturation
Oven			
Fuel Type: Electric (n=61)	79%	97%	110%
Fuel Type: Natural Gas (n=15)	20%		
Combo Units (n=77)	70%		
Dishwasher			
Type: Front-down panel door (n=63)	100%	90%	90%
Age in years (n=60)	7		
ENERGY STAR (n=59)	68%		
*All descriptive characteristics of each home appliance or piece of equipment represents the average for that aspect of the appliance. For example, the average unit age of refrigerators is 7.			

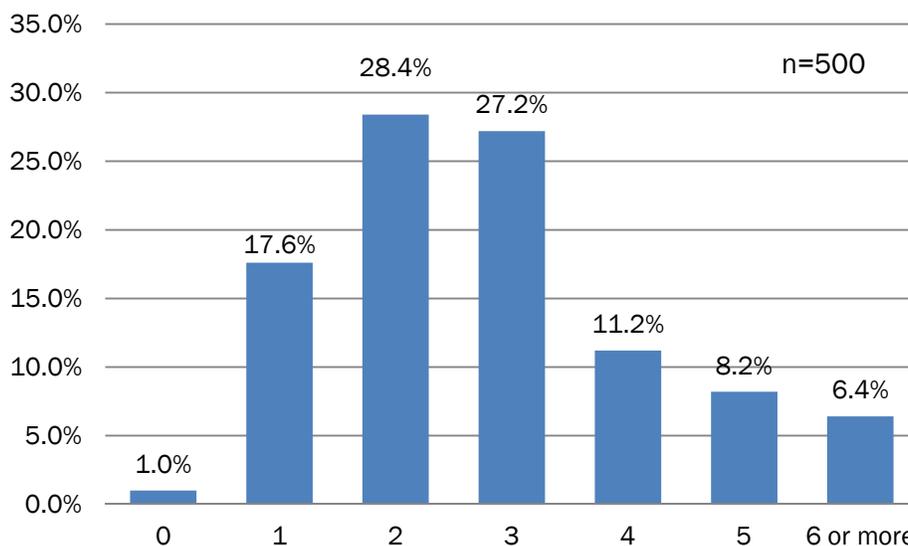
4.6 Consumer Electronics

The following section presents findings related to consumer electronics found in the homes of Delaware residents.

Televisions

Virtually all households (99%) in the state of Delaware have at least one television. A large percentage of residents (74%) have between one and three televisions. The mean number of televisions per household is 2.9.

Figure 4-19: Total Number of TVs per Household



Renters (26%) and homes less than 1,500 square feet (30%) are significantly more likely to have only one television compared to homeowners and those with larger homes.

Higher income levels also translate into more plugged in televisions with 35% those reporting incomes of \$75,000 or more claiming to possess four or more televisions compared to only 15% of those with incomes under \$30,000.

Set-Top Boxes (Cable Boxes and TV Digital Recorders)

On average, Delawareans have 2.4 set-top boxes per home. Set-top boxes are present in 91% of homes.

Low income Delaware residents, those with reported income under \$30,000, are more likely to have only one set-top box (52%) compared those in higher income brackets (24%). In fact, higher income brackets, where residents reported income over \$75,000, were almost twice as likely to possess three or more set-top boxes (40%) compared to those reporting income under \$30,000 (22%).

Computers

Ninety-one percent of Delawareans have a computer in their home. In total, the average number of computers among homes with computers is 3.0. The type of home computer did not vary significantly with 68% of homes with a computer reporting owning a desktop computer and 69% of homes with a computer reporting owning a lap top computer.

As expected, the mean number of computers per household is influenced by education and income. On average, households that are above the low income threshold and have some college level experience tend to report having more computers present in the home. Surprisingly, homeownership did not have a significant effect on the number of household computers. Table 4-12 shows the mean number of computers by these demographic categories.

Table 4-12: Mean Number of Computers by Household Characteristics

Demographics	Mean Number of Desktop Computers	Mean Number of Lap Top Computers	Mean Number of All Computers
Overall (n=500)	1.2	1.7	3.0
Education			
Less than college	1.2	1.6	2.9
College or higher	1.3	1.8	3.0
Home Ownership			
Own	1.2	1.7	3.0
Rent	1.2	1.7	3.0
Income			
Low income	1.0	1.4	2.4
Middle income	1.3	1.6	3.1
High income	1.3	1.9	3.1

Video Game Systems

Fifty-two percent of households in Delaware have video game systems. While nearly two-thirds (60%) of these homes have one system, 25% of these residents have two. Overall, the average number of video game systems for all homes is 1.7.

As expected, the penetration of video game systems is higher in households with children (81%) than those without (43%). Residents with large homes (more than 2,500 square feet, 62%) are more likely to have at least one system than those with smaller residences (49%).

Program Considerations

The penetration of consumer electronics is high in Delaware homes and the fast moving market for these products indicates that usage in this area will continue to increase. These two factors suggest there is opportunity to improve efficiency in this area of home energy use. The challenge with consumer electronics is the relatively low savings per measure and the hassle factor consumers associate with unplugging and/or managing their “plugged in” items.

Traditional rebate approaches are unlikely to serve this market, products are low cost and the savings when compared to the potential cost of programs of this nature limit the ability to cost effectively deliver rebates in this sector. Market lift programs which provide upstream incentives to retailers/wholesalers/manufacturers, that increase their sales share of equipment above a pre-established baseline, may prove an effective means of capturing consumer electronics savings.

Behavioral programming continues to evolve and may provide options for addressing this area through education, feedback and continuous reinforcement for behaviors that reduce overall energy consumption in the home. Home energy management devices like advanced power strips, whole house controls and smart or green switches may also help address these issues over time.

Summary

As expected, penetration of consumer electronics is quite high across all items addressed in this section. Televisions are by far the most common consumer electronic device owned by Delawareans with 99% of households reporting ownership. Computers are also fairly common with 91% of households reporting ownership of either a desktop or laptop computer; however, saturation of laptop computers is quite a bit higher (119%) than desktop computers (85%). Table 4-13 shows the penetration and saturation rates for all consumer electronics featured in this section.

Table 4-13: Penetration and Saturation of Consumer Electronics

	Penetration	Saturation
Consumer Electronics		
Televisions	99%	289%
Set-Top Boxes	91%	216%
Desktop Computers	69%	85%
Laptop Computers	69%	119%
All Computers	91%	140%
Game Consoles	52%	88%

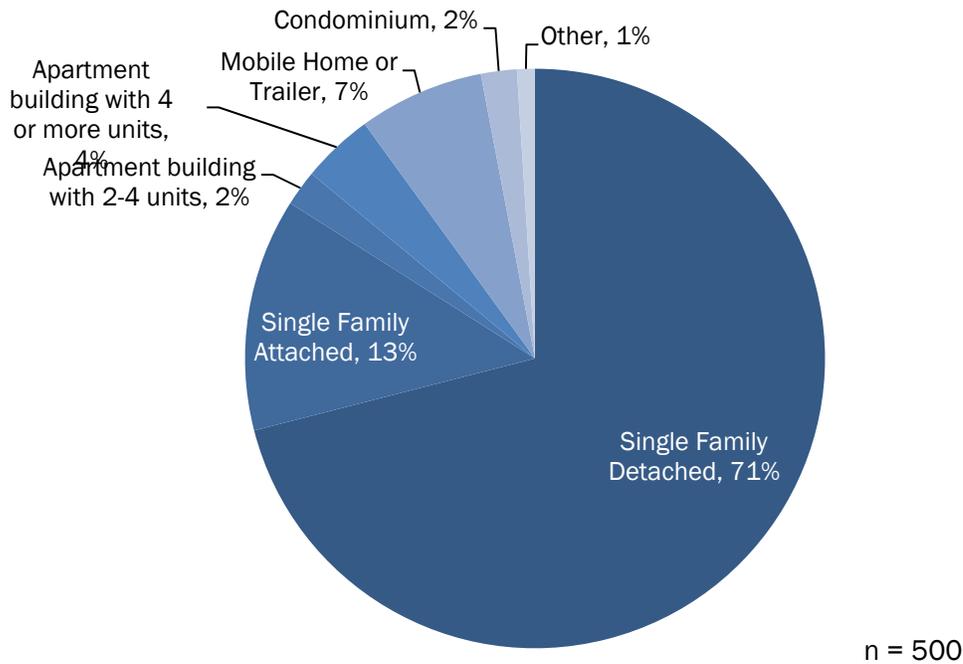
4.7 Building Envelope

The following sections present findings related to the building envelope characteristics and other equipment auditors were able to collect throughout Delaware.

