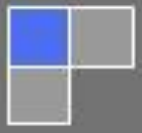
2012

Pennsylvania Statewide Residential End-Use and Saturation Study

Submitted to: The Pennsylvania Public Utility Commission

Submitted by: **GDS Associates, Inc**
In partnership with: **Nexant, Inc. & Mondre Energy**



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1 EXECUTIVE SUMMARY

1.1 OVERVIEW

This report presents the results of a residential energy efficiency baseline study for the service areas of seven investor-owned electric utilities in Pennsylvania. GDS Associates (GDS), Nexant, Inc. (Nexant) and Mondre Energy – collectively known as the Statewide Evaluation (SWE) Team – were contracted by the Pennsylvania Public Utility Commission (PUC) to perform an energy efficiency potential assessment for the State of Pennsylvania and its seven largest electric distribution companies (EDCs). The EDCs included as part of this study are below:

- Duquesne Light Company (DLC)
- Metropolitan Edison Company (MetEd)
- Pennsylvania Electric Company (Penelec)
- Pennsylvania Power Company (Penn Power)
- West Penn Power Company (WPP)
- PPL Electric Utilities (PPL)
- PECO Energy Company[1]

The first step in the energy efficiency potential assessment process is to establish baseline energy characteristics for the residential, commercial and industrial sectors. This report documents the findings of that end use and saturation study in the residential sector[2], and serves to provide baseline energy equipment saturations as well as electric equipment efficiency levels for the subsequent residential electric energy efficiency potential assessment.

This study evaluates the characteristics of the energy using equipment and efficient electric equipment stock present in the residential sector of Pennsylvania for the seven EDC service territories. GDS used its experience working with the Pennsylvania EDCs (as part of the SWE Team evaluating their current energy efficiency programs) and performing previous energy efficiency potential studies to help identify the critical data collection needs from the on-site surveys that will be integral to future resource planning and energy efficiency activities in Pennsylvania.

The results found within this residential baseline study rely solely upon primary research conducted in the form of onsite customer surveys. A review of available secondary sources, such as US Census data and manufacturer product data, was also performed in an effort to clarify and compliment primary research efforts in addition to filling in gaps – either in the presence or quality of data.

[1] The SWE Team did not collect primary data as part of its onsite survey for PECO, but rather relied on data collected during Spring 2010 and published as part of the 2011 Baseline Report for PECO published by Navigant Consulting prepared February 7, 2011.

[2] A companion report, issued by Nexant, will detail the findings in the commercial and industrial sectors.

1.2 METHODOLOGY

The SWE Team performed on-site surveys during Fall 2011 to collect detailed and accurate inventories of residential appliance, equipment, and housing characteristics for residential consumers throughout the state of Pennsylvania. This study captured a variety of energy-related data, including the penetration of electric- and non-electric equipment and appliances, energy efficiency levels of electric equipment and appliances, building shell characteristics, lighting socket counts, and other relevant information.

A total of 488 site surveys (including data from the 2011 PECO Baseline Study) stratified by EDC, housing segment, and annual kWh consumption were conducted. The desired level of precision for EDC specific results, ±10% precision, with 90% confidence, necessitated a total of 70 on-site visits per EDC. The data for all EDC's were then aggregated to the statewide level, and these estimates carry precision of ±5% precision, with 95% confidence. The sample size was not large enough, nor was it intended, to provide housing segment specific results within each EDC.[3]

The survey estimates presented in this report are subject to a certain degree of uncertainty. Practical constraints make it impossible for the SWE team to conduct an on-site survey of the entire population of Pennsylvania residences, necessitating the selection of a small sample population from which to collect data. When using a sample to estimate a population metric, factors of uncertainty are introduced, primarily based on the size of the sample and the existence of biases within the sample.

The uncertainty can be described by the confidence level and margin of error. As noted above, the targeted confidence level and margin of error in this study was set at 95% and 5%, respectively, for the state-wide residential sector. This means that if this study were repeated multiple times, 95% of the studies would produce estimates to within ±5% of the true population value.

Given the different characteristics between single family (SF), multifamily, and manufactured homes, the SWE team developed case weights to control for sample bias when presenting results by EDC.[4] Further, in an effort to provide a more inclusive study and to provide estimates for each of the EDC territories, a sample of 70 residential sites was selected for each EDC irrespective of the size of the EDC. Thus, when aggregating the EDCs estimates to the statewide level, it was necessary to create a second set of case weights to control for differences in the number of residential accounts across the seven EDCs. This approach provides more weight to the data for larger EDCs when compared to smaller EDCs in the statewide findings.

[3] At the statewide level, there were a significant number of observations to make statistically valid conclusions in excess of ±10% precision, with 90% confidence for single family-detached housing. For single family-attached and multifamily housing segments, however there were only enough observations to make assumptions at ±15% precision, with 90% confidence, and the number of manufactured housing observations was significantly small enough that the SWE team does not recommend using for statistically reasonable conclusions.

[4] EDC case weights also controlled for sample bias related to the age of the head of household. The on-site sample had a higher proportion of older homeowners than the general population (according to 2010 US Census data). Additional discussion of the case weights can be found in section 3.4.2

1.3 STATEWIDE RESULTS

Statewide level findings include data collected from both the 420 on-site surveys conducted by the SWE team throughout six EDCs and, when possible, data from 68 on-site surveys conducted by Navigant for the 2011 PECO Residential Baseline Study. The data presented below represents statewide results for all housing types combined. More detailed data, including a breakdown by housing type is included in section 4 (Statewide Residential Findings) of this report.

This report frequently sites two metrics: penetration and saturation. It is important to understand how each is defined in this study.

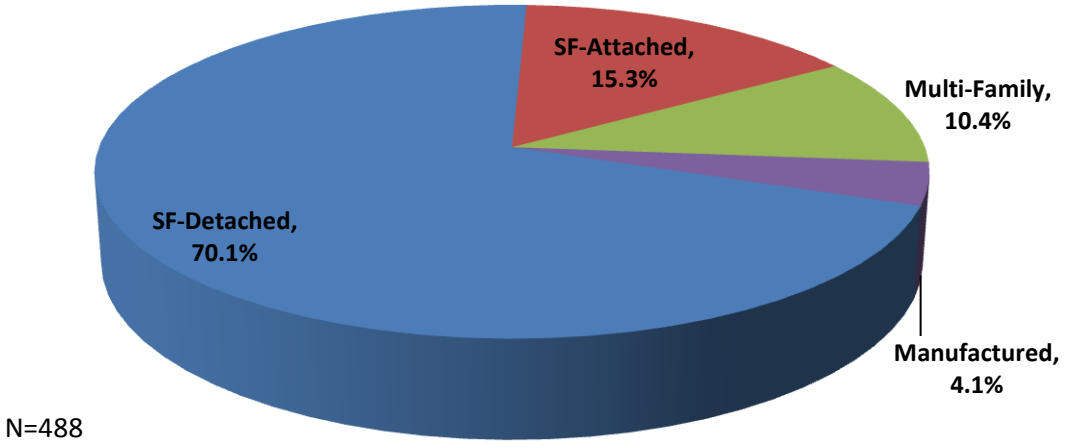
Penetration is the proportion of households that have one or more of a particular appliance (or other piece of equipment). It is calculated by dividing the number of customers with one or more of an appliance (or other piece of equipment) by the total number of surveys with responses to that question.

Alternatively, saturation represents how many of a particular appliance/equipment exists among all customers. It is calculated by dividing the total number of a particular appliance/equipment by the total number of surveys with responses to that question. This percentage is typically higher than the corresponding penetration because some households will have more than one of the appliance.

1.3.1 Basic Home Characteristics

Housing Type. After applying statewide weighting factors, SF-Detached housing represents 70% of the total surveyed housing units. SF-Attached (townhouses, row houses, duplexes) represents 15% of the statewide housing units, followed by multifamily housing (condos, apartments, etc.), and manufactured (or mobile) homes.[5]

Figure 1-1: Statewide Residences by Housing Type



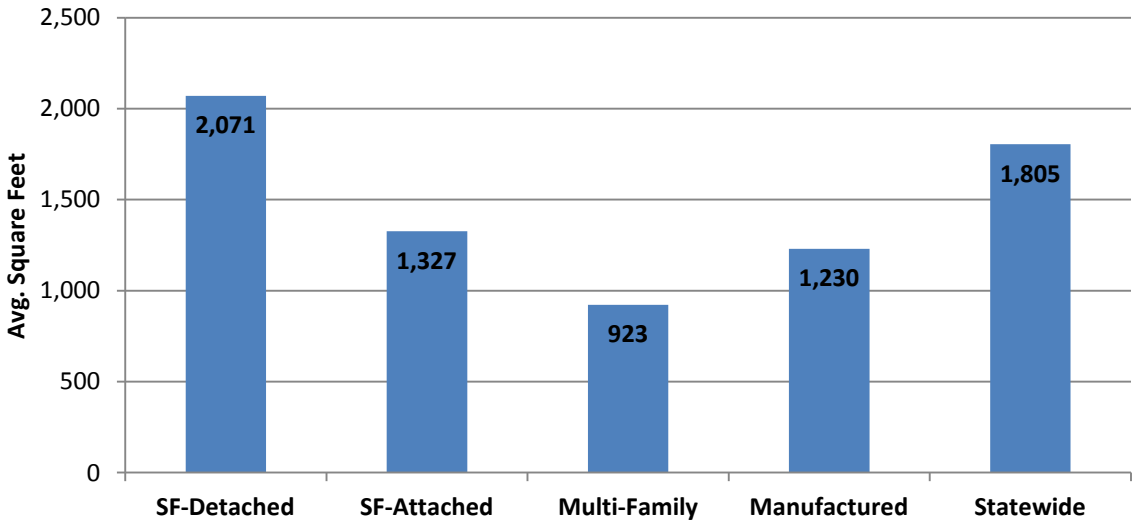
N=488

[5] Manufactured housing in this study refers to mobile homes and other housing on a fixed, steel chassis and towed to the home site. Modular homes are included as SF-detached housing.

Average Age. The average age of housing units statewide was 50 years old. Approximately 42% of homes were built prior to 1960 while only 8% were built within the last 10 years.

Average House Size. The average square footage of conditioned space, including finished basements, for all housing was approximately 1,805 square feet.[6] Single family detached housing square footage was approximately 2,070 square feet (N=350). SF-Attached, multifamily, and manufactured housing conditioned space square footage ranged from roughly 925 sq. ft. to 1,325 sq. ft.

Figure 1-2: Average Square Feet of Conditioned Space by Housing Type[7]



Monthly Energy (kWh) Use. Approximately 22% of surveyed homes statewide consumed less than 500 kWh per month based on historical billing data. 60% of homes consume less than 1,000 kWh per month. Only 16% consume more than 1,500 kWh monthly. In general, SF-Detached and manufactured housing had the highest proportion of 1,500 kWh and above residences. As expected, multifamily units were most likely to consume 500 kWh or less monthly.

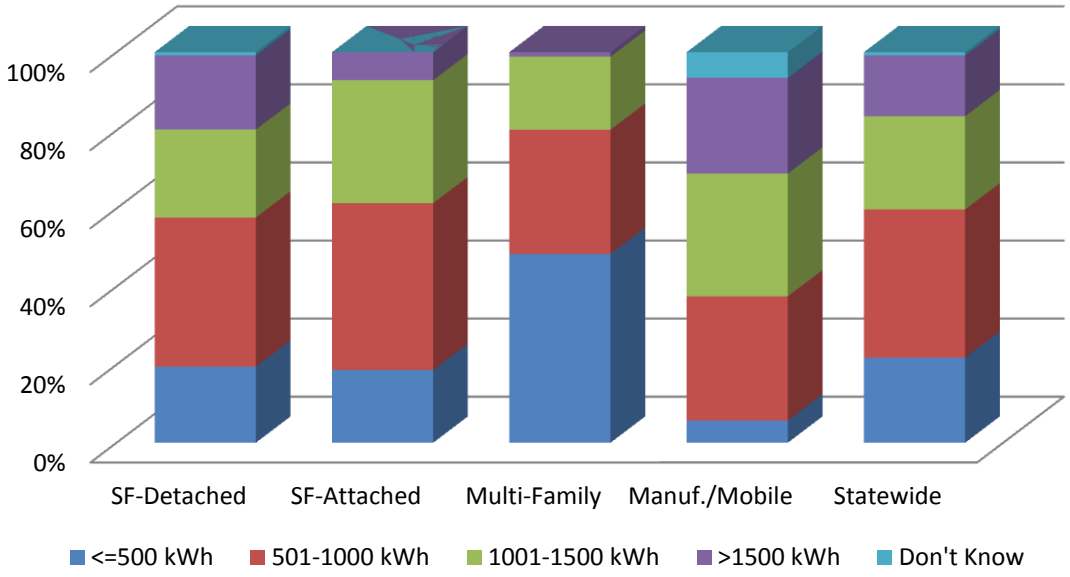
Foundation. Approximately 47% of surveyed homes statewide had unconditioned basements; an additional 35% had conditioned basements. Only 7% and 8% were slab on-grade or crawlspace foundations, respectively.

Other Demographics. Statewide, the average annual number of occupants was 2.6 people per household. Nearly all homes were used as year-round residences (97%) and the majority were owner-occupied (81%).

[6] For purposes of this baseline study, conditioned space was generally classified as any area, room, or finished space being heated and/or cooled by equipment or appliance.

[7] "Statewide" refers to all housing types combined throughout this study.

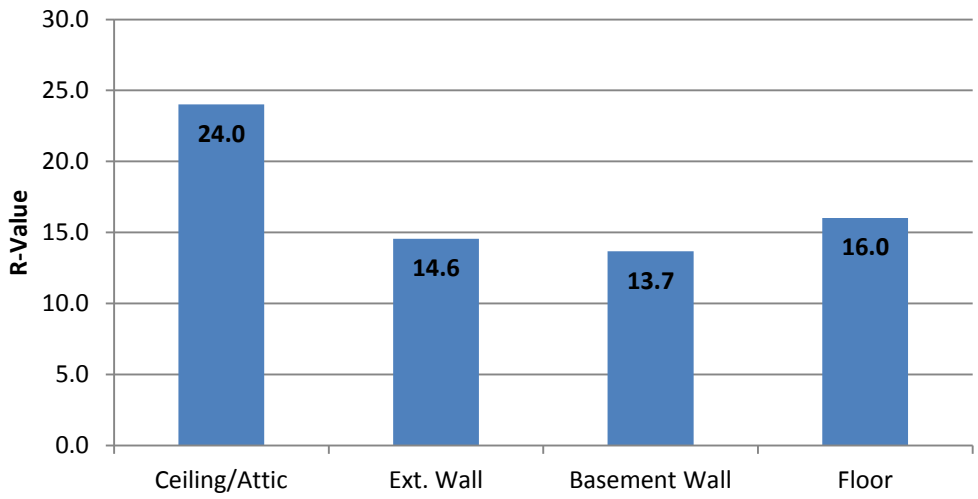
Figure 1-3: Distribution of Average Monthly kWh Consumption (based on historical billing data)



1.3.2 Building Shell

Insulation. Insulation was only verified to be absent in 9% of attics/ceilings and 19% of exterior side walls. Insulation was less common in basement walls or floor space. The average R-value of insulation, when present, is depicted in the tables below for all houses statewide.

Figure 1-4: Average Insulation R-Value by Location



Windows. On average, houses statewide have a total of 17 windows per residence. The average square footage of window area per home is 150 square feet.

12% of all surveyed windows statewide were single-paned windows. Approximately 19% of surveyed windows were believed to be double-pane low-E or triple-paned windows. The majority of windows were standard double-paned.

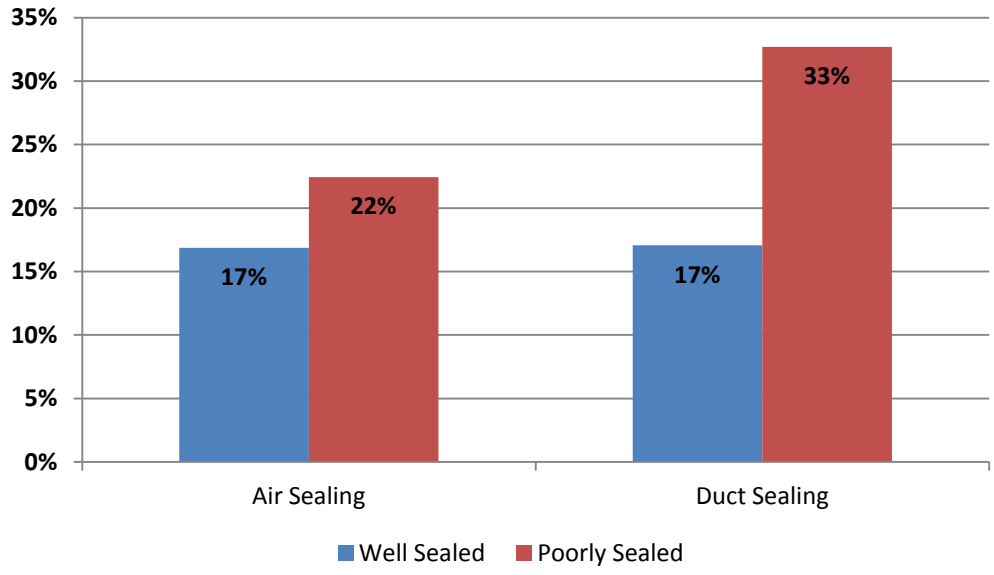
Table 1-1: Average Number of Windows, Window Area, and Glazing Type

Average # per Home	Average Window Area per Home	% of All Windows Single-Pane	% of All Windows Double Pane	% of All Windows DP Low-E or Triple Pane
17	150	12%	69%	19%

Air/Duct Sealing. Proper air sealing and duct sealing was qualitatively assessed during the on-site surveys. Surveyors were asked to examine residences for signs of air leakage at or around door and window sills, recessed can lighting, HVAC closets, or other points of entry. Ductwork was also examined for proper sealing techniques, including mastic or rated duct tape around a sampling of joints.