General Home Characteristics

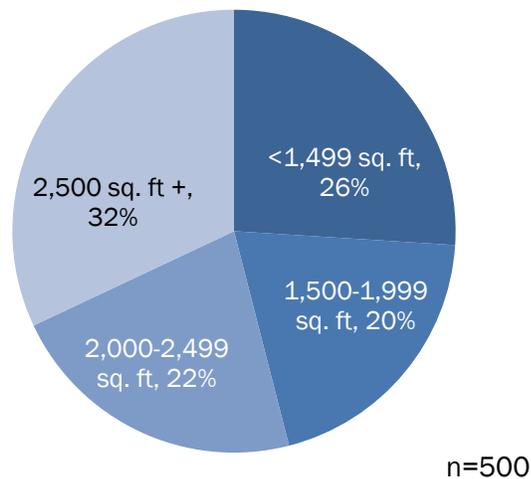
Nearly all surveyed residents live in single-family homes (91%), which include single-family detached homes, single-family attached homes, mobile homes and trailers. Surveyed respondents most commonly lived in single-family detached homes (71%).

Figure 4-20: Residence Type



In terms of size, homes surveyed are fairly large. Only a quarter of homes (26%) were reported to be under 1,499 sq. feet, while about a third of homes (32%) were 2,500 sq. feet or larger. The average home size is 1,872 sq. feet.

Figure 4-5: Home Size



In addition, 97% of the households visited had 1 or 2 levels and (30%) had between 6 and 23 rooms. The average number of rooms in homes visited is 14.

Figure 4-22: Number of Levels

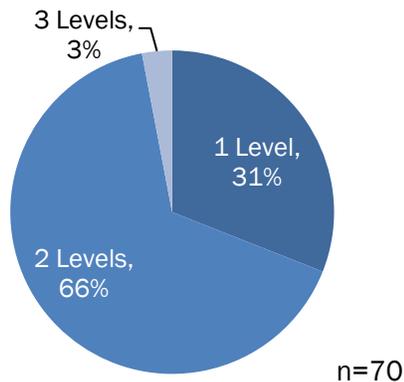
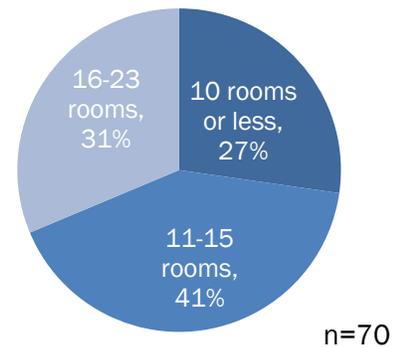


Figure 4-23: Number of Rooms



Over half of those surveyed (55%), have lived in their homes for ten years or less. The majority of Delawareans we surveyed (83%) own their homes. The 70 homes visited by auditors varied greatly in age from 2 to 200 years old. The average age of homes assessed was 38 years.

Building Foundation and Attic

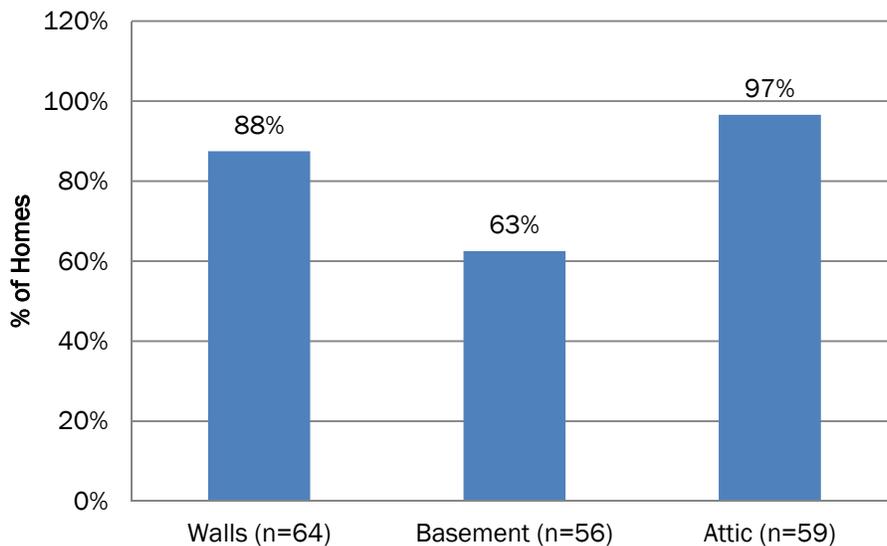
The majority (84%) of homes audited had attic space and 71% had basements. Nearly two-thirds (60%) of the homes are set on basement foundations with 21% having crawl space foundations and 14% having slab foundations. Among those homes that could be assessed, 45% of basements are unconditioned, 31% are partially conditioned, and 24% are conditioned. Of those with basements, over half (58%) were considered by auditors to be finished spaces.

Insulation

Given the inherent difficulties in accessing areas (e.g., walls and attic space) to assess insulation types, the results presented in this section are not necessarily representative of the population of Delaware.¹⁵

¹⁵ In many instances, auditors could not readily access insulation to determine type and or depth because access to an attic is not available or one cannot determine what lies behind a finished wall.

Figure 4-24: Home Insulation



Nevertheless, almost two-thirds (63%) of the homes reviewed by auditors had basement insulation. Within basements, the majority of installed insulation (47%) was in walls, but a third (32%) had ceiling or floor insulation. Eighty-eight percent of the 70 homes visited by auditors had wall insulation. Of homes with attic space, 97% were insulated, with an average of 10 inches per attic; however, auditors were only able to assess insulation depth in 26 homes.

Program Considerations

As noted under the HVAC section above, the opportunity to help keep treated air in the home once delivered by reducing air leaks, infiltration, and heat transfer through un-insulated or under-insulated walls and attics seems to be ripe in Delaware. Programs, such as Home Performance with ENERGY STAR, that tend to take a comprehensive view of a home—with an emphasis on shell measures and other home improvements—hold promise for delivering energy savings in Delaware.

Summary

As expected, penetration of building envelope related items is quite high across all items addressed in this section. Most of the homes surveyed across Delaware were quite large, averaging 1,872 sq. feet, with the bulk (71%) being single-family detached style homes. Delawarean homes also appear to be fairly well insulated; however, only attic insulation was directly measured by auditors and of those homes with attic space, 80% were insulated with an average of 10 inches.

5. **AWARENESS, ATTITUDES AND BEHAVIOR**

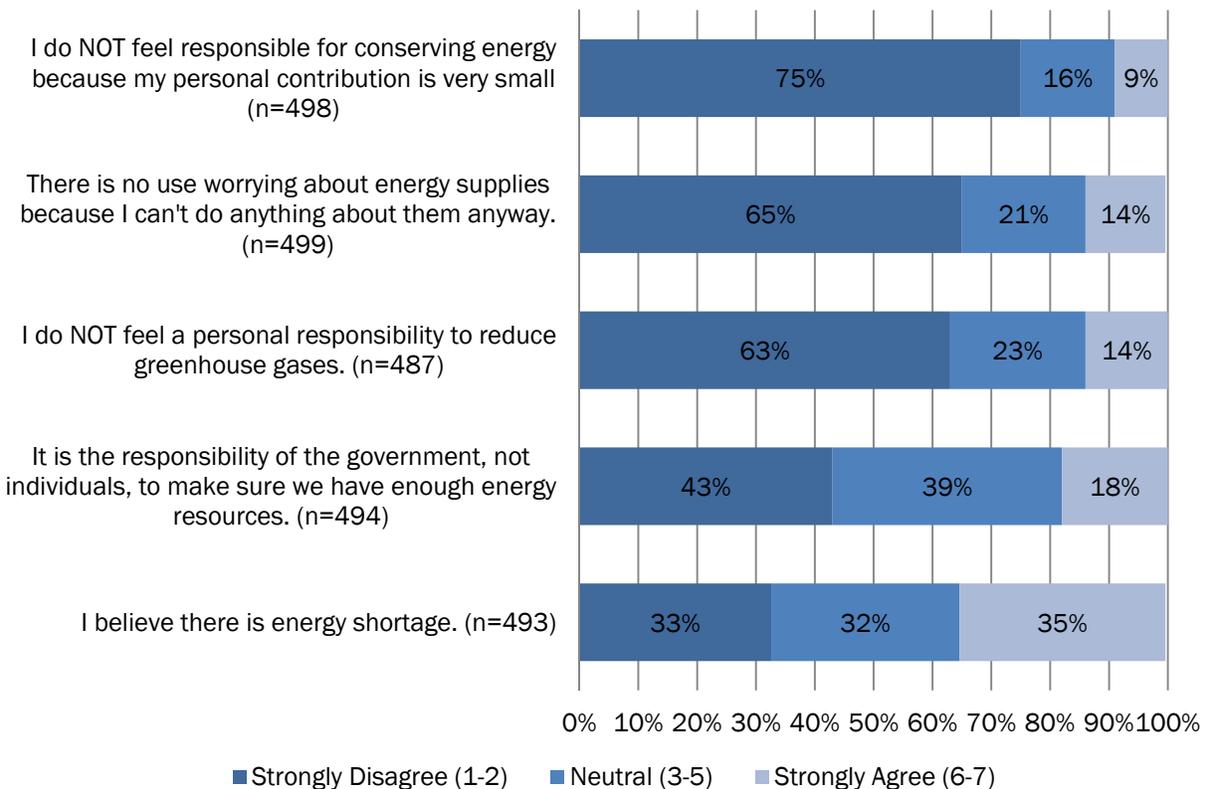
This section explores how Delaware residents think about energy usage and energy efficiency in their everyday lives and provides a baseline assessment of residents' energy-related attitudes, perceptions and behaviors. Key topics of discussion include: the importance of saving energy and the level of personal responsibility residents feel for conserving energy; residents reported knowledge of energy efficiency, potential barriers that could prevent residents from becoming more energy efficient in their daily lives, and residents propensity to take energy efficiency actions in the future.