In general surveyors found that 17% of all surveyed homes statewide were well sealed in terms of air infiltration and duct-sealing quality. Air sealing was assessed as poor in 22% of surveyed homes, while duct sealing was assessed as poor in 33% of homes, suggesting a sizeable opportunity for proper duct sealing procedures.

Figure 1-5: Air Sealing and Duct Sealing Quality

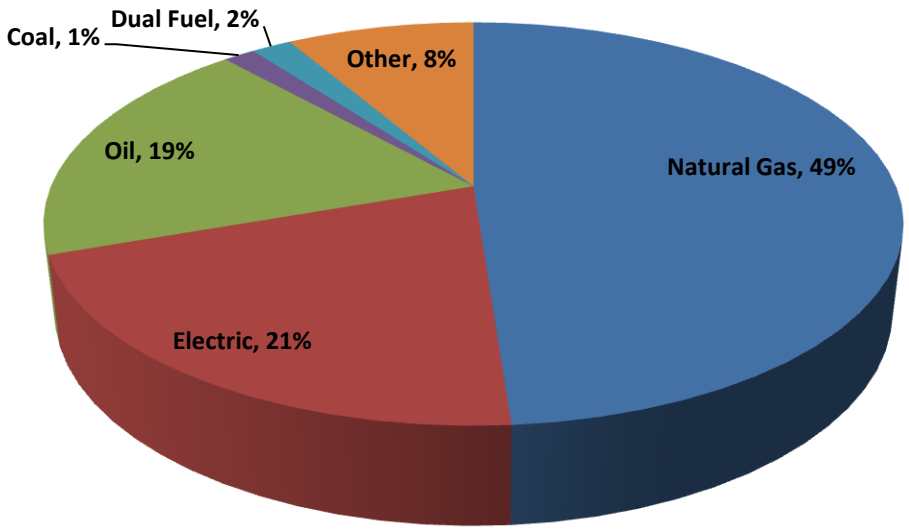


1.3.3 HVAC Equipment

Heating Fuel Type. Natural gas was the most common form of primary heating fuel-type statewide (49%). Electric heating was the primary fuel in 21% of households statewide. Oil heating systems were present in 19% of households. Other category includes propane, kerosene, and wood heating.

System Type (Primary Electric). The majority of all heating systems are central furnaces across all heating types; the majority of primary electric heating systems are air source heat pumps (43%). Baseboard heating is also common among primary electric systems (28% of all electric heated homes statewide), and electric furnaces are found in 16% of primarily electric-heated homes. The remaining 13% of primary electric systems include geothermal, wall-mounted space heating, and electric boilers.

Figure 1-6: Primary Heat Fuel Type (All Fuels)

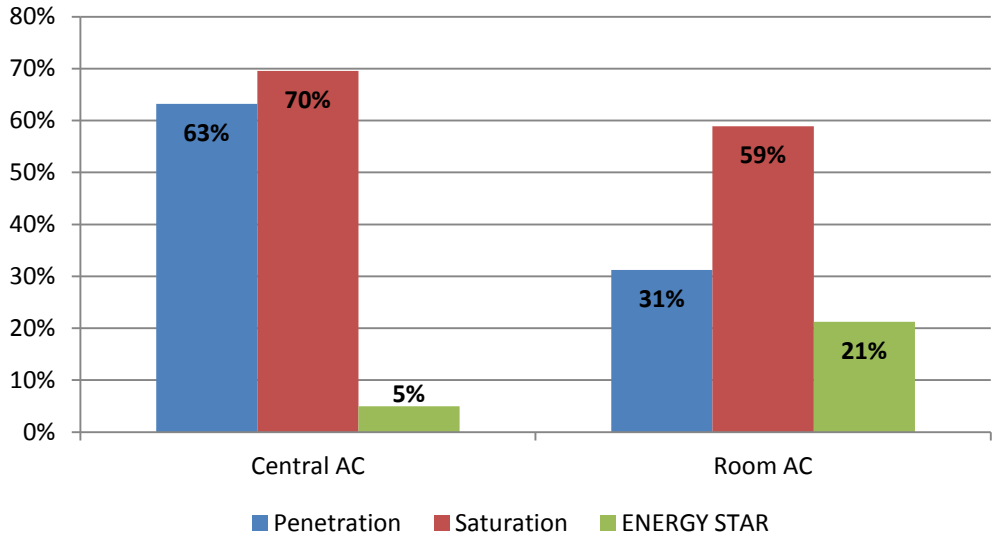


Cooling. 63% of homes have at least one central air conditioner and 31% of homes have at least one room air conditioner. After accounting for residences with multiple central or room air conditioning units, the saturation of central air conditioning in Pennsylvania households is 70% and the saturation of room air conditioners is 59%.

Only 5% of all central air conditioning, including central air only, heat pumps and mini-split systems, were verified to have a SEER rating of 14.5 or better (currently meeting or exceeding ENERGY STAR standards). For comparison, 32% of central air conditioners in residences statewide are currently below the minimum federal efficiency standard of SEER 13.

Room air conditioners fared better: 21% of room air conditioners were either verified to possess an ENERGY STAR rating or exceeded current ENERGY STAR compliancy standards.

Figure 1-7: Penetration and Saturation of Cooling Systems



Only 5% of all central air conditioning, including central air only, heat pumps and mini-split systems, were verified to have a SEER rating of 14.5 or better (currently meeting or exceeding ENERGY STAR standards). For comparison, 32% of central air conditioners in residences statewide are currently below the minimum federal efficiency standard of SEER 13.

Room air conditioners fared better: 21% of room air conditioners were either verified to possess an ENERGY STAR rating or exceeded current ENERGY STAR compliancy standards.

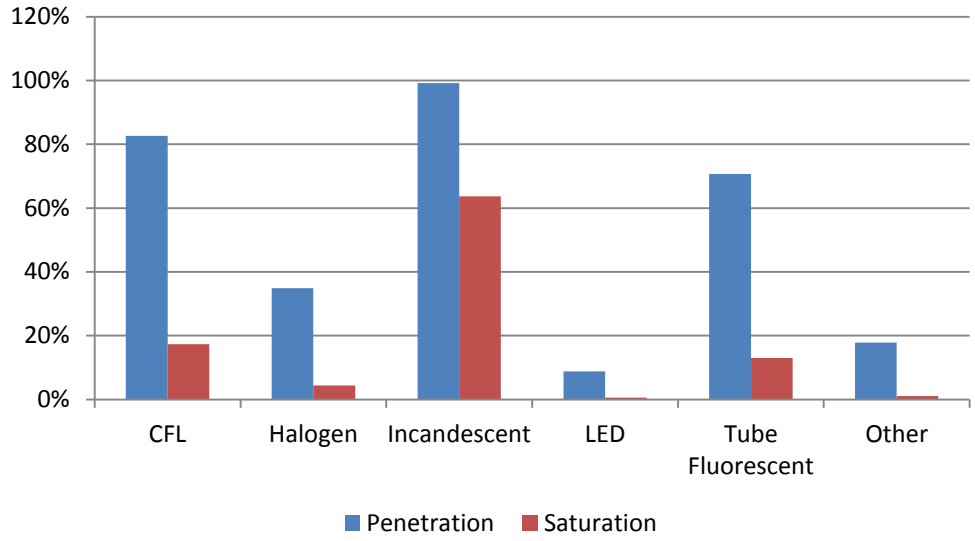
1.3.4 Lighting

Sockets per Home. On average, there were a total of 54 interior lighting sockets per home across all housing types statewide. SF-Detached housing had an even greater number of average sockets (63), followed by SF-Attached housing (37) and multifamily housing (25).

In addition to interior lighting, the average number of exterior lighting sockets was six. SF-Detached housing averaged 8 exterior bulbs per home, while other housing types typically had 2-4 exterior sockets per home.

Bulb Type. The penetration and saturation of lighting by bulb type is present in the table below. Lighting saturation refers to the proportion of lighting composed of the given bulb type. For this reason, lighting saturation is lower than or equal to its corresponding penetration. Nearly 83% of all housing units statewide possess at least one compact fluorescent light (CFL) bulb. However, CFLs are only found in 17% of all sockets statewide. Incandescent lighting, by contrast, is found in 99% of all homes and 64% of all sockets.

Figure 1-8: Penetration and Saturation of Lighting by Bulb Type

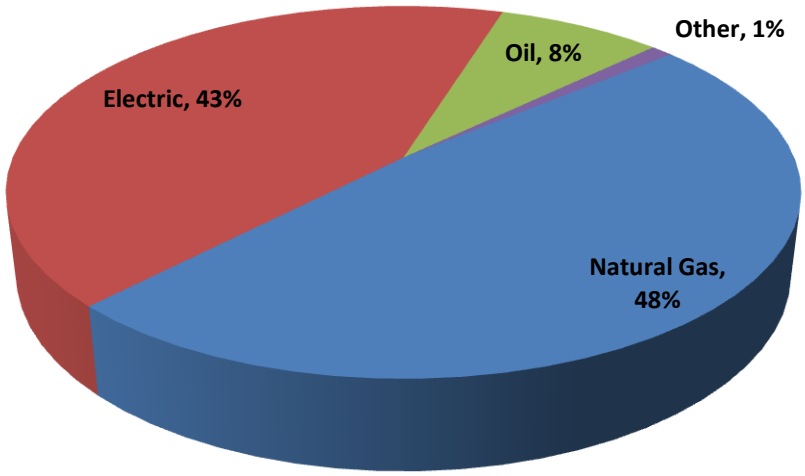


Not all sockets can easily be retrofitted with efficient lighting options. After eliminating current tube fluorescent lighting, certain specialty lighting, and sockets that are currently empty the average number of sockets per home that could reasonably be expected to receive CFL bulbs is reduced to 45 interior sockets. Based on this reduced socket count, current CFL saturation increases to 21%

1.3.5 Water Heating

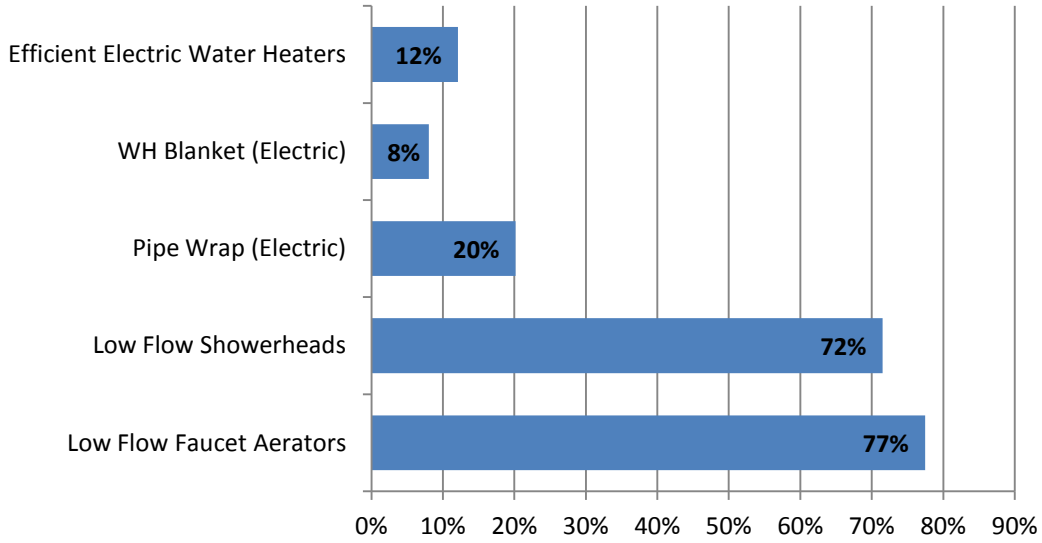
Fuel Type. The most common fuel type for domestic water heating is natural gas (48%), followed by electric (43%), and oil (8%). Other forms of domestic water heating, such as propane, solar, and wood are relatively uncommon.

Figure 1-9: Water Heating Fuel Type



Efficient Water Heating Measures. The table below describes the % of equipment related to water heating that is currently energy efficient. Twelve percent of electric water heaters currently have an energy factor (EF) =.93 or above. Additionally, 8% of electric water heaters are currently equipped with a water heater blanket (tank wrap) and 20% of pipes at or around the water heater are currently wrapped to reduce stand-by losses.

Figure 1-10: Water Heating Efficiency Measures



Low flow showerheads and faucet aerators were fairly common among surveyed housing units. Nearly 72% of all showers were equipped with the low-flow showerheads and 77% of all sinks were equipped with faucet aerators.

1.3.6 Appliances and Other

Appliance Penetration and Saturation. The table below outlines the penetration and saturation of all remaining major appliances, consumer electronics, and other common equipment for which we collected data. The saturation percentage is typically higher than the corresponding penetration because some households will have more than one of the appliance.

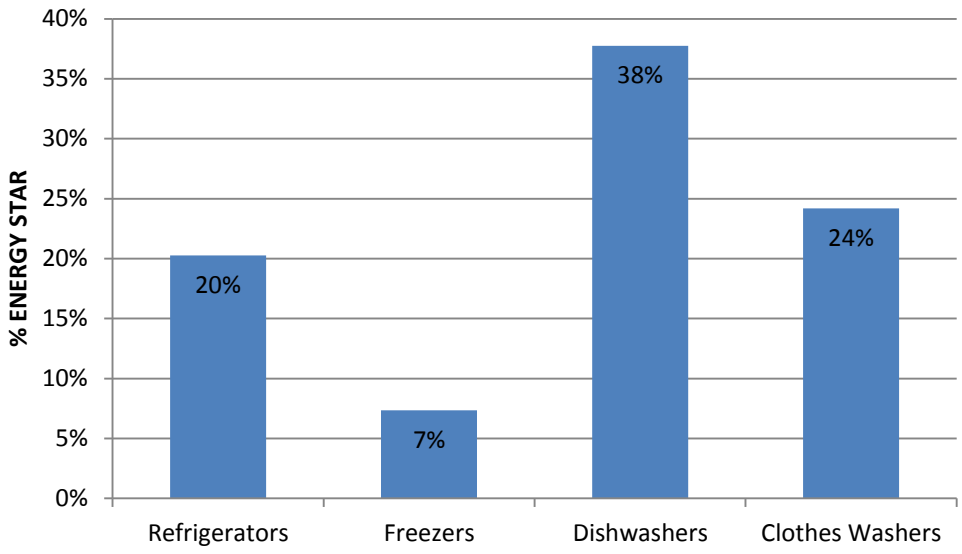
Table 1-2: Penetration and Saturation of Major Appliances and Other Equipment

Equipment	Penetration	Saturation
Major Appliances		
Refrigerators	99%	140%
Freezers	39%	43%
Dishwashers	71%	71%
Clothes Washers	91%	92%
Electronics		
Televisions	98%	301%
PC (Desktop/Laptop)	89%	164%

Equipment	Penetration	Saturation
Tablet PCs	11%	11%
DVD Players	87%	132%
VCR	44%	57%
Gaming Systems	41%	57%
Fax Machines	13%	15%
Stereo Systems	58%	73%
Home Theater	24%	26%
Mobile Phone Charger	89%	177%
Seasonal		
Dehumidifiers	42%	44%
Humidifiers	17%	19%
Ceiling Fans	79%	257%
Recreational		
Pools	10%	10%
Hot Tubs	6%	6%

Major Energy Star Appliances. Of the major appliances, dishwashers were the most common ENERGY STAR rated appliance. 36% of all dishwashers were verified to have been ENERGY STAR rated either by visual inspection or through manufacturer data. Similarly 24% of clothes washers, 20% of primary refrigerators, and 7% of freezers were verified to have been ENERGY STAR rated.

Figure 1-11: ENERGY STAR Appliances



It should be noted that there are likely occasions where an appliance was ENERGY STAR compliant at one time, but may have since lost its rating due to increased efficiency standards. For purposes of

this study, appliances that were once designated as ENERGY STAR (but would not meet current and updated standards) were included in the pool of efficient appliances.[8]

1.4 EDC OVERVIEW

In addition to presenting results at the statewide level, this report also provides the results of the on-site surveys collected for each of the EDCs. EDC level results have been weighted based on housing type and age of head of household. See section 3.4.2 for more details.

More detailed and additional data tables are included in section 5 (EDC-Specific Findings) of this report.

1.4.1 Electric Fuel Share by End Use

The percentage of homes that are primarily heated, with electricity, not including dual fuel systems, ranged from 8% in the Duquesne service area to 30% in the MetEd territory. Electric space cooling, either in the form of central cooling systems or room air conditioners, ranged from 69% in the Penelec area to 98% in the MetEd territory. Electric water heating ranged from 11% of surveyed homes (Duquesne) to 57% (MetEd). Other major electric end-uses (lighting, appliances, and electronics) were found in 100% of surveyed homes.

Table 1-3: Electric Fuel Share by End Use

Electric End Use Share	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Primary Space Heating	8%	30%	11%	23%	28%	29%	15%
Space Cooling	94%	99%	69%	93%	87%	88%	98%
Water Heating	11%	57%	38%	42%	54%	56%	32%
Lighting	100%	100%	100%	100%	100%	100%	100%
Appliances/Plug Load	100%	100%	100%	100%	100%	100%	100%

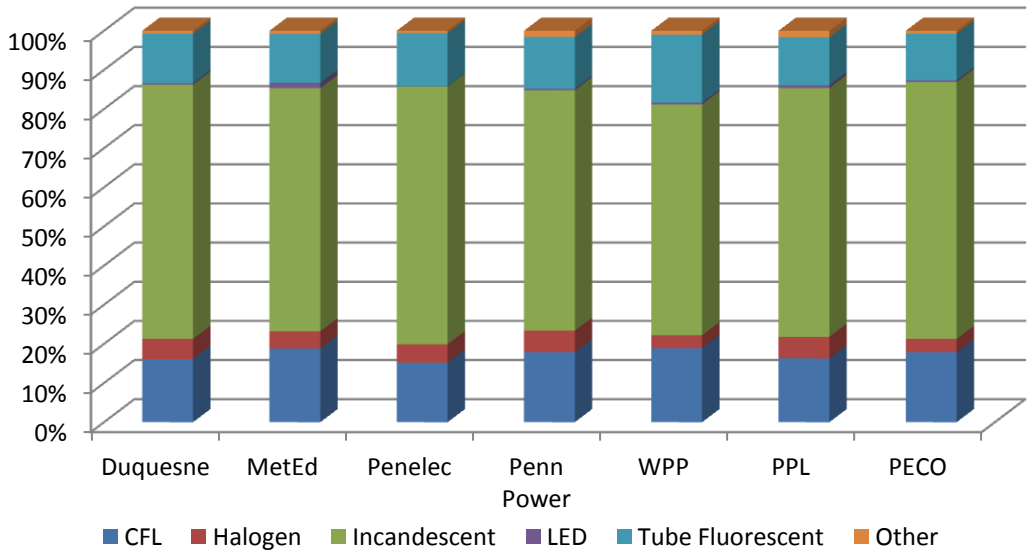
1.4.2 Lighting

Figure 1-12 demonstrates the saturation of all interior sockets by bulb type. In general, 15%-19% of all interior sockets were fitted with compact fluorescent light (CFL) bulb technology. By contrast, the saturation of incandescent lighting ranged from 59% to 66% of all interior sockets. The saturation of LED bulb technology is almost non-existent (1% or less) across the EDCs.

After accounting for interior lighting sockets where CFL bulbs are unlikely to be replaced due to incompatible socket and bulb types (i.e. current fluorescent tube fixtures, pin-based halogens, and other specialty bulbs), the saturation of CFL lighting increases to 18%-23% of all eligible bulb types.

[8] This reporting is consistent with the SWE team's method for estimated energy efficient technology saturations used in the electric energy efficiency potential study.

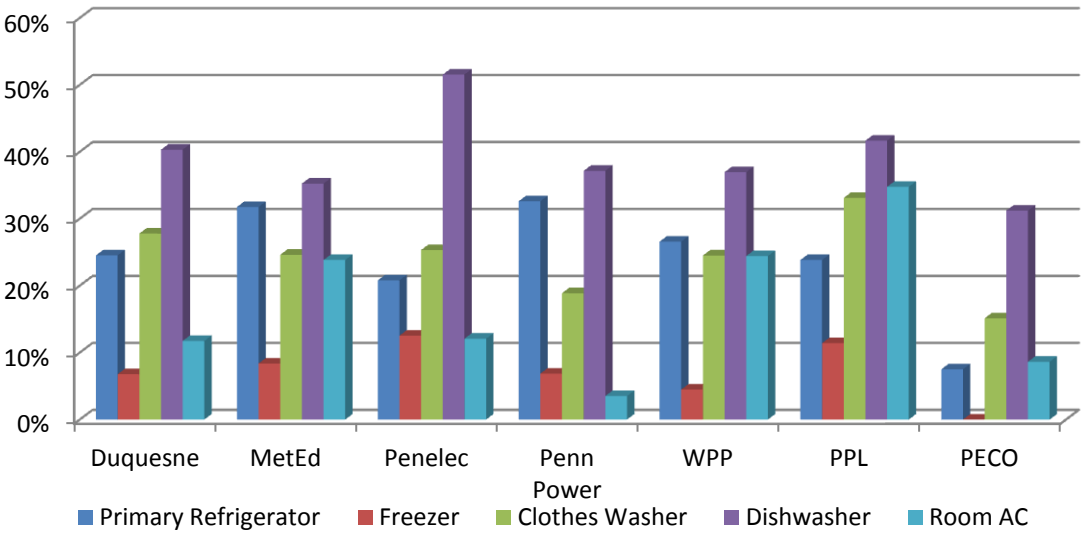
Figure 1-12: Interior Lighting Socket Saturation by Bulb Type



1.4.3 ENERGY STAR Saturation for Select Appliances by EDC

In general, dishwashers and refrigerators were the two appliances most likely to possess an ENERGY STAR rating in households across the seven EDCs, followed by clothes washers and room air conditioners. Stand-alone freezers were generally found to not have the ENERGY STAR rating. Detail regarding the efficiency levels of other electric equipment, including HVAC and water heating systems by EDC can be found in section 5 of this report.

Figure 1-13: ENERGY STAR Saturation of Select Appliances by EDC



2 INTRODUCTION

2.1 OVERVIEW

This report presents research results conducted in the state of Pennsylvania by the Statewide Evaluation (SWE) Team of GDS Associates, Nexant, and Mondre Energy as part of a residential baseline study. The baseline energy study's objective is to assess a "market baseline" for the energy efficiency level of existing residential building and equipment stock as well as estimates for the saturation of key energy efficiency and conservation (EE&C) measures for the seven EDCs bound by Act 129.[9]

The seven Electric Distribution Companies (EDCs) represented in this study are:

- Duquesne Light Company (DLC)
- Metropolitan Edison Company (MetEd)
- Pennsylvania Electric Company (Penelec)
- Pennsylvania Power Company (Penn Power)
- West Penn Power Company (WPP)
- PPL Electric Utilities (PPL)
- PECO Energy Company

The SWE Team completed seventy on-site surveys within six of the seven EDCs, excluding PECO. In total, the SWE Team conducted 420 residential on-site surveys over a 12-week period in 2011 from late September through mid-December. Using data collected for the 2011 PECO Baseline study where applicable, the SWE Team was able to incorporate 68 additional surveys for a total of 488 surveys statewide.

2.2 ACT 129 BACKGROUND

Pennsylvania ACT 129 was passed in October of 2008 and signed into law. The Act requires that seven of the state's largest EDCs deliver energy efficiency programs that reduce their electric load by 1% by May 31, 2011 and 3% by May 31, 2013. Act 129 also requires a total peak load reduction of 4.5% by May 31, 2011.

The Pennsylvania Public Utility Commission (PUC) is currently considering targets for the possible implementation of Phase 2 of Act 129 starting June 1, 2013. In mid-2009, the SWE team was selected by the PUC to become the State's first Statewide Evaluator. A key element of the SWE Team's scope of work is to conduct an electric energy efficiency market potential study to help inform the implementation of Phase 2 of Act 129. As a first step in this process, the SWE team conducted residential, commercial and industrial energy efficiency baseline studies to characterize

[9] Note that while PECO results are presented in this study, the SWE team incorporated findings from a prior 2011 PECO Baseline report rather than collect additional primary data. See the 2011 PECO Baseline Study, prepared by Navigant Consulting, February 7, 2011.

the energy usage and electric energy efficiency opportunities in the State of Pennsylvania for the seven EDCs bound by Act 129.

The results of the residential sector baseline study are presented within this report. The result of the commercial and industrial sector baseline study are presented in a companion report presented by Nexant.

2.3 STUDY GOALS

While this study aims to assess current residential electric equipment stock and estimate the saturation of key energy efficiency and conservation measures as eventual inputs to the energy efficiency market potential study, it is also designed to serve as a stand-alone residential baseline study presenting contemporary information across the seven largest EDCs in Pennsylvania. These results can supply information that is useful for future energy efficiency and demand response program development, system planning, and obtaining a general understanding of the energy consuming equipment located throughout the state of Pennsylvania. Based on these ultimate considerations, the following goals were identified for this study:

- Select a representative stratified random sample of residential customers within each EDC for participation in the baseline study
- Determine the current saturation of energy using equipment in residences at the statewide and EDC level
- Determine the current saturation of electric efficiency measures in residences at the statewide level by housing type, as well as at the EDC level

2.4 ORGANIZATION OF THE REPORT

The remainder of this report includes the following sections:

- Section 3 – Study Methodology
- Section 4 – Statewide Residential Findings
- Section 5 – EDC Specific Findings
- Appendices *(On-site Survey Instrument, Initial Recruitment Letter, and Recruitment Telephone Script)*

3 METHODOLOGY

3.1 STUDY PARAMETERS

The SWE Team performed on-site surveys from September 2011 through December 2011 to collect detailed and accurate inventories of residential structure and equipment characteristics throughout the state of Pennsylvania. This study captured a variety of energy-related data, including the penetration of electric- and non-electric equipment and appliances, energy efficiency levels of electric equipment and appliances, building shell characteristics, lighting socket counts, and other relevant information.

A total of 488 site surveys (including data from the 2011 PECO Baseline Study) stratified by EDC, housing segment, and annual kWh consumption were conducted. The desired level of precision for EDC specific results, ±10% precision, with 90% confidence, necessitated a total of 70 on-site visits per EDC. The data for all EDC's were aggregated to the statewide level, and these estimates carry precision of ±5% precision, with 95% confidence. The sample size was not large enough, nor was it intended, to provide housing segment specific results within each EDC.[10]

3.2 PRIMARY DATA COLLECTION

While each EDC routinely captures important demographic and equipment characteristics in their territory through Residential Appliance Saturation Studies and other targeted studies, there is often a notable absence of data specific to the penetration of energy efficient equipment. To overcome this hurdle, the SWE team conducted a survey of Pennsylvania residential electric consumers to gather accurate data that is specific to Pennsylvania and the six EDC service territories included in this study (primary onsite data for PECO from Navigant's 2011 PECO Baseline Study was also included where possible). In order to maximize the reliability of the survey, the SWE team aimed to gather information through customer site visits.

3.2.1 Sample Design

The target precision and confidence level for the residential on-site survey was ±10% precision, at the 90% confidence interval, for each EDC. To achieve this desired level of precision, a sample of 70 was required for each EDC. To insure proper representation, the sample was designed to include a broad cross-section of residential customers for each EDC. The samples for each EDC were stratified by home type and average electric consumption. Stratifying on home type and energy use insured representation across all levels of consumption, which in turn ensures representation of other key demographic characteristics (i.e., number of occupants, square footage, heating/cooling equipment

[10] At the statewide level, there were a significant number of observations to make statistically valid conclusions in excess of ±10% precision, with 90% confidence for SF-Detached housing. For SF-Attached and multifamily housing segments, there were only enough observations to make assumptions at ±15% precision, with 90% confidence, and the number of manufactured housing observations was significantly small enough that the SWE team does not recommend using for statistically reasonable conclusions.

type, and other key metrics), without over-burdening the overall stratification and sampling process. To accurately produce a recruitment sample representative of each EDCs current population, it was important to remove non-premise buildings and inactive accounts from each EDC customer database. Ultimately, the SWE team created a recruitment sample of 700-900 residences within each EDC. The 700-900 recruitment sample mirrored (as closely as possible) the complete customer databases of each EDC. While the SWE team only stratified the recruitment sample based on housing type and electric consumption history, the SWE team also verified that the recruitment sample had similar geographic distribution compared to the customer database. In addition, the recruitment sample distribution of home heating type was also compared to the full customer dataset (when available). Recruitment is discussed in further detail later in this section.

The target confidence interval and precision for the residential on-site survey sample for each EDC was a 90% confidence interval with a precision interval of less than 10%. This yielded a final sample size of approximately 70 on-site surveys for each EDC.

With a significantly large population, ±5% precision at the 95% confidence level can generally be achieved with a minimum random sample size of 385 observations. The 420 on-site surveys conducted by the SWE team and 68 on-site surveys conducted for the 2011 PECO Baseline study result in 488 on-site surveys. Thus, results presented at the statewide level may achieve higher levels of precision and confidence than can be found at the EDC level.

3.2.2 Recruitment

The first step in the survey process was to design a letter to inform customers in the recruitment sample that an energy survey was to be performed in their respective territory and that a SWE team representative would potentially contact them to request participation in the study. The initial recruitment letter was sent out under the name and letterhead of each respective EDC. Next, a phone recruitment script was designed to introduce the study to the residential homeowner, explain the process and demands of the on-site survey and ask for participation.[11] In order to facilitate recruitment, the SWE team was able to offer a $50 incentive to homeowners willing to participate in the survey.

In order to ensure an adequate mix of housing types and electric usage, the SWE team sorted each EDC's recruitment sample of 700-900 residences by housing type and monthly energy usage and divided these residences into 70 select bins per EDC. Once a homeowner in a given bin agreed to the on-site survey, the SWE team did not actively recruit the remaining residences in that bin. This helped to guarantee a final on-site sample that continued to be stratified by both housing type and energy use. Occasionally, if no homeowners within a bin were able to participate in the study, recruiters would circle back to neighboring bins for a second participant. The SWE team would attempt to contact customers a maximum of three times before considering an account not part of the study.

[11] A sample copy of the initial recruitment letter and the telephone recruitment script for the residential baseline study can be found in Appendix B and C, respectively.

The SWE team contacted a total of 3,325 residential consumers across the state and performed a total of 420 site visits with an average recruitment rate of 12.6%. The table below provides a breakdown of the total number of customers contacted and recruited for on-site visits.

Table 3-1: Overall Survey Recruitment Results

EDC	Customers Contacted	Surveys Completed	Recruitment Rate
Duquesne	571	70	12.3%
MetEd	619	70	11.3%
Penelec	465	70	15.1%
Penn Power	530	70	13.2%
WPP	641	70	10.9%
PPL	499	70	14.0%
TOTAL	***3,325***	***420***	***12.6%***

3.2.3 On-site Survey

By using an on-site survey instrument and trained staff to review end-use appliances within the home, the data collected has a high level of accuracy. In order to maximize the effectiveness of each site visit and provide results with a high level of detail, the SWE team designed the on-site survey to be as comprehensive as possible without being overly intrusive to the homeowner. The SWE team also reviewed the on-site data collection form used by Navigant for the 2011 PECO Baseline study to ensure the ability to incorporate their results into the statewide analysis. The SWE team also asked EDC personnel and the EDC evaluation teams to review and provide comments on a draft of the survey instrument. The final version of the onsite survey gathers data on the presence of each end-use studied as well as equipment fuel type and efficiency level.

The on-site surveys were completed by nine trained site surveyors during a 12-week period from September 2011 through December 2011. In total 420 surveys were completed by the SWE team. Surveyors were equipped with a tablet PC to collect data required by the survey instrument and were typically able to complete each survey within a 2 hour window (excluding the time to travel to and from each site from a central location). To ensure consistent results, the electronic survey form was designed to restrict data entry within selected expected data ranges and was able to confirm the completeness of each survey. A hard copy of the on-site survey instrument is included in Appendix A of this report.

3.2.4 End Uses

The study categorizes energy using equipment in each of the EDC service territories into appropriate end uses. The types of end-uses included in this report are consistent with those typically considered in other regional or national studies. For ease of comparison, the results of this study are presented by end-use in a format consistent with the 2011 PECO Baseline Study. The residential end-uses included in this study are:

- Building Envelope
- Heating Equipment
- Cooling Equipment

- Lighting
- Water Heating
- Major Appliances
- Consumer Electronics
- Other

3.3 EXTERNAL DATA COLLECTION

The data collection and mining effort included a search of available secondary sources in an effort to streamline primary research efforts and identify gaps – either in the presence or quality of the data. In addition to these sources, the SWE team agreed to utilize the 2011 PECO Baseline Study in lieu of conducting additional on-site visits in the PECO area.