Energy Efficiency Attitudes

Saving energy is important to almost all Delaware households. On average, Delaware residents rate the importance of saving energy an 8.7 on a scale from 0 to 10 where 0 is "not at all important" and 10 is "very important".

Most survey respondents feel that their personal actions and behaviors impact the supply of energy resources, although views are mixed on whether an actual energy shortage exists. Across several questions utilizing a seven (7) point scale, only a small percentage of survey respondents report that they are not personally responsible for energy efficiency and conservation. However, as shown in Figure 5-1, 33% do not believe there is an energy shortage while another 32% are uncertain.

Figure 5-1: Attitudes Regarding Personal Responsibility Related to Energy (Phone)



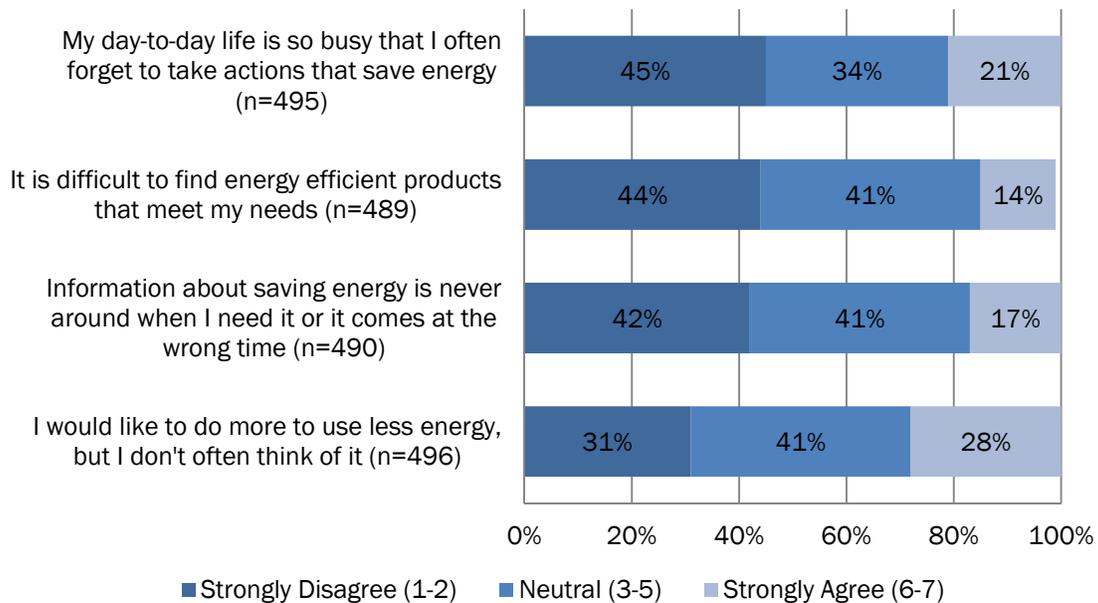
Note: Don't know and refused responses are not included in this analysis.

Feelings of personal responsibility towards energy use and conservation vary by demographic group. Across all of the personal responsibility statements above, residents with higher incomes are more likely to feel greater personal responsibility for reducing their energy use. Other differences in attitudes across customer groups include:

- Delawareans who attended or graduated college are more likely to believe it is worth worrying about energy supplies (69%) and more likely to not believe that the government bears sole responsibility for ensuring there are sufficient energy resources (46%).
- As expected, residents who plan to take actions such as reducing their energy usage (75%) or purchasing CFLs (78%) *do* feel responsible for conserving energy regardless of whether their personal contribution is small compared to those who do not plan to take similar actions.

Across several questions, Delaware residents tend to report lifestyle or informational barriers to energy efficiency. The greatest barrier relates to being so busy that taking energy saving actions is forgotten. Nearly one-third of respondents (28%) say they would like to do more to save energy but they often do not think about it.

Figure 5-2: Attitudes Regarding Energy Efficiency Barriers, Perceptions and Motivations (Phone)



Note: Don't know and refused responses are not included in this analysis.

Some Delaware residents are more likely to report barriers towards energy efficiency than others:

- Residents who have not attended college are more likely to report it is difficult to find energy efficient products that meet their needs (21%) compared to those who attended or graduated college (12%).
- Renters (26%) are more likely to have greater difficulty finding information regarding how to save energy than home owners (15%).

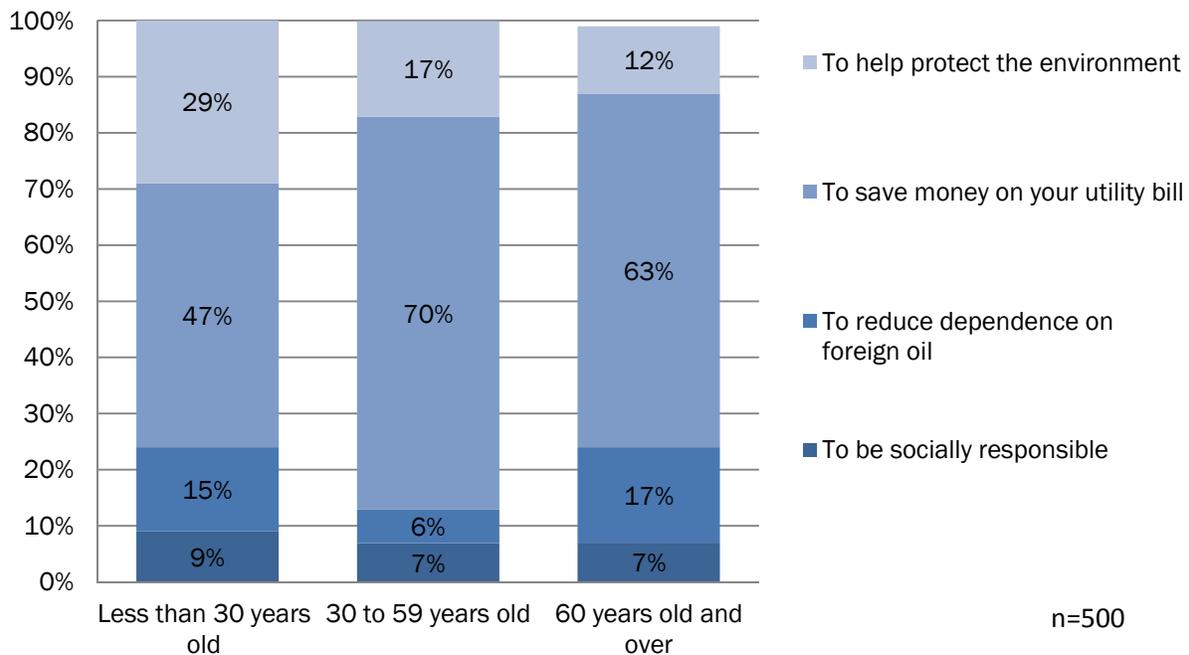
In terms of motivations, two-thirds of Delaware residents (67%) cite the potential to save money as the primary reason why they might try and save energy in their home. Less commonly mentioned motivators include reducing dependence on foreign oil (11%) and social responsibility (8%).

Table 5-1: Reasons Why Residents Might Try to Save Energy (Phone)

Reasons to Save Energy	Percentage of Residents (n=500)			
	#1 Reason	#2 Reason	#3 Reason	Total
Save money on utility bill	66%	18%	11%	95%
Help protect the environment	16%	41%	31%	88%
Reduce dependence on foreign oil	10%	25%	29%	64%
Be socially responsible	8%	15%	28%	51%
Don't know/Refused	1%	1%	2%	4%

Age plays an important role in Delaware residents’ motivation to save energy. For example, residents who are less than 30 years of age are more likely to cite protecting the environment (29%) as the number one reason why a person would try and save energy compared those aged 30 to 59 years old (17%), or 60 years or older (12%).