3.3.1 2010 PECO Baseline Study

Early on during the development of the market baseline scope of work, the SWE team, Pennsylvania PUC, and PECO decided additional on-site surveys would not be performed in the PECO service territory since a comprehensive baseline study was performed on its residential consumers in 2010. The SWE team has worked with the authors of the PECO Baseline Study Report to review, analyze, and incorporate the findings from the existing study with findings from this study when possible. It was not always possible to incorporate PECO into all statewide findings included in this report due to varying surveying techniques, data ranges, and scopes of work. The SWE team has noted throughout the report when PECO data is absent in statewide totals and EDC-specific results.

3.3.2 Data Sources

The SWE team also examined a number of existing data sources to identify data gaps. For example, additional research was performed to utilize appliance manufacturer information collected onsite to determine the efficiency of the major appliances as well as major end-use equipment. In addition to manufacturer product data, the SWE team collected and utilized ENERGY STAR product lists, Consortium for Energy Efficiency (CEE) product lists, and the Air-Conditioning, Heating and Refrigeration Institute (AHRI) product database in order to help determine specific appliance efficiencies.

3.4 DATA ANALYSIS

3.4.1 Data Cleaning

The SWE team reviewed all collected data fields for validity and completeness to ensure data quality across all responses. All fields were scanned for entry errors as well as outliers, enabling the SWE team to address the majority of errors. In addition to entry errors, the SWE team also checked internal consistency in recorded responses across fields. For example, where the number of televisions did not add up to the television count by screen type, we corrected fields where possible.

In addition, select missing or questionable data points were cleaned through follow-up phone calls or through publicly available data sources, such as public property records. Finally, as noted in the prior section, the make/model numbers of various appliances of HVAC equipment were recorded

during the on-site survey to allow for future verification of equipment efficiency. While not all make/model numbers could successfully be located and verified through online databases, the accuracy regarding the saturation of energy efficient appliances and HVAC equipment was significantly upgraded through this practice.[12]

3.4.2 Weighting Factors

Given the different characteristics between single family, multifamily, and manufactured homes, the SWE team developed case weights to control for sample bias within each EDC. Specifically, we calculated sample weights by post-stratifying the sample by building type. The case weights for the EDC-specific results reflect the ratio of the percentage of population to the percentage of the sample.

$$W_h = N_h / n_h$$

Where:
W = weight
h = housing type
N = percent of total residential accounts for the given building type
n = percent of sample for the given building type

In addition to weighting the EDC-level results by building type, the SWE team also compared selected demographic data collected through the on-site surveys to available data from recent EDC-specific appliance saturation studies and from the US Census.[13] Although minimal differences were present between the three datasets (SWE sample, EDC results, and US Census), the age of head of household was consistently lower in the SWE sample compared to the US Census data across all EDCs. As a result, the SWE team layered an additional weighting factor to the EDC-level results.

Table 3-2 shows the case weights for each building type within each EDC. Percent of total residential account estimates for case weights were derived from existing demographic data supplied by EDCs to the SWE Team. The age of head of household estimates for total customers were derived from data contained in the U.S. Census: 2008-2010 American Community Survey.

Table 3-2: Survey Weighting for EDC Level Results

% OF CUSTOMERS (by EDC)							
	PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO
60 and Older							
SF-Detached	23.9%	22.2%	23.8%	30.7%	29.6%	25.8%	20.1%
SF-Attached	5.2%	3.3%	2.8%	1.4%	1.9%	2.7%	8.7%
Multifamily	3.1%	9.1%	5.6%	2%	1.9%	1.8%	2.3%
Manuf./Mobile	1.7%	0.5%	2.8%	1.9%	2.6%	2.7%	0.0%
Under 60							

[12] The data cleaning process did not include the reclassification of ENERGY STAR-rated equipment to non-ENERGY STAR if equipment no longer meets updated specifications. This reporting is consistent with the SWE team's method for estimated energy efficient technology saturations used in the electric energy efficiency potential study.

[13] U.S. Census: 2008-2010 American Community Survey, 3-Year Estimates

SF-Detached	46.5%	41.1%	44.2%	54.5%	52.5%	52.4%	44.6%
SF-Attached	10.1%	6.2%	5.2%	2.5%	3.4%	5.5%	19.3%
Multifamily	6.1%	16.8%	10.4%	3.6%	3.4%	3.6%	5.1%
Manuf./Mobile	3.4%	0.8%	5.2%	3.3%	4.6%	5.6%	0.0%
% OF SAMPLE (by EDC)							
	PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO
60 and Older							
SF-Detached	42.9%	27.1%	35.7%	37.1%	37.1%	21.4%	35.3%
SF-Attached	4.3%	2.9%	1.4%	2.9%	2.9%	10.0%	13.2%
Multifamily	1.4%	8.6%	2.9%	1%	5.7%	1.4%	0.0%
Manuf./Mobile	2.9%	0.0%	4.3%	4.3%	4.3%	1.4%	0.0%
Under 60							
SF-Detached	30.0%	44.3%	45.7%	40.0%	32.9%	51.4%	29.4%
SF-Attached	7.1%	5.7%	1.4%	4.3%	7.1%	1.4%	14.7%
Multifamily	7.1%	10.0%	5.7%	2.9%	5.7%	8.6%	7.4%
Manuf./Mobile	4.3%	1.4%	2.9%	7.1%	4.3%	4.3%	0.0%
EDC WEIGHTS							
	PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO
60 and Older							
SF-Detached	0.56	0.82	0.67	0.83	0.80	1.20	0.57
SF-Attached	1.21	1.16	1.96	0.49	0.67	0.27	0.65
Multifamily	2.19	1.06	1.96	1.43	0.34	1.23	-
Manuf./Mobile	0.61	-	0.65	0.44	0.61	1.92	-
Under 60							
SF-Detached	1.55	0.93	0.97	1.36	1.60	1.02	1.52
SF-Attached	1.41	1.08	3.64	0.58	0.47	3.86	1.31
Multifamily	0.85	1.68	1.82	1.27	0.60	0.42	1.00
Manuf./Mobile	0.79	0.91	1.82	0.47	1.08	1.30	-

In an effort to provide a more inclusive study and to provide estimates for each of the EDC territories, a sample of 70 residential sites was selected for each EDC irrespective of the size of the EDC. When aggregating the EDCs estimates to the statewide level, it was necessary to create a second set of case weights to control for differences in the number of residential accounts across the seven EDCs. This approach provides more weight to the data for larger EDCs when compared to smaller EDCs in the statewide findings. Furthermore, depending on the availability of PECO data, weighting factors were calculated with and without PECO data. The tables below detail the customer counts provided by the individual EDCs as well as the weights that were applied throughout the analysis when rolling up EDC data to statewide findings.

Table 3-3: EDC 2011 Customer Counts (Including PECO)

EDC 2011 CUSTOMER COUNT (WITH PECO)							
PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO	PA
1,225,825	524,865	620,151	140,200	504,450	486,318	1,413,206	4,915,015
25%	11%	13%	3%	10%	10%	29%	-

Table 3-4: Statewide Weights (Including PECO)

STATE WEIGHTS (WITH PECO)							
	PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO
60 and Older							
SF-Detached	0.97	0.61	0.59	0.16	0.57	0.83	1.17
SF-Attached	2.11	0.87	1.72	0.10	0.48	0.19	1.35
Multifamily	3.81	0.79	1.72	0.28	0.24	0.85	-
Manuf./Mobile	1.06	-	0.57	0.09	0.44	1.32	-
Under 60							
SF-Detached	2.69	0.69	0.85	0.27	1.14	0.70	3.13
SF-Attached	2.46	0.80	3.20	0.12	0.34	2.66	2.71
Multifamily	1.48	1.25	1.60	0.25	0.43	0.29	2.06
Manuf./Mobile	1.37	0.68	1.60	0.09	0.77	0.90	-

Table 3-5: EDC 2011 Customer Counts (Excluding PECO)

EDC 2011 CUSTOMER COUNT (WITHOUT PECO)							
PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO	PA
1,225,825	524,865	620,151	140,200	504,450	486,318	0	3,501,809
35%	15%	18%	4%	14%	14%	0%	-

Table 3-6: Statewide Weights (Excluding PECO)

STATE WEIGHTS (WITHOUT PECO)							
	PPL	Duquesne	FE (WPP)	FE (Penn Power)	FE (Penelec)	FE (Met Ed)	PECO
60 and Older							
SF-Detached	1.17	0.73	0.71	0.20	0.69	1.00	0.00
SF-Attached	2.55	1.05	2.08	0.12	0.58	0.23	0.00
Multifamily	4.60	0.95	2.08	0.34	0.29	1.02	0.00
Manuf./Mobile	1.27	-	0.69	0.10	0.53	1.60	0.00
Under 60							
SF-Detached	3.25	0.84	1.03	0.33	1.38	0.85	0.00
SF-Attached	2.97	0.97	3.87	0.14	0.41	3.21	0.00
Multifamily	1.79	1.51	1.93	0.31	0.52	0.35	0.00
Manuf./Mobile	1.65	0.82	1.93	0.11	0.94	1.08	0.00

3.4.3 Penetration vs. Saturation

This report frequently sites two metrics: penetration and saturation. These metrics merit further explanation.

Penetration refers to the proportion of homes assigned a given equipment type or characteristic. For instance, computers in the PPL service area have a penetration of 84%. This means 84% of all homes have at least one PC (though they could have more than one). Saturation refers to the average number of units across all homes (except lighting).[14] For instance, a computer saturation of

[14] Lighting saturation refers to the proportion of lighting composed of the given bulb type. For this reason, lighting saturation is lower than or equal to its corresponding penetration.

149% in the PPL territory indicates that, on average, there are 1.49 computers in residential households.

While saturations indicate the average number of units across all households (including households that do not have the equipment), a third metric, mean units, tells us the average number of units for households with at least one unit. Dividing saturation by the penetration gives us the mean units. In the computer example for PPL above, while the saturation of computers is 149%, only 84% of the households have at least one computer. This indicates that of the households that have at least one computer, there are, on average, 1.77 computers.

3.4.4 Significance Testing

Due to budget and time constraints, no statistical testing was conducted during the course of this research to determine if the estimates (proportion or mean) for a given metric were significantly different across samples or across specific groups within one sample. If such tests were to be performed, the t-Test could be performed to test the differences between means derived from two independent samples. For example, in Table 5-3 on page 63, the average age of home 47.1 and 52.1 years, respectively, in the WPP and PECO service areas. Comparison of the computed t-value using the individual participant data regarding age of home to the critical t-value based on the desired alpha level (e.g., $\alpha = .05$) and degrees of freedom ($n_1 + n_2 - 2$) would provide the information needed to accept/reject the null hypothesis that the differences between the two means are not statistically significantly different or to accept the alternative hypothesis that the differences are statistically significant. A similar type analysis could be performed to test the differences between two proportions; however, rather than a t-test, a z-test or Chi-squared test would be the appropriate method.

3.5 UNCERTAINTY

The survey estimates presented in this report are subject to a certain degree of uncertainty. Practical constraints make it impossible for the SWE team to conduct an on-site survey for the entire population of Pennsylvania residences, necessitating the selection of a small sample population from which to collect data. When using a sample to estimate a population metric, factors of uncertainty are introduced, primarily based on the size of the sample and the existence of biases within the sample.

The uncertainty can be described by the confidence level and margin of error, targeted in this study at 95% and 5%, respectively, for the state-wide residential sector. This means that if this study were repeated multiple times, 95% of the studies would produce estimates to within ±5% of the true population value. The sample size required to achieve these levels of confidence with a large population is given in the Equation 3.1.

Equation 3-1: Sample Size Determination

$$n = \frac{t^2 \times (p)(1-p)}{d^2}$$

Where:
n = Sample size
t = Value for selected confidence level, 95% corresponds to 1.96
p = Expected proportion of responses. Maximum possible proportion of 0.5 yields maximum sample size
d = Margin of error, 0.1

Based on this equation, the minimum sample size required to achieve precisions of ±5%, at 95% confidence, is 384. The SWE team's targeted sample size of 420 customers (488 with the addition of the PECO dataset) is sufficiently large to achieve this level of confidence. As can be shown by the equation above, a sample size greater than 384 will result in an increased level of confidence and a smaller margin of error.

With considerations for sample size it is important to note that the more aggregated findings in this report have the highest confidence, while the confidence decreases as results become more disaggregated (either by housing type or EDC). For example, if 334 customers out of 488 residential sample points across the state have central air conditioning systems, this saturation can be reported with a confidence/precision level of greater than 95/5 due to the sample of 488 data points (well in excess of 384). Likewise if 58 customers out of 70 sample points in an EDC territory have central air conditioning, this saturation can be reported with a confidence/precision level of approximately 90/10. However, the percent of central cooling systems that are of a particular efficiency level will have greater uncertainty because the sample size of central cooling is only 58. Additionally, the amount of uncertainty increases when developing estimates of particular metrics at the housing type level due to the limited sample points. When attempting to analyze the survey responses by EDC and by housing type, the sample sizes became very small; therefore, results at the EDC level were not broken out by housing type. Additionally, while results at the statewide level are disaggregated by housing type, the level of confidence/precision differs by housing type since some segments received fewer observations than others (e.g. single family-attached homes only have 54 observations statewide).

Due to differences in the overall mix of equipment within each home, it was not possible to collect data for every characteristic at every site. For example, while all homes have water heating, only a fraction of them are electric water heaters. This report notes when field-specific sample sizes have a limited number of observations. For qualitative comparison purposes, we have included sample sizes for all metrics, even when the number of observations is extremely limited. However, when the number of observations falls below 17, the level of confidence/precision falls below 90/20, and we caution against making any statistical inferences based on such a small sample.

While on-site surveys are generally able to achieve more accurate and detailed datasets than self-reported or telephone surveys, it was not possible to collect data for all data fields at all locations. One example is that the make/model number for an end use may have been transcribed incorrectly, was not legible, or the equipment was of significant age, and product data was no longer available from the manufacturer. In these cases, a "Don't Know" field was specified. The SWE team has included "Don't Know" responses in our analysis where meaningful; otherwise, we present the

percentages after eliminating these unknown responses. The SWE team has also attempted to consistently note where the exclusion of "Don't Know" responses has resulted in a limited sample size.

Finally, another factor that can influence the accuracy of the results is the extent to which the sample is representative of the population as a whole. Though stratified samples were selected randomly, it is possible that the sample contains some type of bias which can influence results. One such example is a sample with a high percentage of retirement age homeowners (and thus more available for an on-site survey), potentially resulting in different energy consumption habits than the true population. The results found within this study have been reweighted to correct for a known bias toward older head of households.

In addition to uncertainty due to sample size or random sampling error, other forms of uncertainty may occur during on-site survey collection. This report combines the results of 420 on-site surveys collected by the SWE team with 68 completed by Navigant Consulting for the 2011 PECO Baseline Study. Although the SWE team reviewed the Navigant data collection instrument in an effort to collect consistent data, differences in data collection procedures may exist. As an example, the estimated distribution of insulation R-value in homes appears different between the PECO territory and the remaining EDCs. It is difficult to determine whether these are actual differences in the distribution of insulation R-value or whether these differences occur due to contrasting collection or R-value determination methods.

Where possible, the SWE team took steps to ensure biases were minimized in the samples given the time and budget constraints allotted. Samples were selected randomly from each EDC's customer database in a manner which eliminated the potential for human error or other biases. The SWE team stratified the recruitment sample to calibrate the 70 on-site surveys based on a known mix of housing types and energy consumption. The SWE team attempted to minimize the potential for systematic uncertainty through consistent surveyor training and data collection materials, with these steps taken, the SWE team believes that the results of the survey can be used to make reasonable assumptions about the characteristics of the overall customer base of the EDCs included in this study.

4 STATEWIDE RESIDENTIAL FINDINGS

4.1 INTRODUCTION

This section describes the residential sector findings obtained from the on-site survey collection and analysis activities at the statewide level. As noted in section 3.4.2, statewide results were weighted by EDC to control for differences in the number of residential accounts across the seven EDCs. This approach provides more weight to the data for larger EDCs when compared to smaller EDCs in the statewide findings. Statewide level findings include data collected from both the 420 on-site surveys conducted by the SWE team throughout six EDCs and, when possible, data from 68 on-site surveys conducted by Navigant for the 2011 PECO Baseline Study. In select instances, the SWE team was unable to successfully incorporate results from the PECO Baseline study and these occurrences have been noted throughout the report.