Figure 5-3: Number One Reason Why Someone Would Save Energy (Phone)



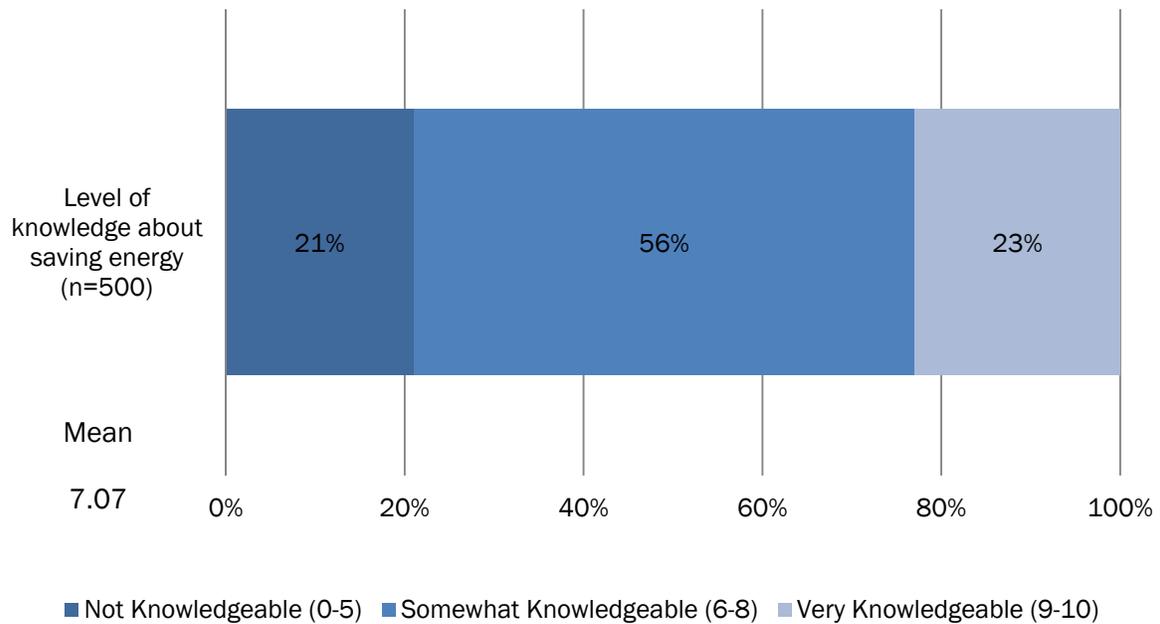
Note: Don't know and refused responses are not included in this analysis.

Over half (59%) of Delaware residents report that they are very likely to try and reduce the amount of energy used in their home to try to decrease utility costs next year. Combining positive responses, over ninety percent (92%) of those surveyed intend to reduce their energy usage in the next year. Only 4% of those surveyed said it was very unlikely that they would try to reduce their energy usage.

Energy Efficiency Knowledge

More than two-thirds of telephone survey respondents (79%) report they have some level of knowledge about how to save energy at home (a rating of 6 to 10 on a 0 to 10 scale). However, the majority do not consider themselves experts in the subject. Only 23% of surveyed residents rate their knowledge as a 9 or a 10 on the same rating scale.

Figure 5-4: Knowledge about Ways to Save Energy (Phone)



Note: Don't know and refused responses are not included in this analysis.

In general, residents who have higher incomes are more likely to feel knowledgeable about how to save energy in their home:

- As income levels increase, residents are more likely to consider themselves knowledgeable about saving energy. For instance, only 68% of those with incomes under \$30,000 claim to feel knowledgeable about how to save energy in their homes compared to 77% of those with incomes between \$30,000 and \$75,000, and 81% of those with income over \$75,000.
- Delawareans 60 years old or older (27%) were most likely to report being very knowledgeable about how to save energy in their homes compared to those between 30 and 59 years old (21%), and those under 30 (15%).
- Residents who reported having some college level experience were slightly more likely (81%) to report being knowledgeable about how to save energy in their homes compared those with college experience (74%).

6. PROFILE OF RESPONDENTS

The table below presents the demographic characteristics of respondents participating in the residential baseline telephone survey and the in-home visits.

Table 6-1: Respondent Demographics

Demographics	Residential Phone Survey % of Respondents (N=500)	In-Home Visits % of Respondents* (N=70)
Ownership		
Own	83%	87%
Rent	17%	13%
Other	0%	0%
Refused	<1%	--
Number of people in household		
1	16%	10%
2	37%	40%
3	19%	23%
4	16%	16%
5	7%	6%
6	2%	4%
7 or more	1%	1%
Refused	<1%	--
Age		
Under 30	7%	6%
30 to 39	13%	10%
40 to 49	17%	16%
50 to 59	31%	30%
60 or over	32%	39%
Refused	5%	--
Level of Education		
Grade school or less (1-8)	1%	0%
Some high school (9-11)	5%	1%
Graduated high school (12)	24%	13%
Vocational/technical school	2%	3%
Some college (1-3 years)	22%	30%
Graduated college (4 years)	25%	29%
Post graduate education	20%	24%
Refused	1%	--
Employment Status		
Employed full-time	56%	51%
Employed part-time	9%	10%
Unemployed	6%	6%
Homemaker	5%	6%

Demographics	Residential Phone Survey % of Respondents (N=500)	In-Home Visits % of Respondents* (N=70)
Student	3%	3%
Retired	17%	20%
Something else	5%	4%
Refused	1%	--
Racial or Ethnic Background		
White or Caucasian	83%	82%
African American or Black	10%	13%
Hispanic/Spanish American	2%	0%
Asian	1%	2%
Native American/Indian	1%	0%
Mixed/bi-racial	2%	2%
Other	1%	2%
Refused	4%	4%
Household Income		
Less than \$15,000	8%	5%
\$15,000 to less than \$30,000	12%	8%
\$30,000 to less than \$50,000	16%	18%
\$50,000 to less than \$75,000	18%	17%
\$75,000 to less than \$100,000	16%	22%
\$100,000 to less than \$150,000	17%	22%
\$150,000 or more	11%	8%
Refused	18%	14%
Residence Type		
Single family home detached	71%	80%
Single family home attached (townhouse or duplex)	13%	20%
Apartment building with 2 to 4 units	2%	--
Apartment building with 4 or more units	4%	--
Mobile home	7%	--
Condominium	2%	--
Cottage or Cabin	<1%	--
Other	<1%	--
Size of home (square footage)		
Less than 1,000 sq. ft.	7%	0%
1000-1499 sq. ft.	18%	18%
1500-1999 sq. ft.	21%	22%
2000-2499 sq. ft.	23%	28%
2500-2999 sq. ft.	12%	12%
3000-3999 sq. ft.	12%	14%
4000-4999 sq. ft.	4%	4%
5000-5999 sq. ft.	1%	4%

Demographics	Residential Phone Survey % of Respondents (N=500)	In-Home Visits % of Respondents* (N=70)
6000-6999 sq. ft.	1%	0%
7000-7999 sq. ft.	<1%	0%
8000 or more sq. ft.	1%	0%
Don't know	31%	--
Refused	<1%	--
Natural Gas Utility Provider		
Delmarva Power	57%	--
Chesapeake Utilities	30%	--
Other	13%	--
Electric Utility Provider		
Delmarva Power	59%	--
Delaware Electric Cooperative	24%	--
City of Dover	5%	--
Town of Smyrna	2%	--
City of Newark	2%	--
City of Lewes	1%	--
Town of Middleton	1%	--
City of Milford	1%	--
City of Seaford	1%	--
Chesapeake Utilities	<1%	--
Town of Clayton	<1%	--
Other	1	--
Refused	<1%	--

*Adjusted from In-Home Visits

DATA COLLECTION INSTRUMENTS – TELEPHONE SURVEY

Introduction

Hello, my name is [INTERVIEWER NAME] and I'm calling from Opinion Dynamics on behalf of the Delaware Department of Natural Resources and Environmental Control (DNREC). We are conducting a study of households across the State of Delaware to better understand how residential residents like you use energy. Your participation is important in helping DNREC [NOTE TO INTERVIEWER: PRONOUNCED "DEN REC"] improve their energy efficiency programs for residential residents. May I please speak with someone in your household who is involved in making decisions regarding energy use in your home? [CONTINUE WITH CORRECT CONTACT]

(If needed: This survey should take about 10 minutes.)

Screener

S3. How long have you lived in this home?

1. Less than 1 year
2. 1-3 years
3. 4-10 years
4. 11-20 years
5. More than 20 years
9. (Refused) [THANK AND TERMINATE]

S4. Which of the following best describes the use of this home?

1. Year-round, full-time residence
2. Seasonal or part-time use [THANK AND TERMINATE]
3. Landlord [THANK AND TERMINATE]
00. (Other, Specify)
98. (Don't know) [THANK AND TERMINATE]
99. (Refused) [THANK AND TERMINATE]

[ASK IF S4= 00]

S4a. Is this a year round residence?

1. Yes
2. No [THANK AND TERMINATE]
98. (Don't know) [THANK AND TERMINATE]
99. (Refused) [THANK AND TERMINATE]

[ASK OF LANDLINE SAMPLE ONLY]

X10. Does anyone in your household have a working cellular telephone?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK X11 IF X10=1]

X11. Please consider all of the telephone calls that you and your family receive. Would you say that all or almost all calls are received on cell phones, some are received on cell phones and some on regular landline phones, or would you say very few or no calls are received on cell phones?

1. All or almost all calls on cell phones
2. Some on cell phones, some on regular landline phones
3. Very few or none on cell phones
8. (Don't know)
9. (Refused)

[ASK OF CELLPHONE SAMPLE ONLY]

X12. Does your household have a working landline telephone?

1. Yes
2. No
8. (Don't know)
9. (Refused)

(If yes to X12 (also have landline phone))

X13. Please consider all of the telephone calls that you and your family receive. Would you say that all or almost all calls are received on landline phones, some are received on cell phones and some on regular landline phones, or would you say very few or no calls are received on landline phones?