When all data fields were available, statewide results are based on a total of 488 observations.[15] The total number of observations by housing type is as follows: SF-Detached houses (358), SF-Attached (54), multifamily (48), and manufactured housing (28). Statistical level of confidence falls to 90/15 at 30 observations and 90/20 at 17 observations. Note that throughout this section, number of manufactured housing observations was significantly small enough that the SWE team does not recommend using for statistically reasonable conclusions. Total sample sizes for all metrics have been noted throughout.[16]

4.2 BASIC HOME CHARACTERISTICS

4.2.1 Usage

As noted earlier in the report, each EDC provided the SWE team with historical billing data for the pool of potential on-site survey recruits. The potential residential recruits were then stratified by average monthly kWh consumption and home type and recruited to attain a representative sample of each EDC territory in terms of average monthly usage and housing type. Table 4-1 shows the representation of electric usage weighted for statewide level results.

Table 4-1: Average Monthly Electricity Usage by Statewide Weights

Occupants	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
<=500 kWh	19%	19%	48%	6%	22%
501-1000 kWh	38%	43%	32%	32%	38%
1001-1500 kWh	23%	32%	19%	31%	24%
>1500 kWh	19%	7%	1%	24%	16%
Don't Know	1%	0%	0%	7%	1%

[15] In the data tables presented throughout this section, "Statewide" refers to all housing types combined.

[16] To reduce confusion and the appearance of non-integer site visit counts, sample sizes (n) throughout the report reflect the number of observations prior to any weighting factors.

Grand Total	100%	100%	100%	100%	100%
n	356	55	48	29	488

4.2.2 Home Type

Table 4-2 displays the types of residential sites weighted to represent the statewide proportion of housing stock. Single family detached houses are the dominant housing type (70%). Single family attached houses consisting of row houses, townhomes, and duplexes represent 15%, followed by multifamily and manufactured/mobile housing.

Table 4-2: Home Type by Statewide Weights

Home Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
%	70.1%	15.3%	10.4%	4.1%	100.0%
n	358	54	48	28	488

Home Age. The average age of the home was 50 years. Table 4-3 displays the distribution of the years of construction. Approximately 50% of housing was built between 1960 and 2000. Only 8% of the total existing housing stock was built after 2000. In general, the multifamily and manufactured housing stock is more recent than single family homes.

Table 4-3: Average Age of Home by Statewide Weights

Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Average Age	49.8	60.2	45.6	24.7	49.9
n	354	55	46	29	484

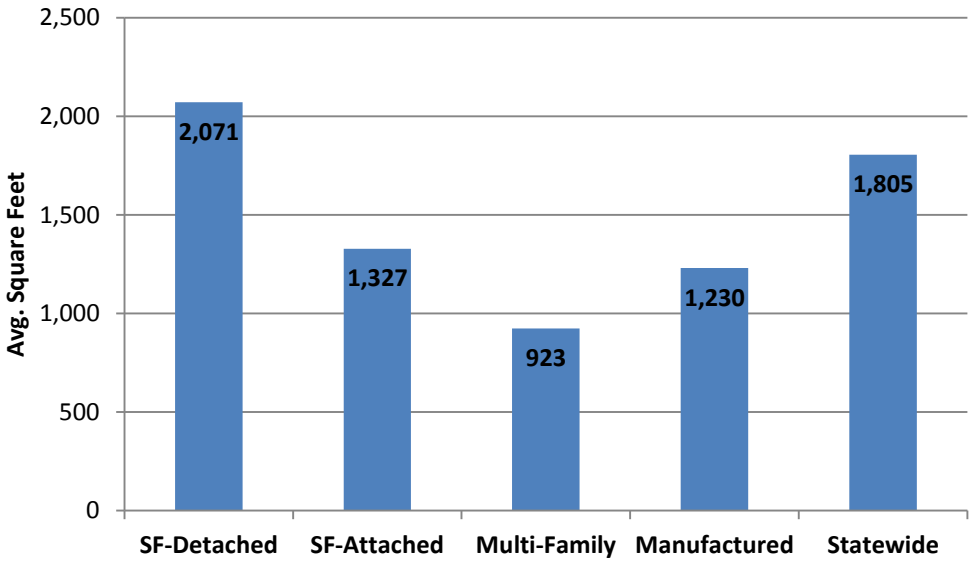
Table 4-4: Year of Construction by Statewide Weights

Year of Construction	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Pre-1900	5%	6%	4%	0%	5%
1900-1910	2%	17%	1%	0%	4%
1911-1920	5%	3%	6%	0%	4%
1921-1930	4%	4%	1%	0%	3%
1931-1940	5%	9%	8%	0%	6%
1941-1950	7%	9%	10%	0%	8%
1951-1960	13%	9%	4%	0%	11%
1961-1970	15%	9%	9%	19%	14%
1971-1980	10%	8%	20%	14%	11%
1981-1990	13%	10%	10%	24%	13%
1991-2000	13%	9%	9%	31%	13%
2001-Present	7%	6%	17%	11%	8%
Grand Total	100%	100%	100%	100%	100%
n	354	55	46	29	484

4.2.3 Home Size

The average square footage of conditioned space for all housing was approximately 1,805 square feet. Single family detached housing square footage was approximately 2,070 square feet (n=350). SF-Attached, Multifamily, and manufactured conditioned square footage ranged from roughly 920 sq. ft. to 1,325 sq. ft. However these conditioned space area estimates for housing types other than SF-detached are based on a limited number of observations (n=55 or less).

Figure 4-1: Average Home Square Footage (Conditioned Space) by Statewide Weights



Home Foundation. The majority of housing units have either conditioned or unconditioned basements. Crawl space was generally only found in manufactured homes and slab on-grade foundations were relatively uncommon, particularly in SF-Detached residences. Foundation information was not readily available for the 2011 PECO dataset and the statewide weights exclude PECO.

Table 4-5: Foundation Type by Statewide Weights

Foundation Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Slab	2%	19%	14%	30%	7%
Enclosed Crawl	2%	6%	0%	58%	5%
Open Crawl	1%	0%	4%	12%	2%
Uncond. Basement	51%	50%	39%	0%	47%
Conditioned Basement	43%	22%	13%	0%	35%
Unit above Cond. Space	1%	3%	30%	0%	4%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	312	36	43	29	420

*Data does not include 2011 PECO on-site data

4.2.4 Demographics

Homeownership. Approximately 81% of all surveyed houses were considered to be owner-occupied. Although based on a limited number of observations (N=48), multifamily homes were predominately rented space.

Table 4-6: Own vs. Rent by Statewide Weights

Homeownership	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Own	95%	65%	8%	90%	81%
Rent	5%	35%	92%	10%	19%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Type of Residence. Nearly all of surveyed homes are year-round, main residences.

Table 4-7: Year Round Residences by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Year-Round	97%	97%	98%	100%	97%
n	356	55	48	29	488

Occupancy. The average year-round home occupancy was approximately 2.6 persons per household, statewide.

Table 4-8: Number of Year Round Occupants by Statewide Weights

Occupants	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. # of Occupants	2.7	2.6	1.8	2.3	2.6
Max. # of Occupants	8	5	5	5	8
Min. # of Occupants	1	1	1	1	1
n	356	55	47	29	487

4.3 BUILDING SHELL

4.3.1 Insulation

Attic Insulation. The majority of surveyed homes had some level of attic insulation present. Less than 10% of homes statewide were verified to have no attic insulation present (Less than 5% of SF-Detached housing). Surveyors were unable to verify the presence or absence of insulation in 12% of homes. This was largely the case in multifamily units where access to attic space is limited or not available. N/A refers to homes were attic insulation was not applicable.

Table 4-9: Presence of Attic Insulation by Statewide Weights

Insulation Present?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	86%	51%	31%	77%	74%
No	5%	27%	13%	0%	9%

Insulation Present?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
N/A	4%	4%	14%	0%	5%
Don't Know	5%	19%	43%	23%	12%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Attic Insulation Type. Fiberglass is the predominant form of attic insulation, when insulation is present. Fiberglass batting or loose-fill fiberglass was present in 83% of surveyed attics with insulation. Note that not all attics were verified to possess attic insulation.

Table 4-10: Type of Attic Insulation by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Cellulose Loose Fill	7%	0%	0%	1%	6%
Fiberglass Batting	53%	29%	57%	61%	51%
Fiberglass Loose	30%	62%	11%	19%	32%
Other	7%	9%	15%	0%	7%
Don't Know	2%	0%	17%	19%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	310	32	15	22	379

Attic Insulation Thickness. The average thickness of attic insulation was 8.0 inches. The average R-value was R-24. Due to limited access to attics, particularly in multifamily units, attic insulation thickness was not able to be determined in all instances where attic insulation was present.

Table 4-11: Attic Insulation Thickness/R-Value by Statewide Weights

Thickness	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Thickness	8.0	8.4	8.8	6.2	8.0
R-Value	24.0	24.0	30.9	19.0	24.0
n	292	31	9	16	348

For homes where attic insulation was present and insulation levels assessed, the table below indicates the proportion of insulation by R-value. 23% of homes, statewide, had less than R-19 insulation located in their attics. 15% of homes had R-38 or greater. The majority of homes (62%) had at least R-19 but less than R-38 insulation.

Table 4-12: Proportion of Attic Insulation R-Value by Statewide Weights

Attic R-value	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
R1-R12	8%	15%	3%	3%	8%
R13-R18	15%	14%	0%	30%	15%
R19-R37	62%	63%	35%	66%	62%
R38-R59	13%	1%	62%	1%	12%
R60 or above	2%	7%	0%	0%	3%

Grand Total	100%	100%	100%	100%	100%
n	292	31	8	16	347

Wall Insulation. The majority of surveyed homes had some level of wall insulation present. Statewide, 19% of homes were verified to have no wall insulation present. Surveyors were unable to verify the presence or absence of insulation in 15% of homes. N/A refers to homes were wall insulation was not applicable.

Table 4-13: Presence of Wall Insulation by Statewide Weights

Insulation Present?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	73%	45%	35%	85%	65%
No	18%	36%	12%	0%	19%
N/A	1%	0%	0%	0%	1%
Don't Know	9%	19%	53%	15%	15%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Wall Insulation Type. Fiberglass batting is the predominant form of wall insulation (57%). Surveyors were not able to determine the type of insulation in 11% of instances. Note that not all homes had wall insulation present and the number of total observations outside of SF-detached homes is limited.

Table 4-14: Type of Wall Insulation by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Cellulose Loose Fill	4%	0%	0%	0%	3%
Fiberglass Batting	58%	41%	48%	81%	57%
Fiberglass Loose	11%	24%	21%	9%	13%
Other	16%	35%	16%	3%	17%
Don't Know	12%	1%	15%	6%	11%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	256	27	15	25	323

Wall Insulation Thickness. The average thickness of wall insulation was 4.6 inches. The average R-value was R-15. Due to limited access to wall space, particularly in multifamily units, wall insulation thickness was not able to be determined in all instances where wall insulation was present.

Table 4-15: Wall Insulation Thickness/R-Value by Statewide Weights

Thickness	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Thickness	4.6	5.0	4.0	4.3	4.6
R-Value	14.6	14.9	12.6	13.9	14.6
n	227	25	9	20	281

For homes with wall insulation, the table below indicates the proportion of insulation by R-value. 40% of homes, statewide, had less than R-13 insulation located in their attics. An additional 23% of homes with wall insulation have between R-13 and R-18 wall insulation. 36% of homes with wall insulation exceed R-19.

Table 4-16: Proportion of Wall Insulation R-value by Statewide Weights

Wall R-value	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
R1-R12	38%	46%	56%	42%	40%
R13-R18	25%	12%	13%	32%	23%
R19-R37	34%	42%	31%	25%	34%
R38-R59	3%	0%	0%	0%	2%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	224	26	8	20	278

Basement Wall Insulation. Based on the results of surveyed homes with basements, 25% of homes with basements possessed some level of basement wall insulation. In order to incorporate the 2011 PECO data, the SWE team assumed all homes where basement wall insulation was N/A referred to homes without basements and were excluded from the basement wall analysis.

Table 4-17: Presence of Basement Wall Insulation by Statewide Weights

Insulation Present?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	29%	12%	3%	0%	25%
No	69%	88%	73%	0%	72%
Don't Know	2%	0%	24%	0%	3%
Grand Total	**100%**	**100%**	**100%**	**-**	**100%**
n	313	34	20	0	367

Basement Wall Insulation Type. When basement wall insulation is present, fiberglass batting is the predominant form of basement wall insulation (53%). Rigid board insulation is also fairly common (27%). Note the limited number of observations available for basement wall insulation for all housing types outside of SF-Detached housing units. These limited observations restrict the level of confidence of reported statistics.

Table 4-18: Basement Wall Insulation Type by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Fiberglass Batting	53%	57%	0%	0%	53%
Fiberglass Loose	8%	0%	0%	0%	8%
Rigid Board	26%	43%	0%	0%	27%
Other	9%	0%	0%	0%	8%
Don't Know	5%	0%	100%	0%	5%
Grand Total	**100%**	**100%**	**100%**	**-**	**100%**
n	87	5	1	0	93

Basement Wall Insulation Thickness. In surveyed homes with basement wall insulation, the average thickness of insulation is 3.8 inches. The average R-value of basement wall insulation was R13.7. Note the limited number of observations available for basement wall insulation based on both the overall number of homes with basement wall insulation present as well as surveyor ability to determine thickness and R-value in these homes. These limited observations restrict the level of confidence of reported statistics.

Table 4-19: Basement Wall Insulation Thickness/R-value by Statewide Weights

Thickness	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Thickness	3.9	2.3	-	-	3.8
R-Value	14.1	8.4	-	-	13.7
n	74	5	0	0	79

Floor Insulation. Based on the results of surveyed homes, 31% of homes with basements and or crawlspaces possessed some level of floor insulation. In order to incorporate the 2011 PECO data, the SWE team assumed all homes where floor insulation was N/A referred to homes without basements and/or crawlspaces or other eligible locations for floor insulation and were excluded from this portion of the analysis.

Table 4-20: Presence of Floor Insulation by Statewide Weights

Insulation Present?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	32%	19%	33%	58%	31%
No	66%	80%	35%	6%	64%
Don't Know	2%	1%	32%	35%	5%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	342	43	24	22	431

Floor Insulation Type. Fiberglass batting is the predominant form of floor insulation (80%). Note that only a subset of the surveyed homes possesses floor insulation. As a result, the number of observations available for this metric is limited from the complete dataset.

Table 4-21: Floor Insulation Type by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Fiberglass Batting	83%	100%	38%	66%	80%
Fiberglass Loose	8%	0%	18%	0%	8%
Rigid Board	2%	0%	0%	0%	2%
Other	1%	0%	0%	0%	1%
Don't Know	6%	0%	43%	34%	10%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	100	7	7	15	129

Floor Insulation Thickness. In surveyed homes with floor insulation present, the average thickness of floor insulation was 5 inches. The average R-value was R16. The total number of observations is limited based as not all homes were eligible to possess floor insulation, and surveyors were not able to determine thickness and R-value at all site visits.

Table 4-22: Floor Insulation Thickness/R-value by Statewide Weights

Thickness	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Thickness	5.0	5.3	5.6	5.0	5.1
R-Value	15.9	17.1	12.5	16.9	16.0
n	89	7	4	10	110

For homes with floor insulation installed and where surveyors were able to determine average thickness and R-value, slightly less than half (49%) currently meet or exceed the R-19 level; 34% fall below R-13.

Table 4-23: Proportion of Floor Insulation R-value by Statewide Weights

Floor R-value	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
R1-R12	34%	29%	92%	17%	34%
R13-R18	18%	20%	0%	13%	17%
R19-R37	48%	50%	8%	70%	48%
R38-R59	1%	0%	0%	0%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	89	7	3	10	109

4.3.2 Windows

Number of windows. The average number of windows per surveyed household was approximately 17 windows. SF-Detached housing averaged 20 windows per household statewide. The remaining housing types averaged slightly lower number of windows per residence. The minimum number of windows in a residence was 2; the maximum was 57.

Table 4-24: Average Number of Windows per Household by Statewide Weights

# of Windows	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. # of Windows	20.3	13.5	7.1	10.3	17.4
Max. # of Windows	57	34	49	18	57
Min. # of Windows	3	4	2	6	2
n	356	55	48	29	488

Total Window Area. The average total square footage of window glazing area for all households statewide was nearly 150 sq. ft. per household. SF-Detached houses averaged 171 sq. ft. per residence.

Table 4-25: Average Area of Window Glazing per Household by Statewide Weights

Avg. Window Area	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. Sq. Ft. per Home	170.8	115.1	79.0	103.8	149.9
n	356	55	48	29	488

Glazing Type. The table below describes the glazing types present at the surveyed homes. The majority of windows were double-paned. Less than 1% of windows are triple-paned across all housing types statewide. 12% of all windows are still single-paned across all housing types statewide. Where surveyors were unsure of the existence low-E coating, windows were assumed to be standard double-paned.

Table 4-26: Window Glazing Type by Statewide Weights

% of Windows	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Single-paned	10%	18%	22%	27%	12%
Double-paned	68%	73%	68%	64%	69%
Low-E double-paned	20%	8%	10%	9%	18%
Triple-paned	1%	1%	0%	0%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	6694	688	340	303	8025

4.3.1 Roofs

Roof Color. The majority of surveyed homes have dark roofs (73%). The remainder of surveyed homes had mostly light colored roofs, with only very small percent (2%) having white roofs. The 2011 PECO dataset did not align with the data collected by the SWE team; however, their dataset reports 81% of homes also had dark-colored roofing.

Table 4-27: Roof Color by Statewide Weights

%	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
White	1%	0%	5%	2%	2%
Light	26%	14%	26%	28%	25%
Dark	73%	86%	70%	70%	73%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	312	36	43	29	420

*Does not include 2011 PECO on-site data

4.3.2 Air Sealing

Air Sealing. Air Sealing was assessed qualitatively by surveyors by checking for possible areas of leakage around doors, windows, recessed cans, and other gaps in the thermal envelope. Surveyed homes were assessed as either: well-sealed, partially sealed, or poorly sealed. Less than one-quarter of surveyed homes (22%) were assessed as poorly sealed. The majority of homes (53%)

were assessed as partially sealed, with a small percent of homes (17%) assessed as well-sealed. Surveyors were unable to assess in approximately 8% of housing statewide.

The 2011 PECO Baseline Study dataset did not assess air sealing specifically, and was not included in the statewide weighting.

Table 4-28: Quality of Air Sealing by Statewide Weights

%	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Well Sealed	16%	27%	16%	16%	17%
Partially Sealed	57%	47%	39%	39%	53%
Poorly Sealed	21%	20%	31%	27%	22%
Unable to Assess	6%	5%	14%	18%	8%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	312	36	43	29	420

*Does not include 2011 PECO on-site data

4.3.3 Duct Sealing

Duct Location. The majority of duct work (52%) in the surveyed homes statewide was located in unconditioned space (typically basements, crawlspaces, and/or attics). 32% of ductwork was located in conditioned space or conditioned/unconditioned mix. N/A refers to homes without duct work. Responses were omitted when the surveyor was unable to confirm the location of the ductwork; the final number of observations (n) is included below.

Table 4-29: Duct Location by Statewide Weights

%	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Cond./Uncond. Mix	16%	11%	4%	28%	14%
Conditioned Space	20%	11%	17%	17%	18%
Unconditioned Space	52%	61%	39%	43%	52%
N/A	12%	17%	40%	12%	15%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	332	53	34	25	444

Duct Sealing. The table below presents a qualitative assessment of duct sealing in homes with existing ductwork. Well sealed ducts refer to existing ductwork sealed with mastic or approved tape and no visible signs of air leakage around inspected HVAC joints. Well sealed refers to minimal gaps, while poorly sealed ducts were assessed when ductwork was not taped or sealed with appropriate materials or significant amounts of leakage were visible.

37% of homes with existing ductwork were assessed to be either partially or well sealed based on statewide weighting. However, an additional 30% of homes had ductwork that was unable to be assessed (i.e. unable to access duct location).

Table 4-30: Quality of Duct Sealing by Statewide Weights

%	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Well Sealed	20%	17%	0%	7%	17%
Partially Sealed	21%	17%	21%	10%	20%
Poorly Sealed	36%	47%	14%	5%	33%
Unable to Assess	23%	19%	65%	78%	30%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	280	33	31	24	368

*Does not include 2011 PECO on-site data

4.4 RESIDENTIAL HVAC

This section presents details on the residential space heating and cooling systems present at the surveyed homes.

4.4.1 Equipment Saturations by Fuel/Type – Heating

Fuel Type. Natural gas was the most prominent heating fuel found in residential homes (49%) statewide. Electric and oil systems were also fairly common across housing types. The saturation of electric primary heating systems was approximately 21% of all households. The remaining space heating fuel types include coal, propane, wood, etc.

Table 4-31: Fuel Type of Primary Space Heating Systems by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Natural Gas	49%	59%	49%	11%	49%
Electric	19%	21%	41%	8%	21%
Oil	20%	20%	9%	21%	19%
Coal	2%	0%	0%	0%	1%
Dual Fuel	3%	0%	0%	0%	2%
Kerosene	0%	0%	0%	11%	1%
Propane	3%	0%	1%	49%	4%
Wood	5%	0%	0%	0%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	353	53	44	29	479

Backup Systems. The saturation of homes with at least one back-up heating system is 27% of households statewide. Across housing types, SF-Detached houses are the most likely to have back-up systems (34%). The tables below also present the fuel type of backup heating systems. However, note the small sample size in all housing types outside of SF-Detached. These limited observations do not meet a reasonable level of statistical confidence.

Table 4-32: Homes with Back-Up Heating Systems by Statewide Weights

Back-Up Heating	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
% of Homes	34%	17%	6%	8%	27%
n	356	55	48	29	488

Table 4-33: Fuel Type of Secondary Space Heating Systems by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Natural Gas	18%	0%	0%	0%	16%
Electric	51%	62%	100%	50%	53%
Oil	6%	16%	0%	0%	6%
Coal	2%	0%	0%	0%	2%
Dual Fuel	1%	0%	0%	0%	1%
Propane	5%	0%	0%	0%	4%
Wood	17%	22%	0%	50%	17%
Other	1%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	107	6	2	2	117

Primary System Type. 54% of primary heating systems are central furnaces regardless of fuel type. The next most common systems are boilers and heat pump systems.

Table 4-34: System Type of Primary Space Heating Systems by Statewide Weights

System Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Central Furnaces	53%	62%	35%	90%	54%
Boilers	20%	26%	26%	6%	21%
Heat Pumps	12%	5%	13%	0%	11%
Baseboard	7%	0%	16%	2%	7%
Other	1%	0%	5%	0%	1%
Space Heaters	1%	7%	5%	2%	2%
Stoves	6%	0%	0%	0%	4%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	351	52	40	29	472

Primary Electric Heating System Type. Air Source Heat Pumps are the most common form of primary electric and dual-fuel heating systems (43%). Although there are only a limited number of types of primary electric heating systems, these system types are shown below. Heat Pumps are the most common form of electric heating equipment across SF-Detached housing, followed by base baseboard heating and furnaces.

Table 4-35: System Type of Primary Electric Heating Systems by Statewide Weights

System Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Air Source Heat Pump	50%	28%	30%	0%	43%
Baseboard	32%	0%	35%	27%	28%
Furnace	9%	50%	15%	73%	16%
Geothermal Heat Pump	8%	0%	0%	0%	5%
Wall Mounted Space	1%	23%	12%	0%	6%
Boilers	1%	0%	0%	0%	0%
Other	0%	0%	8%	0%	2%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	71	6	17	3	97

Secondary System Type. Baseboard systems and central furnaces are also common secondary heating systems. Heat Pumps, space heaters, and wood/coal stove heating are also common forms of back-up heating systems statewide and across housing types. Due to the small number of homes with back-up space heating, the number of observations for this data is limited for data outside of SF-Detached homes. These limited observations do not meet a reasonable level of statistical confidence.

Table 4-36: System Type of Secondary Space Heating Systems by Statewide Weights

System Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Baseboard	22%	20%	100%	0%	23%
Central Furnaces	22%	16%	0%	0%	21%
Stoves	19%	22%	0%	50%	19%
Heat Pumps	18%	0%	0%	50%	16%
Space Heaters	12%	42%	0%	0%	14%
Boilers	4%	0%	0%	0%	3%
Other	4%	0%	0%	0%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	108	6	2	2	118

4.4.2 Equipment Saturations by Type – Cooling

Penetration of Central Air Conditioning (AC) Systems. Statewide, 63% of households have at least one central air conditioning unit (includes heat pumps, and mini-split systems). Across housing types, the penetration of central air conditioning units is fairly stable, with only multifamily units having a lower percent (40%). Of homes with central AC systems, a relatively small number of SF-Detached homes had more than one system.

Table 4-37: Penetration of Central AC Systems by Statewide Weights

# of Central AC	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
0	32%	41%	60%	37%	37%
1	60%	59%	40%	63%	58%
2	6%	0%	0%	0%	4%
3+	1%	0%	0%	0%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Saturation of Central AC Systems. The saturation of primary Central AC systems is 63%. As suggested above, the saturation of secondary central air conditioning is low statewide. 9% of SF-Detached homes and 6% of all homes have secondary Central AC units.

Table 4-38: Saturation of Central AC Systems by Statewide Weights

Saturation	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Primary	68%	59%	40%	63%	63%
Secondary	9%	0%	0%	0%	6%
n	356	55	48	29	488

Central AC System Type. While traditional Central AC systems are the predominant system type for cooling (80% statewide), heat pumps also account for 16% of central cooling systems.

Table 4-39: Central Air Conditioning System Type by Statewide Weights

Central AC Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Central AC Unit	77%	90%	74%	100%	80%
Central AC Unit (Mini Split)	1%	0%	0%	0%	1%
Geothermal	2%	0%	0%	0%	2%
Heat Pump	17%	10%	26%	0%	16%
Heat Pump (Mini Split)	1%	0%	0%	0%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	235	33	20	18	306

Penetration of Room AC Systems. The penetration of room air conditioning systems varies across the housing types. Statewide, SF-Detached homes have the lowest penetration of room air conditioners (27% of SF-Detached homes have at least one room AC). Although the sample size is limited for other housing types, room air conditioning appears more prevalent in these housing units.

Table 4-40: Penetration of Room Air Conditioners by Statewide Weights

# of Room AC Units	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
0	73%	57%	60%	58%	69%

# of Room AC Units	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
1	11%	13%	10%	17%	11%
2	9%	23%	28%	13%	13%
3+	7%	7%	2%	11%	7%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Saturation of Room AC Systems. As suggested above, the overall saturation for room air conditioning is lowest in SF-Detached housing. Statewide, the saturation of room air conditioners is 59%.

Table 4-41: Saturation of Room Air Conditioners by Statewide Weights

Saturation	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Room ACs	50%	81%	79%	78%	59%
n	356	55	48	29	488

4.4.3 Efficiency Levels

Central AC SEER Rating. The Central AC energy efficiency level was infrequently provided on the equipment, but where the make and model was available the SWE team recorded and researched manufacturer data. A large portion of Central AC systems were found to currently have a SEER rating below current federal minimum standards (SEER 13). Only 5% of all Central AC systems (including heat pumps, geothermal and mini split systems statewide were found to currently meet ENERGY STAR criteria of 14.5 SEER or better.

Table 4-42: Central AC System SEER Ratings by Statewide Weights

SEER Rating	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Below 13	32%	28%	41%	23%	32%
13	20%	28%	6%	28%	20%
14	9%	9%	6%	0%	9%
14.5 or above	6%	1%	0%	0%	5%
Don't Know	32%	34%	47%	49%	34%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	235	33	20	18	306

This table includes the Central AC systems where the SEER rating was unable to be determined. It is probable that a majority of these unknown systems are currently at or below the current minimum standard as manufacturer data was often unavailable for older systems. Additionally, although this data includes the 2011 PECO dataset, the SWE team did not verify equipment efficiency against make/model data for the PECO dataset. Efficiency levels were unknown in nearly 70% of the PECO dataset. Finally, note that the sample size is limited for Central AC systems across housing types currently utilizing Central AC systems for cooling needs.

ENERGY STAR Room Air Conditioners. 21% of room air conditioners were ENERGY STAR rated statewide. The SWE team documentation of ENERGY STAR Room ACs was based on the ability to visually detect the label or determine that a particular model was ENERGY STAR rated by searching for the make and model number on the ENERGY STAR website or manufacturer data. The number of room air conditioners with make/model number detail available is listed to demonstrate the limited sample size associated with this metric for housing types other than SF-Detached.

Table 4-43: ENERGY STAR Room Air Conditioners by Statewide Weights

ENERGY STAR Room AC	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	23%	22%	20%	4%	21%
No	77%	78%	80%	96%	79%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	172	32	32	17	253

Programmable Thermostats. Roughly 59% of Central AC systems statewide had a programmable thermostat installed. Homes without central AC systems were not included in this metric.

Table 4-44: Programmable Thermostats by Statewide Weights

Prog. Thermostat	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	58%	81%	31%	56%	59%
No	42%	19%	69%	44%	41%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	235	33	20	18	306

4.4.4 Other

Heating System Age. The average heating system is 14 years old. System age is fairly consistent across housing types.[17]

Table 4-45: Average Heating System Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	13.2	15.1	16.4	13.9	13.7
n	444	57	38	31	570

Heating Maintenance. The majority of homeowners reported that they had recently (within the last year) had a seasonal tune-up performed on their heating systems. However, an additional 23% statewide reported they had never had a seasonal tune-up performed on their heating systems.

Table 4-46: Time since Last Seasonal Tune-Up (Heating Systems) by Statewide Weights

Last Tune Up?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Equipment is < 1 year old	1%	0%	0%	7%	1%

[17] Equipment age for HVAC units, and other major appliances, was typically reported by the homeowner.

Last Tune Up?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Less than 1 year	50%	43%	54%	40%	49%
1-2 years	16%	14%	9%	34%	16%
More than 2 years	11%	13%	10%	7%	11%
Never	21%	29%	27%	12%	23%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	330	51	35	27	443

Heating System Set-Points. The average heating set point while homeowners were home and awake is 68°F. While asleep and/or away from home, homeowners generally reduced their heating set point. The 2011 PECO dataset is not represented in these tables as a result of different data collection methods related to heating system temperature set points.

Table 4-47: Heating System Temperature Set Points by Statewide Weights

Heating Set Points	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Awake	68	69	67	69	68
Asleep	67	67	66	68	67
Away	63	62	64	66	64
n	286	35	37	25	383

*Does not include 2011 PECO on-site data

Central AC System Age. The average cooling system is 10 years old.

Table 4-48: Average Central AC System Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	9.8	14.5	7.3	9.4	10.2
n	252	35	16	17	320

The table below presents the age range of central AC systems surveyed statewide. Overall, 40% of current systems are more than 10 years old, while roughly one-quarter are estimated to be 3 years old or less.

Table 4-49: Central AC System Age Range by Statewide Weights

Central AC Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
0-3 Years	26%	18%	20%	26%	24%
3-10 Years	35%	31%	56%	25%	35%
11-15 Years	21%	21%	18%	33%	21%
16 Years or Older	18%	30%	7%	16%	19%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	252	35	16	17	320

AC System Maintenance. The majority of homeowners reported that they had recently (within the last year) had a seasonal tune-up performed on their AC system. Similar to heating seasonal tune-ups, roughly 22% of households statewide reported they had never had a seasonal tune-up performed on their AC systems.

Table 4-50: Time since Last Seasonal Tune-Up (Cooling Systems) by Statewide Weights

Last Tune Up?	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Equipment is < 1 year old	2%	0%	0%	0%	2%
Less than 1 year	48%	27%	65%	21%	45%
1-2 years	14%	31%	9%	32%	16%
More than 2 years	14%	17%	21%	18%	15%
Never	23%	26%	5%	29%	22%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	232	35	18	18	303

Cooling System Set-Points. The average cooling set point while homeowners were home was 73°F with no discernible difference between awake and asleep temperature. While away from home, homeowners generally raised their thermostat to reduce cooling times. The 2011 PECO dataset is not represented in these tables as a result of different data collection methods related to heating system temperature set points.

Table 4-51: Cooling System Temperature Set Points by Statewide Weights

Cooling Set Points	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Awake	73	74	74	71	73
Asleep	73	73	74	71	73
Away	77	78	77	72	77
n	182	25	17	16	240

*Does not include 2011 PECO on-site data

4.5 LIGHTING

This section presents details on the lighting equipment used in the surveyed residential sites.

4.5.1 Sockets per Home

Interior Sockets per Home. The average number of interior lighting sockets per home is 54 total sockets. These include all Edison-base, candelabra; pin-based and empty sockets found in homes and conditioned spaces. Exterior lighting is not included in this socket count. SF-Detached homes averaged 63 sockets statewide, with fewer sockets across the remaining housing types.

Table 4-52: Number of Interior Sockets per Home by Statewide Weights

Number of Sockets	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Average per Home	63	37	25	31	54

Number of Sockets	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
n	356	55	48	29	488

Adjusted Interior Sockets per Home. After accounting for empty lighting sockets, tube fluorescent lighting, specialty sockets (i.e. neon lights, xenon, zircon gas), and pin-based halogen bulbs, the total number of sockets per home reduces to an average of 45 sockets per home statewide. This socket count aims to represent the total number of sockets eligible for CFL placement by removing sockets where CFL bulbs cannot easily be retrofitted.

Table 4-53: Adjusted Number of Interior Sockets per Home by Statewide Weights

Number of Sockets	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Average per Home	52	31	21	29	45
n	356	55	48	29	488

Note that this count represents all sockets where CFL could reasonably be placed, and includes those sockets where daily use is relatively low (i.e. less 3 hours per day), such as closets, utility closets, garages, and other areas.

Exterior Sockets per Home. The average number of exterior lighting sockets per home is 6 sockets.