1. All or almost all calls on landline phones
2. Some on cell phones, some on regular landline phones
3. Very few or none on landline phones
8. (Don't know)
9. (Refused)

X7. Which best describes your current employment status?

1. Employed full-time
2. Employed part-time
3. Unemployed
4. Homemaker
5. Student
6. Retired [CREATE RETIRED FLAG]
7. Something else
9. (Refused)

S5. What is your zipcode? (Create calculation to determine if zipcode is urban or rural)
99999. (Refused) [THANK AND TERMINATE]

Home Characteristics

H1. Do you own or rent your home?

1. Rent
2. Own
9. (Refused)

H2a. Which of the following best describes your home?

1. Single Family Home Detached (No common walls)
2. Single Family home Attached (Townhouse or Duplex)
3. Apartment building with 2-4 units
4. Apartment building with 4 units or more
5. A mobile home or trailer
6. Condominium
7. Cottage or cabin
00. Other, specify
98. (Don't know)
99. (Refused)

[Ask IF H2a=5]

H2b. How many units does your building have?

1. 4 or fewer
2. 5 or more
6. (Not applicable)
8. (Don't know)
9. (Refused)

H3. Approximately how many square feet of living space does your home have? Don't include the basement unless it is a space that you consider lived in.

1. (Under 1,000 sq. ft.)
2. (1,000 - 1,499 sq. ft.)
3. (1,500 - 1,999 sq. ft.)
4. (2,000 - 2,499 sq. ft.)
5. (2,500 - 2,999 sq. ft.)
6. (3,000 - 3,999 sq. ft.)
7. (4,000 - 4,999 sq. ft.)
8. (5,000 - 5,999 sq. ft.)
9. (6,000 - 6,999 sq. ft.)
10. (7,000 - 7,999 sq. ft.)
11. (8,000 or more sq. ft.)
98. (Don't know)
99. (Refused)

Energy Efficiency Attitudes

I am going to ask you several questions about energy and your thoughts about it. There is no right or wrong answer to any of these questions, so please just give me your honest response.

A1. On a scale from 0 to 10 where 0 is not at all important and 10 is very important, how important, is saving energy to your household?

- 0. 0 – not at all important
- 1. 1
- 2. 2
- 3. 3
- 4. 4
- 5. 5
- 6. 6
- 7. 7
- 8. 8
- 9. 9
- 10. 10 – very important
- 98. (Don't know)
- 99. (Refused)

A2. Please indicate the extent to which you agree or disagree with the following statements. Please use a 1-7 scale where 1 means “Strongly Disagree” and 7 means “Strongly Agree.”
[RANDOMIZE LIST]

- a. [REMIND OF SCALE IF NEEDED] My day-to-day life is so busy that I often forget to take actions that save energy.
- b. [REMIND OF SCALE IF NEEDED] It is difficult to find energy efficient products that meet my needs.
- c. [REMIND OF SCALE IF NEEDED] Information about saving energy is never around when I need it or it comes at the wrong time.
- d. [REMIND OF SCALE IF NEEDED] I would like to do more to use less energy, but I don't often think of it.

A3. The following are four possible reasons why you might try and save energy in your home. Which of the following is the most important to you?

A3B. Which is the second most important reason as to why you would try to save energy at your home?

A3C. Which of the following is the third most important reason?

[Randomize list]

1. To help protect the environment
2. To save money on your utility bill
3. To reduce dependence on foreign oil
4. To be socially responsible
8. (Don't know)
9. (Refused)

A4. For the next set of questions, please indicate the extent to which you agree or disagree with the following statements. Please use a 1-7 scale where 1 means “Strongly Disagree” and 7 means “Strongly Agree.” [RANDOMIZE LIST]

- a. [REMINDE OF SCALE IF NEEDED] I do NOT feel responsible for conserving energy because my personal contribution is very small.
- b. [REMINDE OF SCALE IF NEEDED] I do NOT feel a personal responsibility to reduce greenhouse gases.
- c. [REMINDE OF SCALE IF NEEDED] There is no use worrying about energy supplies because I can't do anything about them anyway.
- d. [REMINDE OF SCALE IF NEEDED] It is the responsibility of the government, not individuals, to make sure we have enough energy resources.
- e. [REMINDE OF SCALE IF NEEDED] I believe there is energy shortage.

Energy Efficiency Knowledge & Behavior

K1. How would you rate your knowledge of the different ways you can save energy in your home? Please use a 0-10 scale where 0 means “Not at all knowledgeable” and 10 means “Extremely knowledgeable.”

0	1	2	3	4	5	6	7	8	9	10	98	99
Not at all knowledgeable							Extremely knowledgeable				DK	Ref

K2. In the next year, how likely are you to try and reduce the amount of energy you use in your home to try to decrease your utility costs?

1. Very likely
2. Somewhat likely
3. Somewhat unlikely
4. Very unlikely
8. (Don't know)
9. (Refused)

CFL Module

Now I would like to ask you some questions about the lighting you have in your home.

CFL1. Have you ever heard of compact fluorescent light bulbs, sometimes called CFLs?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[SKIP INTRO LANGUAGE TO CFL2 IF CFL1=1]

CFLs also known as Compact Fluorescent Lamps are light bulbs, usually shaped in a spiral (“corkscrew”) or in a double U-shape that are advertised as using less energy than normal light bulbs and fit into a regular light bulb socket.

CFL2. How familiar are you with CFLs? Would you say that you are...?

1. Very familiar
2. Somewhat familiar
3. Not very familiar
4. Not at all familiar
8. (Don't know)
9. (Refused)

CFL3. Do you currently have any CFLs installed inside or outside of your home?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[SKIP if NOT CFL3=1]

CFL4. Approximately how many CFLs do you currently have installed on the inside and outside of your home? Your best estimate is fine.

00. [NUMERIC OPEN END]
998. (Don't know)
999. (Refused)

[SKIP CFL4a if CFL4 = 0, none]

CFL4a. Thinking about all of the light sockets inside and outside of your home that could use a CFL, would you say all of them, most of them, some of them, or a few of them currently have CFLs?

1. All of them
2. Most of them
3. Some of them
4. A few of them
8. (Don't know)
9. (Refused)

CFL5. The next time you buy a light bulb, how likely are you to buy a CFL?

1. Very likely
2. Somewhat likely
3. Somewhat unlikely
4. Very unlikely
8. (Don't know)
9. (Refused)

[ASK IF CFL5 = 3 OR 4]

I'm interested in learning more about why you aren't likely to buy CFLs the next time you buy light bulbs. I'm going to read a short list of reasons why some people don't purchase or use CFLs. After I read each one, please tell me if this is a very important reason why you don't plan to purchase CFLs, a somewhat important reason, or not an important reason. [ROTATE REASONS]

- CFL6. CFLs are too expensive
- CFL7. Dissatisfied with past CFLs
- CFL8. Don't like the like the quality of light CFLs produce
- CFL9. CFLs are not bright enough
- CFL10. CFLs contain mercury
- CFL11. Not sure about which CFL to purchase

1. Very important reason
2. Somewhat important reason
3. Not an important reason
8. (Don't know)
9. (Refused)

LED1. Have you ever heard of LED light bulbs that can be used to replace standard light bulbs in your home?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF LED1 = 1]

LED2. Have you ever installed an LED bulb in your home?

1. Yes
2. No
8. (Don't know)
9. (Refused)

LAW1. As you may know, in 2007, Congress passed a law to set higher energy standards for light bulbs. The law phases out standard light bulbs, or incandescent light bulbs, over the next three years. How familiar are you with this law? Would you say you are...

1. Very familiar
2. Somewhat familiar
3. Not very familiar
4. Not at all familiar
8. (Don't know)
9. (Refused)

End-Use Equipment Module

Now I would like to ask you a few questions about major energy-using equipment and appliances within your home.

E1. For each equipment type I read, please tell me if you have that type of equipment within your home and, if so, how many you have? [enter number between zero and ten, 98 = Don't Know, 99 = Refused]

How many (read category) do you have?

- E1a. Televisions that are plugged in
- E1b. Set-Top Boxes (i.e., cable boxes and/or TV digital recorders)
- E1c. Desk-top computers
- E1d. Lap-top computers
- E1e. Game consoles (such as Ninetendo Wii, Sony P3, Microsoft Xbox 360, etc.)
- E1f. Room air conditioners
- E1g. Electric space heaters
- E1h. Refrigerators
- E1i. Stand alone freezers
- E1j. Ceiling fans
- E1k. Dishwashers
- E1l. Clothes washers
- E1m. Clothes dryers

E2. What type of fuel does your water heater use?

1. Electric
2. Gas
3. Propane
4. Oil
00. Other, specify _____
98. (Don't know)
99. (Refused)

E3. What is the primary fuel used to heat your home?

- 1. Electric
- 2. Gas
- 3. Propane
- 4. Oil
- 00. Other, specify _____
- 98. (Don't know)
- 99. (Refused)

E4. Does your home have central air conditioning?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

U1. Does a utility provide natural gas service to your home?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

[ASK if U1 = 1]

U2. What is the name of your natural gas utility? [READ CODES IF NECESSARY]

- 1. (Chesapeake Utilities)
- 2. (Delmarva Power)
- 00. (Other, specify: _____)
- 98. (Don't know)
- 99. (Refused)

U3. What is the name of your electric utility? [READ CODES IF NECESSARY]

- (Chesapeake Utilities)
- (Clayton (town of))
- (Cover (City of))
- (Delaware Electric Cooperative)
- (Delmarva Power)
- (Lewes (City of))
- (Newark (City of))
- (New Castle (City of))
- (Middleton (Town of))
- (Milford (City of))
- (Seaford (City of))
- (Smyrna (Town of))
- 00. (Other, specify: _____)
- 98. (Don't know)
- 99. (Refused)

Demographics

We're almost finished. I just have a few questions about your household.

X1. In what year were you born?

[NUMERIC OPEN END; 1890-19991]

9999. (Refused)

X2. Including yourself, how many people lived in your home during the past 12 months?

[NUMERIC OPEN-END, RECORD NUMBER 1-9]

10. 10 or more

99. (Refused)

[SKIP X3 IF X2=1]

X3. How many children under 18 years of age currently reside in this home? [NUMERIC OPEN-END, RECORD NUMBER 0-9]

10. Ten or more

99. (Refused)

X4. Which category best describes your total household income in 2011, before taxes?

Please stop me when I get to the appropriate category.

1. Less than \$15,000

2. \$15,000 to less than \$30,000

3. \$30,000 to less than \$50,000

4. \$50,000 to less than \$75,000

5. \$75,000 to less than \$100,000

6. \$100,000 to \$150,000

7. \$150,000 or more

8. (Don't know)

9. (Refused)

X6. What is the last grade of school you completed? [READ CODES 1-7 IF NECESSARY]

1. (Grade school or less (1-8))

2. (Some high school (9-11))

3. (Graduated high school (12))

4. (Vocational/technical school)

5. (Some college (1-3 years))

6. (Graduated college (4 years))

7. (Post graduate education)

9. (Refused)

X8. How would you describe your race? (If necessary: For example, White, African American, Arab American, Hispanic, Asian, or something else?)

1. (White)
2. (African American/Black)
3. (Arab American)
4. (Hispanic/Spanish-American)
5. (Asian)
6. (Native American/Indian)
7. (Mixed/bi-racial)
00. (Other, SPECIFY)
98. (Don't know)
99. (Refused)

X9. RECORD GENDER (DO NOT ASK)

1. Male
2. Female

INVITATION FOR RESIDENTIAL HOME AUDIT

Focus will be on:

Single Family homes (Recruit only if question H2a = 1).

Appropriate mix of retirees (vs. non-retirees) – (question X7 = 6 for retirees)

Appropriate mix of urban vs. rural residents

As part of an effort to better understand residential energy usage among Delaware residents, the Delaware Department of Natural Resources and Environmental Control (DNREC) will be conducting in-home assessments with a representative sample of state residents. The assessment takes about 1 hour to 1 hour and 30 minutes to complete and would be conducted by a trained representative of DNREC [NOTE TO INTERVIEWER: PRONOUNCED “DEN REC”]. The intent of the assessment is to determine the type of lighting, consumer electronics, and other energy using equipment in your home. The data collected will be used to help the State of Delaware plan for its future energy needs. If you are selected to participate, you will receive a \$75 Visa gift card after the assessment has been completed.

Here's how it would work: first, if you are selected for participation, we would set up an appointment time that works with your schedule. At the agreed upon time, a DNREC representative would arrive at your home for the appointment. The DNREC representative will have a photo ID badge and will have proper credentials. You would accompany the representative through your home as he or she records information.

Just like today, no one will attempt to sell you anything. This assessment is simply a part of a larger research study to understand energy usage in Delaware residences and your assessment will be one of many performed throughout the state. Would you be willing to participate in this study?

1. Yes [continue]
2. No -- OK, that you for participating in this survey. DNREC greatly appreciates your time and input.

IF YES:

Thank you very much for your interest in participating. I want to make sure that we have your name, address, and telephone number.

Record: Name, Address (street, city, state,), telephone number

Within the next two weeks, you may get a call from a DNREC representative to set up an appointment.

Even though I am not able to schedule your appointment right now are there any days of the week that will NOT work for you?

Are there any times during the day that will NOT work for you?

Thank you. Just to be clear, you will be getting a call to set a specific date and time for the on-site assessment. But, we will pass this information along to the people who will be calling you so that they are aware of this.

DATA COLLECTION INSTRUMENTS – ONSITE INSTRUMENT

Introduction

[TO BE FILLED IN BY ON-SITE INSPECTOR]

CP1. Please enter survey ID number: [OPEN END NUMERIC RESPONSE]

CP5. Please enter today's date: [MM/DD/YYYY]

CP6. Please enter on-site inspector name: [OPEN END]

CP7. Please enter time in: [00:00 to 23:59]

Room by Room

Fill out questions below for each room in home.

[BEGIN ROOM BY ROOM LOOP]

R1. Please select room type:

1. Basement (finished)
2. Basement (unfinished)
3. Foyer/Hallway
4. Bathroom
5. Laundry
6. Bedroom
7. Kitchen
8. Living space (family room or living room)
9. Garage
10. Office
11. Dining
00. Other indoor space (Specify: _____)

R2. Does the [INSERT ROOM TYPE] have: [1=Yes, 2= No, 99= Can't Assess]

- a. Light sockets
- c. Dishwasher
- d. Clothes washer
- e. Clothes dryer
- f. Room air conditioning (portable or window units)
- g. Electric space heater
- h. Thermostat
- i. Refrigerator
- j. Stand Alone Freezer
- k. Stovetop
- l. Oven
- m. Ceiling fan
- n. Faucets
- o. Showerheads

Indoor Lighting

[SKIP TO DW1 IF R2a=2, 99]

- L1. What type of bulb is in the room's primary light fixture? [one response]
1. CFL
 2. Incandescent
 3. Halogen
 4. LED
 5. Other fluorescent
 00. Other, specify: _____
 99. Can't Assess

Sockets in Room

Please enter the following for each type of socket in the room.

- S1. Please select the socket type:
1. Standard screw-based
 2. Specialty screw-based
 3. Pin-based
 00. Other, specify
- S2. Please select the control type for this socket:
1. On-Off
 2. Dimmable
 3. 3-Way
 4. Motion Sensor
 5. Timer
 00. Other, specify
 99. Can't Assess
- S3. Please select the bulb type in this socket:
1. Incandescent
 2. CFL
 3. Fluorescent
 4. LED
 5. Halogen
 00. Other, specify
 7. Empty

S4. Please select the bulb shape for this socket:

1. Standard shape/Pear shape
2. Twist/Spiral
3. Globe
4. A lamp
5. Bullet/Torpedo
6. Bug light
7. Spot/Reflector/Flood
8. Circline
9. Tube
00. Other, specify below
96. Not applicable
99. Can't Assess

S6. How many total sockets in this room are exactly like this one? [NUMERIC OPEN END]
[NOTE TO AUDITOR THAT A SOCKET TYPE SHOULD HAVE THE SAME BULB TYPE, BULB SHAPE, AND CONTROL TYPE]

S9. Is there another socket type in this room?

1. Yes
2. No

[GO THROUGH LOOP S1-9 IF S9=1, IF NOT SKIP TO DW1]

Dishwashers

[SKIP TO CLOTHES WASHER (CW1) IF R2c=2,99]

DW1. Please enter number of dishwashers? [OPEN END NUMERIC RESPONSE, 99 = Can't Assess] [UP TO 3]

[SKIP TO CW1 IF DW1= 0,99]

[LOOP THROUGH DW2-DW3 FOR EACH DISHWASHER IN DW1]

DW2. Please enter unit type:

1. Front-down panel door
2. Dish drawer
- 00: Other: Specify _____
99. Can't assess

DW3. Please enter the approximate age of the dishwasher in years: [NUMERIC OPEN END, 99=Can't assess]

DW4. Is the dishwasher ENERGY STAR?

1. Yes
2. No
99. Can't Assess

Clothes Washer

[SKIP TO CD1 IF R2d=2,99]

CW1. Please enter the number of clothes washing machines? [OPEN END NUMERIC RESPONSE, 99=CAN'T ASSESS] [UP TO 3]

[SKIP TO CD1 IF CW1=0,99]

[LOOP THROUGH CW2-CW4 FOR EACH WASHING MACHINE IN CW1]

CW2. Please enter clothes washer type:

1. Front-loading
2. Top-loading
00. Other: Specify _____
99. Can't assess

CW3. Is the unit a combination washer and dryer (both in the same unit)?

1. Yes
2. No
99. Can't assess

CW4. Please enter the approximate age of the clothes washer in years: [NUMERIC OPEN END, 99 = Can't assess]

CW5. Is the clothes washer ENERGY STAR?