Table 4-54: Exterior Sockets per Home by Statewide Weights

Number of Sockets	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Average per Home	8	2	2	4	6
n	304	36	29	23	392

4.5.2 Bulb Type

Penetrations by Interior Bulb Type. The table below presents the penetration of interior lighting by bulb type. Nearly all homes have incandescent lighting. At least one compact fluorescent light (CFL) bulb can be found in 83% of residences. Tube fluorescent lighting is found in approximately three-fourths of most residences. Halogen bulbs are found in 35% of all residences statewide. LED bulbs are currently found in less than 10% of all homes. Other bulbs include empty sockets with no bulbs present.

Table 4-55: Penetration of Lighting by Interior Bulb Type by Statewide Weights

Bulb Type (Penetration)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CFL	83%	87%	76%	78%	83%
Halogen	38%	31%	28%	7%	35%
Incandescent	99%	100%	100%	100%	99%
LED	7%	15%	9%	7%	9%
Tube Fluorescent	77%	68%	46%	37%	71%
Other	21%	7%	14%	22%	18%

n	356	55	48	29	488

Saturations by Interior Bulb Type. Incandescent bulbs account for 64% of all sockets in residences throughout Pennsylvania. While CFLs can be found in 83% of houses, CFL bulbs only account for 17% of all sockets. Tube fluorescent and halogen bulbs make the dominant majority of remaining sockets. Note that while LED lighting can be found in 7% of single family-detached housing, the saturation of LED lighting relative to all bulbs in single family detached housing is less than 0.5%.

Table 4-56: Saturation of Lighting by Interior Bulb Type by Statewide Weights

Bulb Type (Saturation)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CFL	15%	30%	24%	29%	17%
Halogen	4%	8%	5%	1%	4%
Incandescent	66%	50%	61%	63%	64%
LED	0%	2%	1%	3%	1%
Tube Fluorescent	14%	10%	9%	4%	13%
Other	1%	0%	1%	1%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	22,207	2,055	1,153	819	26,234

CFL/LED Saturations based on Adjusted Interior Sockets. The table below presents the saturation of CFL and LED bulbs as a percent of sockets where high efficiency lighting could reasonably be achieved and excludes sockets where CFL/LED placement would be difficult or unrealistic. Under these conditions, the saturation of CFL lighting increases to 21% statewide. This data indicates that there is significant additional potential for lighting energy efficiency savings in homes in Pennsylvania.

Table 4-57: CFL/LED Saturations based on Eligible Sockets by Statewide Weights

Bulb Type (Saturation)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CFL	18%	36%	28%	31%	21%
LED	0%	3%	1%	3%	1%
n	18,085	1,830	988	805	21,708

Saturations by Exterior Bulb Type. Incandescent bulbs account for 69% of all exterior sockets in residences throughout Pennsylvania. Halogen and CFL lighting are the next most common forms of exterior lighting, consisting of 12% and 13% of exterior sockets, respectively.

Table 4-58: Saturation of Lighting by Exterior Bulb Type by Statewide Weights

Bulb Type (Saturation)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CFL	11%	32%	3%	31%	12%
Halogen	14%	3%	6%	11%	13%
Incandescent	70%	55%	77%	57%	69%
LED	0%	0%	0%	0%	0%

Bulb Type (Saturation)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Tube Fluorescent	3%	9%	13%	0%	3%
Other	2%	0%	2%	0%	2%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	2,261	92	60	84	2,497

Average Wattage by Interior Bulb Type. The table below presents the average wattage of interior lighting by bulb type. The average wattage of incandescent bulbs was 55W, suggesting a heavier mix of 40W and 60W bulbs than 75W to 100W bulbs in interior sockets. The average wattage of CFL bulbs was 16W. The number of observations listed refers to CFL bulbs only. There were significantly greater numbers of incandescent bulbs statewide, and significantly less halogen and LED bulbs.

Table 4-59: Average Wattage by Bulb Type by Statewide Weights

Avg. Wattage	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CFL	17	15	16	16	16
Halogen	51	38	38	49	47
Incandescent	55	56	55	49	55
LED	14	4	8	13	9
Tube Fluorescent	42	36	35	36	41
n (for CFL Wattage)	3,149	427	232	281	4,089

4.5.3 Lighting Saturations by Room

Socket by Room Type. Statewide, the majority of lighting was found in bedrooms, followed closely by other high and medium use areas such as bathrooms, basements, kitchens, and living rooms. Closets, garages, and other rooms (i.e. attics, storage, etc.) are common low daily use areas, and represent 12% of interior sockets.

Table 4-60: Interior Socket Saturation by Room Type by Statewide Weights

Avg. Wattage	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Basement	16%	12%	6%	0%	14%
Bathroom	14%	14%	18%	19%	14%
Bedroom	17%	20%	22%	23%	17%
Closet	3%	3%	2%	3%	3%
Dining Room	7%	7%	5%	4%	7%
Foyer/Hallway	8%	8%	6%	5%	8%
Garage	6%	1%	0%	2%	5%
Kitchen	12%	15%	17%	13%	12%
Living Room	11%	16%	20%	19%	12%
Office/Den	4%	3%	4%	4%	4%
Other	4%	2%	1%	8%	4%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**

Avg. Wattage	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
n	22,207	2,055	1,153	819	26,234

4.6 DOMESTIC WATER HEATING

4.6.1 Equipment Saturations by Fuel/Type

Water Heating Fuel Type. Natural gas is the most prevalent fuel source for water heating purposes across all housing types and statewide. Electric water heating is also common, found in 43% of housing statewide. Oil water heating is a distant third, found in only 8% of surveyed houses statewide. Solar water heating and wood water heating was found in less than 1% of surveyed households.

Table 4-61: Water Heating Fuel Type by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Natural Gas	48%	63%	49%	0%	48%
Electric	42%	31%	44%	94%	43%
Oil	9%	6%	7%	5%	8%
Propane	1%	0%	0%	0%	1%
Solar	0%	0%	0%	0%	0%
Wood	0%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	369	53	41	29	492

Water Heating System Type. Of electric water heaters, the large majority (96%) are traditional storage tank water heaters. Approximately 2% of electric water heaters are considered heat pump water heaters. Note that the number of observations shown below is limited only to those surveyed residences with electric water heating.

Table 4-62: Electric Water Heating System Type by Statewide Weights

System Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Stand Alone Tank	97%	94%	100%	93%	96%
Heat Pump WH	2%	6%	0%	0%	2%
Tankless (On Demand)	1%	0%	0%	0%	0%
Don't Know	0%	0%	0%	7%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	147	15	19	26	207

Water Heating Age. Statewide, the average age of electric water heater surveyed statewide is 7.4 years. The number of observations is limited only to those surveyed residences with electric water heating.

Table 4-63: Water Heater Age by EDC

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	7.8	4.9	6.9	6.6	7.4
n	143.0	13.0	17.0	26.0	199.0

Tank Temperature. The average electric water heater tank temperature set point statewide was found to be 123°F. The number of observations is limited only to those surveyed residences with electric water heating.

Table 4-64: Water Heater Tank Temperature by EDC

Tank Temp.	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Degrees (°F)	124	120	121	121	123
n	140	14	18	26	198

4.6.2 Water Heater Energy Efficiency Levels

Energy Factor. The water heater energy efficiency level was infrequently provided on the name plate, but where the make and model were available the SWE team recorded and researched manufacturer data. The table below presents the percent of water heating systems that do not currently meet the federal standard (units below EF=.90), as well as units that could be considered energy efficient (EF=.93 or above). The efficiency of approximately 1/3 of all electric water heating units statewide could not be determined through make/model look up. These units were retained in the overall analysis because an assumption could be made that these undetermined units were likely to be older units and more likely to be below the current energy efficient threshold.

Electric water heater manufacturer efficiency was not readily available in homes surveyed for the 2011 PECO baseline study and were excluded from the statewide weighting. Note the small sample sizes in all housing types outside of SF-Detached homes.

Table 4-65: Electric Water Heater Efficiency by Statewide Weights

Energy Factor (EF)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Below .90	12%	0%	0%	0%	9%
.90 - .92	45%	49%	52%	47%	46%
.93 or above	12%	18%	0%	16%	12%
Don't Know	30%	33%	48%	37%	33%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	131	12	17	26	186

*Does not include 2011 PECO on-site data

Pipe Wrap. 20% of electric water heaters surveyed were found to have pipe wrap located on pipes near the water heater. Note the number of observations is limited only to those surveyed residences with electric water heating.

Table 4-66: Electric Water Heater Pipe Wrap by Statewide Weights

Pipe Wrap	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	24%	16%	2%	11%	20%
No	76%	84%	98%	89%	80%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	146	14	17	22	199

Water Heater Blanket. Tank wrap was found on less than 8% of electric water heating units surveyed. Note the number of observations is limited only to those surveyed residences with electric water heating.

Table 4-67: Electric Water Heater Blankets by Statewide Weights

Tank Wrap	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	9%	14%	2%	0%	8%
No	91%	86%	98%	100%	92%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	146	14	17	22	199

4.6.3 Other

Water efficiency measures aid in energy conservation by reducing hot water usage, and subsequently reducing the overall energy needed to heat water. The most typical water heating efficiency measures are low-flow showerheads and faucet aerators.

Faucet Aerators. Statewide, homes have an average of 3.8 sinks per home. As indicated by the saturations, homes average 2.9 faucet aerators. Overall 77% of all sinks in the surveyed homes were equipped with low flow faucet aerators.

Table 4-68: Sinks and Faucet Aerators by Statewide Weights

Faucet Aerators	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. # of Faucets	4.0	4.5	2.7	2.0	3.8
Avg. # Low Flow	3.0	3.5	2.1	1.7	2.9
% Low Flow	77%	80%	79%	87%	77%
n	356	55	48	29	488

Showerheads. On average, homes have 1.6 showerheads per home statewide. Low flow showerheads were found on 72% of all showerheads.

Table 4-69: Showers and Low Flow Showerheads by Statewide Weights

Showerheads	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. # of Showers	1.7	1.8	1.3	1.2	1.6
Avg. # Low Flow	1.2	1.4	0.7	0.9	1.2

Showerheads	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
% Low Flow	72%	77%	57%	75%	72%
n	356	55	48	29	488

4.7 OTHER APPLIANCES

4.7.1 Refrigerators/Freezers

Number of Refrigerators. Statewide, nearly every surveyed home had at least one refrigerator. Most surveyed homes (63%) have only one refrigerator, and 33% two refrigerators. Only a small number of surveyed homes (3%) have more than three or more refrigerators. SF-Detached houses had the highest percent of two or more refrigerators relative to other housing types.

Table 4-70: Number of Refrigerators by Statewide Weights

#	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
0	1%	0%	0%	0%	1%
1	56%	77%	86%	71%	63%
2	39%	23%	14%	29%	33%
3+	5%	0%	0%	0%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Refrigerator Type. The most common type of refrigerator is the top-mount freezer across all housing types, followed by side-by-side models, and bottom-mounted freezers. Compact refrigerators consist of 6% of all refrigerators found in homes.

Table 4-71: Refrigerator Type by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Bottom Freezer	13%	5%	3%	8%	11%
Compact	7%	0%	4%	11%	6%
Side by Side	26%	30%	15%	18%	25%
Top Freezer	52%	66%	75%	63%	56%
Other	2%	0%	4%	0%	2%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	527	70	53	37	687

Refrigerator Size. The average refrigerator volume, excluding compact refrigerators is approximately 19.9 cubic feet.

Table 4-72: Average Refrigerator Size by Statewide Weights

Volume	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
cubic feet	20.3	19.4	18.2	18.6	19.9
n	470.0	66.0	51.0	33.0	620.0

Refrigerator Age. The average primary refrigerator was approximately 9 years old. Second refrigerators were, on average, older than primary units (15 years old).

Table 4-73: Average Primary Refrigerator Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	9.4	8.1	7.6	8.0	9.0
n	353	54	44	28	479

Table 4-74: Average Secondary Refrigerator Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	15.3	12.1	25.8	15.0	15.2
n	129	14	3	6	152

ENERGY STAR Refrigerators. On average, fewer than 20% of all primary refrigerators currently possess the ENERGY STAR logo or are qualified as ENERGY STAR compliant. Multifamily units had the lowest percent of ENERGY STAR rated primary refrigerators (7%). Secondary refrigerators were much less likely to be ENERGY STAR rated. Only 4% of secondary refrigerators were considered ENERGY STAR.

Where possible, the SWE team collected make/model information of refrigerators and verified ENERGY STAR status. The SWE team included but did not independently verify the ENERGY STAR status of the PECO dataset.

Table 4-75: ENERGY STAR Primary Refrigerators by Statewide Weights

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	23%	16%	7%	18%	20%
No	77%	84%	93%	82%	80%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	355	55	48	29	487

Table 4-76: ENERGY STAR Secondary Refrigerators by Statewide Weights

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	4%	0%	0%	0%	4%
No	96%	100%	100%	100%	96%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	172	15	5	8	200

Number of Freezers. 61% of houses statewide do not possess a stand-alone freezer. Additionally, homes with freezers are unlikely to have multiple units. Generally only 2% of homes have two or more stand-alone freezers.

Table 4-77: Number of Stand-Alone Freezers by Statewide Weights

#	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
0	51%	86%	97%	41%	61%
1	47%	14%	3%	54%	37%
2	2%	0%	0%	0%	1%
3	1%	0%	0%	5%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	356	55	48	29	488

Freezer Type. Statewide, there is near even distribution of upright vs. chest freezers in surveyed households. Overall 50% of freezers were upright models, and 50% were chest freezers. Upright models were more common in SF-Attached and multifamily housing units, while chest freezers were more predominant in manufactured homes. However, note that the sample of freezers observed in homes other than SF-Detached housing is limited.

Table 4-78: Stand-Alone Freezer Type by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Upright	49%	85%	79%	35%	50%
Chest	51%	15%	21%	65%	50%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	203	10	3	21	237

Freezer Age. The statewide average age of stand-alone freezers was 15 years old. As not all homes are equipped with stand-alone freezers, the sample size is limited outside of the SF-Detached data.

Table 4-79: Stand-Alone Freezer Age by EDC by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	15.8	10.3	8.9	9.5	15.0
n	202	10	3	21	236

ENERGY STAR Freezers. Only 7% of stand-alone freezers statewide were considered to be ENERGY STAR compliant. 7% of freezers in SF-Detached houses were ENERGY STAR. Sample sizes in other housing types are outside of the 90/10 confidence interval.

Where possible, the SWE team collected make/model information of freezers and verified ENERGY STAR status. Again, the SWE Team did not independently verify the ENERGY STAR status of the refrigerators included in the PECO residential baseline study.

Table 4-80: ENERGY STAR Stand-Alone Freezers by Statewide Weights

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	7%	8%	0%	11%	7%
No	93%	92%	100%	89%	93%

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Grand Total	100%	100%	100%	100%	100%
n	203	10	3	21	237

4.7.2 Clothes Washers/Dryers

Number of Clothes Washers. The statewide penetration of "in the home" clothes washers is 91% for all housing types combined. 98% of SF-Detached houses have at least one clothes washer (99% saturation). These figures do not include shared clothes washing units commonly found in central facilities in multifamily housing units.

Table 4-81: Number of Clothes Washers by Statewide Weights

Clothes Washer	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	98%	91%	42%	100%	91%
Saturation	99%	91%	42%	100%	92%
n	356	55	48	29	488

Clothes Washer Type. The majority of clothes washers surveyed statewide were top-loading (75%), as opposed to horizontal-axis machines (25%).

Table 4-82: Top-Loading vs. Front-Loading Clothes Washers by Statewide Weights

Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Front Loading	28%	10%	45%	13%	25%
Top Loading	72%	90%	55%	87%	75%
Grand Total	100%	100%	100%	100%	100%
n	353	52	20	29	454

Clothes Washer/Water Heating Type. The majority of clothes washers are supplied with either electric or natural gas water heating. In both the statewide totals for all housing types as well as SF-Detached houses, private clothes washers are most commonly fueled by natural gas water heating followed by electric water heaters.

Table 4-83: Clothes Washer/Water Heating Fuel Type by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Electric	41%	29%	44%	94%	42%
Natural Gas	49%	64%	48%	0%	49%
Oil	8%	7%	8%	5%	8%
Propane	1%	0%	0%	0%	1%
Solar	0%	0%	0%	0%	0%
Wood	0%	0%	0%	0%	0%
Grand Total	100%	100%	100%	100%	100%
n	349	51	17	29	446

Clothes Washer Age. The average clothes washer age, based on "in the home" clothes washers in all housing types is approximately 8.5 years old.

Table 4-84: Clothes Washer Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	8.7	7.4	10.2	8.2	8.5
n	348	51	20	29	448

Loads per Week. The average household with a private washer runs 5 loads of laundry per week. The number of loads is fairly consistent across all housing types despite a limited number of observations in select housing types.

Table 4-85: Clothes Washer Loads per Week by Statewide Weights

Loads/Week	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Avg. Loads	5.4	4.7	3.9	4.1	5.1
n	350	52	20	29	451

ENERGY STAR Clothes Washers. 24% of private clothes washers, statewide, were ENERGY STAR rated based on the statewide weighting.