1. Yes
2. No
99. Can't Assess

Clothes Dryer

[SKIP TO RH1 IF R2e = 2, 99]

CD1. Please enter the number of clothes dryers [OPEN END NUMERIC RESPONSE, 99 = CAN'T ASSESS] [UP TO 3]

[SKIP TO RH1 IF CD1 = 0, 99]

CD2. Please enter dryer fuel type:

1. Electric
2. Natural gas
3. Oil
4. Propane
00. Other, specify
99. Can't assess

Room Heating and Cooling

[SKIP TO RH6 IF R2f=2,99]

RH1. Total number of window unit air conditioners? [OPEN END NUMERIC RESPONSE, 99 = CAN'T ASSESS]

[SKIP TO RH6 IF RH1 = 99]

[LOOP THROUGH RH2-RH5 FOR EACH WINDOW UNIT AIR CONDITIONER IN RH1]

RH2. Please enter unit size: [OPEN END NUMERIC RESPONSE IN BTUS, 99=Can't Assess]

RH3. Please enter unit age: [OPEN END NUMERIC RESPONSE IN YEARS, 99= Can't Assess]

RH4. Please enter the SEER rating of unit: [NUMERIC OPEN END 7 OR ABOVE, 99= Can't Assess]

[ASK IF RH4 = 99]

RH4a. Please enter the EER rating of the unit: [NUMERIC OPEN END, 99 = Can't assess]

RH5. Is the unit ENERGY STAR?

1. Yes
2. No
99. Can't Assess

[SKIP TO TH2/THERMOSTAT IF R2g=2,99]

RH6. Total number of electric space heaters? [NUMERIC OPEN END, 99= Can't Assess]
Thermostat

[SKIP TO RF1 IF R2h=2, 99]

TH2. Is the thermostat programmable?

1. Yes
2. No
99. Can't Assess

[ASK IF TH2 = 1, ELSE SKIP TO TH4]

TH3. Is the programming set?

1. Yes
2. No
99. Can't Assess

TH4. Are there controls for:

1. Heating
2. Cooling
3. Separate Fan Operation
4. Both Heating & Cooling
5. Heating, Cooling & Fan
99. Can't Assess

Refrigerators

[SKIP TO SF1 IF R2i=2,99]

RF1. Please enter number of refrigerators? [OPEN END NUMERIC RESPONSE, 99 = Can't Assess] [UP TO 3]

[SKIP TO SF1 IF RF1= 99]

[LOOP THROUGH RF2-RF6 FOR EACH REFRIGERATOR IN RF1]

- RF2. Please enter unit type:
1. Side-by-side
 2. Top Freezer
 3. Bottom freezer
 4. Built-In
 5. Stand-alone refrigerator (no freezer)
 00. Other: Specify _____
 99. Can't assess

- RF3. Does the refrigerator have a through-the-door ice maker?
1. Yes
 2. No
 99. Can't assess

RF4. Enter refrigerator capacity in cubic feet: [OPEN END NUMERIC RESPONSE, 99= Can't Assess]

RF5. Enter refrigerator age in years: [OPEN END NUMERIC RESPONSE, 99= Can't Assess]

- RF6. Is the refrigerator ENERGY STAR?
1. Yes
 2. No
 99. Can't Assess

[ASK IF RF4 = 99 OR RF5 = 99 OR RF6 = 99]

RF8. Please enter the model number for the refrigerator: [OPEN END, 99 Can't assess]

Stand Alone Freezers

[SKIP TO ST1 IF R2j=2,99]

SF1. Please enter number of stand alone freezers? [OPEN END NUMERIC RESPONSE, 99 = Can't Assess][UP TO 2]

[SKIP TO ST1 IF SF1= 99]

[LOOP THROUGH SF2-SF5 FOR EACH STAND ALONE FREEZER IN SF1]

- SF2. Please enter unit type:
1. Chest
 2. Upright
 3. Bar freezer
 4. Matching pair
 00. Other: Specify
 99. Can't Assess

SF3. Enter freezer capacity in cubic feet: [OPEN END NUMERIC RESPONSE, 99= Can't Assess]

SF4. Enter freezer age in years: [OPEN END NUMERIC RESPONSE, 99= Can't Assess]

SF5. Is the freezer ENERGY STAR?

1. Yes
2. No
99. Can't assess

Stovetop

[SKIP TO 01 IF R2k = 2, 99]

ST1. Please enter the number of stovetops: [OPEN END NUMERIC RESPONSE, 99 = CAN'T ASSESS] [UP TO 3]

[SKIP TO 01 IF ST1 = 0, 99]

ST2. Please enter stovetop fuel type:

1. Electric
2. Natural gas
3. Oil
4. Propane
00. Other, specify
99. Can't assess

Oven

[SKIP TO CF1 IF R2l = 2, 99]

O1. Please enter the number of ovens [OPEN END NUMERIC RESPONSE, 99 = CAN'T ASSESS] [UP TO 3]

[SKIP TO CF1 IF O1 = 0, 99]

O2. Please enter oven fuel type:

1. Electric
2. Natural gas
3. Oil
4. Propane
00. Other, specify
99. Can't assess

[SKIP TO CF1 OR NEXT OVEN IF ST1 = 0, 99 OR R2k = 2, 99]

O3. Are the oven and stovetop separate or combined (in a range)?

1. Separate
2. Combined in a range
00. (Other, specify: _____)
99. Can't assess

Ceiling Fans

[SKIP TO WD1 if R2m=2,99]

CF1. Please enter the number of ceiling fans WITH light bulb sockets in the room? [OPEN END NUMERIC RESPONSE, 99= Can't Assess]

CF2. Please enter the number of ceiling fans WITHOUT light bulb sockets in the room?
[OPEN END NUMERIC RESPONSE, 99= Can't Assess]
[ASK FOR EACH FAN IN CF1-2]

CF3. Is the ceiling fan ENERGY STAR?
1. Yes
2. No
99. Can't assess

Faucets

[SKIP TO SH1 IF R2n = 2, 99]

FA1. Please enter the number of faucets in the room: [OPEN END NUMERIC RESPONSE, 99 = Can't assess]

FA2. Please enter the number of faucets WITH FAUCET AERATORS in the room: [OPEN END NUMERIC RESPONSE, 99 = Can't assess]

Showerheads

[SKIP TO R3 IF R2o = 2, 99]

SH1. Please enter the number of showerheads in the room: [OPEN END NUMERIC RESPONSE, 99 = Can't assess]

SH2. Please enter the number of showerheads WITH LOW-FLOW SHOWERHEADS (2.5 gpm or less) in the room: [OPEN END NUMERIC RESPONSE, 99 = Can't assess]

Additional Rooms

R3. Are there any additional rooms in this house?
1. Yes [BEGIN LOOP AGAIN AT R1]
2. No [SKIP TO HVAC/CH1]

[END ROOM BY ROOM LOOP]

HVAC and Water Heating

Central Heating and Cooling

CH1. Primary heating source: ?
1. Electric
2. Natural gas
3. Oil
4. Propane
00. Other, specify: _____
99. Can't Assess

CH1A. Primary heating type:
Central forced air furnace
Hot water or steam boiler
Electric baseboards
Heat pump
Geothermal heat pump
Space heater
Wood stove
Fireplace
00. Other: Specify: _____
99. Can't Assess

CH5. Please enter the make:
1. Armstrong/Aire Ease
2. Carrier
3. Frigidaire
4. ICP Commercial
5. Kenmore
6. Lennox
7. Maytag
8. Rheem
00. Other, specify:
99. Can't assess

CH6. Please enter the model number: [TEXT OPEN END, 99 = Can't assess]

[ASK IF CH1A = 1 or 2]

CH2. Please enter the AFUE rating of the [CH1A]: [NUMERIC OPEN END, 99 = Can't assess]

[ASK IF CH1a = 4]

CH2a. Please enter the HSPF of the heat pump: [NUMERIC OPEN END, 99 = Can't assess]

[ASK IF CH1a = 1, 2 or 4]

CH8. Please enter the size of the heating unit in BTU/hour: [NUMERIC OPEN END, 99 = Can't Assess]

CH9. Please enter the age of the heating unit in years: [NUMERIC OPEN END IN YEARS, 99 = Can't Assess]

[ASK IF CH1A = 1, 2, 4 OR 5]

CH9a. Does homeowner have a maintenance contract for the central heating unit?
1. Yes
2. No
99. Can't Assess

[SKIP TO BT1/BASEMENT IF CH1A = 4, 5]

CH10. Does the home have central air conditioning?

1. Yes
2. No
99. Can't Assess

[SKIP TO BT1/BASEMENT IF CH10=2, 99]

CH11. How many CAC units does the home have? [NUMERIC OPEN END, 99 = Can't assess, ENTER UP TO 6]

[SKIP TO BT1/BASEMENT IF CH11=0,99]

CH12. Does homeowner have a maintenance contract for the central air conditioner?

1. Yes
2. No
99. Can't Assess

[LOOP THROUGH CH13-CH16 FOR EACH IN CH11]

CH13. Please enter the make:

- Lennox
- Trane
- American Standard
- Goodman
- Carrier
- 00. Other, specify: _____
- 99. Can't assess

CH14. Please enter the model number: [TEXT OPEN END, 99= Can't assess]

CH16 . Please enter the SEER Rating: [NUMERIC OPEN END 7 OR ABOVE, 99= Can't Assess]

CH17. Please enter the size of the CAC unit in tons: [NUMERIC OPEN END, 99 = Can't Assess]

CH18. Please enter the age of the CAC unit: [NUMERIC OPEN END IN YEARS, 99 = Can't Assess]

[ASK IF CH11 <> 1, ELSE SKIP TO BT1]

CH19. Number of CAC units meeting these specifications: [NUMERIC OPEN END, 99 = Can't assess]

[END LOOP IF CH19 = CH11]

Basement and Attic

BT1. Is the home set on a basement, a slab foundation, or a crawl space? (MULTIPLE RESPONSE, UP TO 4)

1. Basement
2. Slab foundation
3. Crawl space
00. Other, specify: _____
99. Can't assess

[ASK IF BT1 = 1, ELSE SKIP TO BT3]

BT2. Is the basement conditioned, unconditioned, or partially conditioned?

1. Conditioned
2. Unconditioned
3. Partially conditioned
99. Can't assess

[ASK IF BT1 = 1 OR 3, ELSE SKIP TO BT4]

BT3. Does the [READ FROM BT1] have any insulation?

1. Yes
2. No
99. Can't access

BT3a. Where is the [READ FROM BT1] insulation installed?

1. Wall
2. Ceiling (floor of home)
00. Other, specify: _____
96. Not applicable
99. Can't access

BT4. Does the home have an attic?

1. Yes
2. No

BT5. Does the attic have any insulation?

1. Yes
2. No
96. Not applicable
99. Can't access

BT5a. Amount of attic insulation in inches [NUMERIC OPEN END, 96 NOT APPLICABLE, 99 CAN'T ASSESS]?

Water Heating

WH1. How many water heaters does the home have? [NUMERIC OPEN END, 99 = Can't assess]

[LOOP THROUGH WH2-WH10/11 FOR EACH IN WH1]
[SKIP TO EL1/EXTERIOR LIGHTING IF WH1=0, 99]

WH1a. Where is the water heater located?

1. Conditioned closet or utility room
2. Conditioned basement
3. Unconditioned basement
4. Conditioned garage
5. Outdoors
00. Other, specify: _____
99. Can't assess

WH2. What type of water heater?

1. Storage
2. On Demand
00. Other, specify: _____
99. Can't Assess

WH3. Primary water heating source?

1. Electric
2. Natural gas
3. Propane
00. Other, specify: _____
99. Can't Assess

WH4. Please enter the make:

- GE
- Rheem/Rheem-Rhud
- Stiebel Eltron
- Bradford White
- Whirlpool
- AO Smith
- Takagi
- Rinnai
- 00. Other, specify: _____
- 99. Can't assess

WH5. Please enter the model number: [TEXT OPEN END, 99= Can't assess]

[ASK IF WH2 = 2, ELSE SKIP TO WH7]

WH6. Please enter BTU per hour for Gas or Watts for electric: [NUMERIC OPEN END 7 OR ABOVE, 99= Can't Assess]

[ASK IF WH2 = 1, ELSE SKIP TO WH8]

WH7. Please enter the size of the water heater tank in gallons: [NUMERIC OPEN END, 99 = Can't Assess]

WH8. Please enter the age of the water heater: [NUMERIC OPEN END IN YEARS, 99 = Can't Assess]

WH9. Is the water heater ENERGY STAR?

1. Yes
2. No
99. Can't Assess

WH10. Are the water pipes insulated?

1. Yes
2. No
99. Can't Assess

[ASK IF WH10 = 1, ELSE SKIP TO WH11]

WH10a. What is the length of insulated pipes in feet? [NUMERIC OPEN END UP TO 500, -99 Can't assess]

[SKIP TO WH12 IF WH2=2]

WH11. Does the water heater have tank wrap?

1. Yes
2. No
3. Internal insulation
99. Can't Assess

[ASK ALL IF WH1 <>1, ELSE SKIP TO EL1]

WH12. Number of water heater units meeting these specifications: [NUMERIC OPEN END, 99 = Can't assess]

[END LOOP IF WH12 = WH1]

Exterior

EL1. Does the home exterior have any light sockets?

1. Yes
2. No
99. Can't Assess

[SKIP TO LS1/LIGHTING IN STORAGE IF EL1=2, 99]

EL2. How many hours per day is the primary exterior light fixture in use? [OPEN END NEAREST WHOLE NUMBER, 99=Can't Assess]

EL3. What type of bulb is the primary exterior light fixture?

1. CFL
2. Incandescent
3. Halogen
4. LED
99. Can't Assess

Exterior Lighting

Please enter the following for each type of socket in the exterior.

EX1. Please select the socket type:

1. Standard screw-based
2. Specialty screw-based
3. Pin-based
00. Other, specify

EX2. Please select the control type for this socket:

1. On-Off
2. Dimmable
3. 3-Way
4. Motion Sensor
5. Programmable
00. Other, specify
99. Can't Assess

EX3. Please select the bulb type in this socket:

01. Incandescent
02. CFL
03. Fluorescent
04. LED
05. Halogen
00. Other, specify
07. Empty

EX4. Please select the bulb shape for this socket:

1. Standard shape/pear shape
2. Twist/Spiral
3. Globe
4. A lamp
5. Bullet/Torpedo
6. Bug light
7. Spot/Reflector/Flood
8. Circline
9. Tube
00. Other, specify
96. Not applicable
99. Can't Assess

EX5. How many total sockets around the exterior are exactly like this one? [NUMERIC OPEN END] [NOTE TO AUDITOR THAT A SOCKET TYPE SHOULD HAVE THE SAME BULB TYPE, BULB SHAPE, AND CONTROL TYPE]

EX6. Is there another socket type around the exterior?
1. Yes
2. No

[GO THROUGH LOOP EX1-EX6 IF EX6=1, IF NOT SKIP TO LS1]

Lighting in Storage

LS1. Are there any light bulbs in storage?
1. Yes
2. No
99. Can't Assess

[SKIP TO F1 IF LS1=2,99]

LS1b. Are there screw-based bulbs, pin-based bulbs, or both types of bulbs in storage?
1. Screw-based only
2. Pin-based only
3. Both types
4. Neither
99. Can't assess

Screw-Based Lights in Storage

[SKIP TO SP1 IF LS1b = 2, 4, OR 99]

SS1. Please enter number of screw-based standard (twist) CFLs bulbs in storage: [OPEN END NUMERIC RESPONSE] [NOTE COUNT INDIVIDUAL BULBS NOT PACKAGES]

SS2. Please enter number of screw-based specialty (covered, rounded) CFL bulbs in storage? [OPEN END NUMERIC RESPONSE]

SS3. Please enter number of screw-based incandescent bulbs (standard bulbs) in storage? [OPEN END NUMERIC RESPONSE]

SS4. Please enter number of screw-based LED bulbs in storage? [OPEN END NUMERIC RESPONSE]

SS5. Please enter number of screw-based halogen bulbs in storage? [OPEN END NUMERIC RESPONSE]

SS6. Other screw-based bulbs in storage? [OPEN END NUMERIC RESPONSE]
[ASK IF SS6>0]

SS6A. Describe bulb type: [OPEN END RESPONSE]

Pin-Based Lights in Storage

[SKIP TO PL1 IF LS1b = 1, 4, 99]

SP1. Please enter number of pin-based CFL bulbs in storage? [OPEN END NUMERIC RESPONSE]

SP2. Please enter number of pin-based linear fluorescent bulbs in storage? [OPEN END NUMERIC RESPONSE]

SP3. Please enter number of pin-based LED bulbs in storage? [OPEN END NUMERIC RESPONSE]

SP4. Please enter number of pin-based halogen bulbs in storage? [OPEN END NUMERIC RESPONSE]

SP5. Other pin-based bulbs in storage? [OPEN END NUMERIC RESPONSE]

[ASK IF SP5>0]

SP5A. Describe bulb type: [OPEN END RESPONSE]

Plans for Stored Lighting (Ask to Resident)

PL1. On average, how many times per year do you replace a light bulb? [OPEN END NUMERIC RESPONSE]

PL2. Are you planning to replace any incandescent lights with CFLs?

1. Yes

2. No

96. Not applicable/No incandescent bulbs installed

99. Don't Know/ Refused

Final Questions

F1. What is the age of the home (in years)? [NUMERIC OPEN END]

F2. What is the approximate square footage of living space? [NUMERIC OPEN END]

F5. Number of levels in the home, not including basement or attic? [NUMERIC OPEN END]

F5a. Does the home have any wall insulation?

1. Yes

2. No

99. Can't assess/Refused

F9. Record Time When Site Visit is Finished: [NUMERIC OPEN END]

F10. Record Gift Card Number Given to Participant: [NUMERIC OPEN END]

The survey is complete. Please thank the homeowner.

Enter any notes relevant to the data captured for this home as needed here: [TEXT BOX]