The SWE team documentation of ENERGY STAR clothes washers was based on the ability to visually detect the label or determine that a particular model was ENERGY STAR rated by searching for the make and model number on the ENERGY STAR website or manufacturer data. The SWE Team did not verify the ENERGY STAR status of the clothes washers in the PECO residential baseline study. It should be noted that there are likely occasions where a clothes washer was ENERGY STAR compliant at one time, but may have since lost its rating due to increased efficiency standards.

Table 4-86: ENERGY STAR Clothes Washers by Statewide Weights

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	26%	15%	22%	25%	24%
No	74%	85%	78%	75%	76%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	353	52	20	29	454

Dryer Fuel Type. Electric dryers are more prevalent on average than natural gas dryers across all housing types statewide. Overall, 74% of all dryers use electricity. Comparatively, only 22% use natural gas. As expected, dryers that use bottle fuels are rare.

Table 4-87: Dryer Fuel Type by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Natural Gas	23%	33%	5%	0%	22%
Electric	73%	67%	95%	99%	74%

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Propane	4%	0%	0%	0%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	346	48	21	29	444

4.7.3 Dishwashers

Number of Dishwashers. 71% of homes surveyed have a dishwasher, with dishwashers being most common in SF-Detached housing units (82%).

Table 4-88: Dishwasher Saturation by Statewide Weights

Saturation (%)	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Dishwashers	82%	53%	44%	33%	71%
n	356	55	48	29	488

Dishwasher/Water Heating Type. The percent of dishwashers with electric water heating is 42% of all dishwashers. The majority of the hot water supplied to dishwashers is heated by natural gas (49%).

Table 4-89: Dishwasher/Water Heating Type by Statewide Weights

Fuel Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Electric	42%	32%	50%	97%	42%
Natural Gas	49%	68%	50%	1%	50%
Oil	8%	0%	0%	0%	6%
Propane	1%	0%	0%	0%	1%
Wood	0%	0%	0%	1%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	282	32	18	11	343

Dishwasher Age. The statewide average age of a dishwasher is 9.1 years.

Table 4-90: Dishwasher Age by Statewide Weights

Avg. Age	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Years	9.1	9.7	8.6	9.4	9.1
n	283	32	20	11	346

ENERGY STAR Dishwashers. 38% of dishwashers were ENERGY STAR rated across the EDCs. Approximately 36% of SF-Detached houses had ENERGY STAR compliant dishwashers. Other housing types have significantly limited observations of dishwashers present.

Where possible, the SWE team collected make/model information of dishwashers and verified ENERGY STAR status. The SWE Team did not independently verify the ENERGY STAR status of the dishwashers included in the PECO residential baseline study.

Table 4-91: ENERGY STAR Dishwashers by Statewide Weights

ENERGY STAR	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	36%	52%	37%	49%	38%
No	64%	48%	63%	51%	62%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	285	33	21	11	350

4.7.4 Consumer Electronics

Number of Televisions. Nearly every residence surveyed had at least one television. Statewide, the average household had nearly 3 televisions per household. This number was slightly greater (3.2) for the average SF-Detached housing unit.

Table 4-92: Penetration/Saturation of Televisions by Statewide Weights

Televisions	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	98%	98%	98%	100%	98%
Saturation	322%	280%	194%	288%	301%
n	356	55	48	29	488

Television Type/Size. Approximately three-quarters of all televisions statewide are currently estimated to have a screen-size of less than 36 inches. Of those televisions with a screen size less than 36 inches, the majority of televisions are cathode ray tube (CRT). As television size increases, the majority of televisions are flat panel screen (LCD and Plasma) technology.

Table 4-93: Screen Size of Televisions by Statewide Weights

Televisions	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Greater than 36"	29%	21%	38%	33%	28%
Less than 36"	71%	79%	62%	67%	72%
n	1105	152	95	82	1434

Table 4-94: Type of Television (Greater than 36") by Statewide Weights

Greater than 36"	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CRT	19%	19%	16%	31%	19%
LCD	49%	45%	54%	52%	49%
Plasma	20%	21%	17%	17%	20%
Other	11%	15%	14%	0%	11%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	336	40	37	27	440

Table 4-95: Type of Television (Less than 36") by Statewide Weights

Less than 36"	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CRT	67%	68%	76%	57%	68%

Less than 36"	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
LCD	27%	26%	15%	38%	27%
Plasma	5%	7%	4%	5%	5%
Other	1%	0%	5%	0%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**
n	769	112	58	55	994

Number of Desktop/Laptop Computers. Nearly 9 out of every 10 homes statewide have at least one PC (desktop and/or laptop) in their home, with the average home containing more than 1.6 PCs. The penetration/saturation of desktops and laptops are also presented individually below. In general single family homes have more desktop and laptop PCs than other housing types.

Table 4-96: Penetration/Saturation of PCs by Statewide Weights

Computers	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	92%	92%	69%	75%	89%
Saturation	178%	151%	106%	128%	164%
n	356	55	48	29	488

Table 4-97: Penetration/Saturation (Desktop Only) by Statewide Weights

Desktop PC	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	73%	54%	30%	62%	65%
Saturation	92%	76%	31%	69%	82%
n	356	55	48	29	488

Table 4-98: Penetration/Saturation (Laptop Only) by Statewide Weights

Laptop PC	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	61%	60%	51%	46%	59%
Saturation	86%	75%	75%	59%	82%
n	356	55	48	29	488

PC Monitor Type. 21% of PC Monitors surveyed were equipped with CRT Monitors. The majority of computers utilize LCD flat screen monitors.

Table 4-99: PC Monitor Type by EDC

PC Monitors	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
CRT	23%	11%	31%	17%	21%
Flat Screen	77%	89%	69%	83%	79%
n	299	36	16	22	373

Number of Tablet PCs. While relatively new to the market, the overall statewide penetration of tablet PCs is 11% across the six EDCs surveyed by the SWE team. PECO data was not available for tablet PC market penetration and is not reflected in the statewide weighting.

Table 4-100: Penetration/Saturation of Tablet PCs by Statewide Weights

Tablet PC	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	11%	10%	7%	15%	11%
Saturation	11%	11%	7%	22%	11%
n	312	36	43	29	420

*Does not include 2011 PECO data

Miscellaneous Consumer Electronics. The statewide penetration and saturation of various small consumer electronics collected by the SWE team is presented below. Similar data from the 2011 PECO baseline study was not available for comparison purposes and are thus not included in the statewide weighting.

Of the surveyed equipment, fax machines and home theater systems are the least common items in the surveyed households. The saturation of gaming systems is roughly 57% statewide. On average, homes have an average of more than one DVD player and 1.8 mobile phone chargers and 1.3 DVD players.

Table 4-101: Penetration/Saturation of Miscellaneous Electronics by Statewide Weights

Misc. Electronics	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
DVD					
Penetration	88%	76%	86%	92%	87%
Saturation	138%	116%	114%	120%	132%
Fax Machine					
Penetration	15%	19%	0%	8%	13%
Saturation	15%	33%	0%	8%	15%
Gaming					
Penetration	40%	44%	39%	50%	41%
Saturation	57%	73%	43%	67%	57%
Home Theater					
Penetration	27%	14%	9%	33%	24%
Saturation	29%	14%	12%	33%	26%
Phone Charger					
Penetration	91%	86%	77%	100%	89%
Saturation	191%	146%	120%	173%	177%
Stereo					
Penetration	61%	53%	51%	44%	58%
Saturation	80%	56%	53%	51%	73%
VCR					
Penetration	46%	46%	31%	38%	44%
Saturation	62%	55%	35%	42%	57%

Misc. Electronics	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
n	312	36	43	29	420

*Does not include 2011 PECO on-site data

4.7.5 Other

Humidifiers/Dehumidifiers. Dehumidifiers are present in 44% of surveyed homes statewide and 58% of SF-Detached housing. Humidifiers are less common, present in only 19% of surveyed homes (22% of SF-Detached residences).

Table 4-102: Humidifier/Dehumidifiers Saturation by Statewide Weights

Saturation	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Humidifiers	22%	10%	12%	21%	19%
Dehumidifiers	58%	19%	10%	0%	44%
n	356	55	48	29	488

Humidifiers/Dehumidifier Usage. On average, dehumidifiers run 4.8 months per year. Humidifiers run slightly less, an average of 3.5 months per year. It is important to note that many of the surveyed households did not have humidifiers or dehumidifiers or did not provide a response to this usage question creating limited samples sizes across the housing unit types.

Table 4-103: Humidifier/Dehumidifier Use (Months/Year) by EDC

Avg. Months/Year	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Humidifiers	3.6	3.0	3.7	3.4	3.5
n	85	9	7	6	107
Dehumidifiers	4.8	5.6	5.1	-	4.8
n	198	13	4	0	215

Ceiling Fans. More than three-quarters of homes have at least one ceiling fan at the statewide level. The penetration of ceiling fans is even greater for SF-Detached housing, at 85% of the surveyed homes, the average number of ceiling fans in all home was 2.6 across all housing types, and 3.0 for SF-Detached houses.

Table 4-104: Penetration/Saturation of Ceiling Fans by EDC

Ceiling Fans	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Penetration	85%	69%	51%	91%	79%
Saturation	295%	206%	98%	209%	257%
n	356	55	48	29	488

Ceiling Fan Usage. Approximately 37% of all ceiling fans are used 6 hours per day or more according to the results available in 6 of the Pennsylvania EDCs. Ceiling fan hours of use were not available for PECO and is not included in the statewide weighting.

Table 4-105: Ceiling Fan Hours of Use by EDC

Used 6 hrs or more	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Yes	35%	45%	51%	33%	37%
n	813	69	42	62	986

*Does not include 2011 PECO on-site data

Pools/Hot Tubs. The vast majority of homes, statewide, do not have any outdoor recreational equipment such as a swimming pool or hot tubs. 90% of households or more have no private swimming pools. Private pools are generally only found in a small number of SF-Detached houses. Similarly, 94% of homes surveyed do not have a hot tub or spa.

Table 4-106: Pool/Spa Saturation by EDC

Pool Type	SF-Detached	SF-Attached	Multifamily	Manufactured	Statewide
Above Ground	10%	7%	0%	0%	8%
In Ground	3%	0%	0%	0%	2%
Hot Tub/Spa	7%	7%	0%	10%	6%
n	314	35	43	28	420

*Does not include 2011 PECO on-site data

5 EDC SPECIFIC FINDINGS

5.1 INTRODUCTION

This section describes the residential sector findings obtained from the on-site survey collection and analysis activities for each of the seven EDCs located throughout Pennsylvania. Data was gathered from two primary sources:

1. 70 on-site surveys conducted by the SWE team in each of the following six EDCs: Duquesne Light, Metropolitan Edison, Pennsylvania Electric, Penn Power, West Penn Power, and PPL.
2. 68 on-site surveys of PECO's residential customers conducted by Navigant for the 2011 PECO Baseline Study

Whenever possible, the SWE Team has included the findings from the 2011 PECO Baseline study with the rest of the EDC specific results for ease of comparison across all seven Pennsylvania EDCs. In select cases, dissimilar data fields prohibited the aggregation of the 2011 PECO Baseline Study. These cases have been noted throughout the following section.

As noted earlier in the report, EDC level results have been weighted based on housing type and age of head of household. See section 3.4.2 for more details.

5.2 BASIC HOME CHARACTERISTICS

5.2.1 Usage

The residential customers were stratified and recruited to attain a representative sample of each EDC territory in terms of average monthly usage and housing type. Table 5-1 shows each EDCs representation of usage based on the final on-site sample.

Table 5-1: Average Monthly Electricity Usage

Avg. Monthly kWh Use	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
<=500 kWh	32%	14%	29%	22%	12%	19%	25%
501-1000 kWh	46%	36%	39%	40%	39%	33%	39%
1001-1500 kWh	14%	28%	15%	17%	31%	25%	26%
>1500 kWh	7%	20%	17%	21%	17%	22%	10%
Don't Know	0%	3%	0%	0%	0%	2%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

5.2.2 Home Type

Table 5-2 displays the types of residential sites surveyed after applying the EDC case weights. Single family detached houses are the dominant housing type across all EDCs. Single family attached houses consist of row houses, townhomes, and duplexes.

Table 5-2: Home Type by EDC

Home Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
SF-Detached	63%	78%	82%	85%	68%	70%	65%
SF-Attached	10%	8%	5%	4%	8%	15%	28%
Multifamily	26%	5%	5%	6%	16%	9%	7%
Manuf./Mobile	1%	8%	7%	5%	8%	5%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Home Age. The average age of surveyed homes ranged from 39 years in the MetEd territory to 61 years in the Penelec territory. Table 5-3 displays the distribution of the years of construction across the seven EDCs.

Table 5-3: Average Age of Home by EDC

Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Average Age	58.0	39.4	60.7	54.5	47.1	44.6	52.1
n	70	68	70	70	70	69	67

Table 5-4: Year of Construction by EDC

Year of Construction	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Pre-1900	4%	1%	8%	3%	1%	5%	8%
1900-1910	2%	0%	8%	1%	8%	2%	6%
1911-1920	3%	8%	4%	7%	7%	5%	2%
1921-1930	11%	0%	8%	7%	2%	3%	0%
1931-1940	13%	3%	6%	8%	4%	2%	8%
1941-1950	13%	4%	5%	13%	5%	7%	10%
1951-1960	19%	8%	10%	16%	9%	7%	13%
1961-1970	7%	10%	21%	4%	12%	14%	16%
1971-1980	3%	20%	15%	12%	15%	10%	6%
1981-1990	10%	17%	2%	11%	11%	18%	13%
1991-2000	12%	16%	4%	12%	9%	16%	14%
2001-Present	3%	13%	11%	5%	16%	11%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	68	70	70	70	69	67

5.2.3 Home Size

The average square footage of conditioned space ranged from 1,684 sq. ft. in the PPL territory to 2,007 sq. ft. in the PECO area. Table 5-5 also provides the un-weighted average per home type, broken out by EDC, as well.

Table 5-5: Average Home Square Footage (Conditioned Space) by EDC

Home Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
SF-Detached	1,975	1,978	1,813	1,830	1,999	1,808	2,391
SF-Attached	1,677	1,305	1,270	1,774	1,275	1,577	1,224

Home Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Multifamily	1,143	1,033	793	833	858	670	970
Manuf./Mobile	980	1,503	1,084	1,135	1,222	1,055	
All Homes	**1,726**	**1,831**	**1,687**	**1,760**	**1,721**	**1,684**	**2,007**
n	70	69	65	70	70	66	68

Home Foundation. Across six EDCs, greater than 75% of homes are equipped with either conditioned or unconditioned basements. Foundation type was not readily available for the 2011 PECO dataset.

Table 5-6: Foundation Type by EDC

Year of Construction	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Slab	7%	16%	5%	6%	6%	4%
Enclosed Crawl	0%	7%	7%	7%	4%	7%
Open Crawl	4%	1%	2%	0%	1%	3%
Uncond. Basement	30%	37%	56%	39%	50%	53%
Conditioned Basement	53%	37%	25%	46%	38%	28%
Unit above Cond. Space	6%	2%	5%	2%	2%	6%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

5.2.4 Demographics

Homeownership. Owner occupied houses range from 72% of all homes in the Duquesne service area to 87% in the Penn Power area.

Table 5-7: Own vs. Rent by EDC

Homeownership	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Own	72%	80%	83%	87%	79%	84%	83%
Rent	28%	20%	17%	13%	21%	16%	17%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Type of Residence. Nearly all of surveyed homes (94-100% across the seven EDCs) are year-round, main residences.

Table 5-8: Year Round Residences by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Year-Round	94%	100%	94%	98%	98%	96%	99%
n	70	70	70	70	70	70	68

Occupancy. The average year-round home occupancy ranges from 2.3 people to 3.0 across each EDC.

Table 5-9: Number of Year Round Occupants by EDC

Occupants	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. # of Occupants	2.3	2.4	2.4	2.4	2.5	2.4	3.0
Max. # of Occupants	6	8	6	5	5	7	8
Min. # of Occupants	1	1	1	1	1	0	0
n	70	70	70	70	69	70	68

5.3 BUILDING SHELL

This section presents information on the characteristics of the building envelope found present at the surveyed residential homes throughout Pennsylvania.

5.3.1 Insulation

Attic Insulation. The majority of surveyed homes had some level of attic insulation present. Typically, less than 14% of homes were verified to have no attic insulation present. Surveyors were unable to verify the presence or absence of insulation in 3% to 22% of homes based on homes with limited or no access to attic space. N/A refers to homes where attic insulation was not applicable.

Table 5-10: Presence of Attic Insulation by EDC

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	59%	75%	77%	91%	78%	75%	75%
No	14%	7%	1%	6%	3%	12%	12%
N/A	9%	1%	0%	0%	0%	0%	13%
Don't Know	19%	17%	22%	3%	19%	13%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Attic Insulation Type. Where insulation was present, fiberglass is the predominant form of attic insulation. Fiberglass batting or loose-fill fiberglass was present in 72% to 93% of surveyed attics with insulation. Other includes rock wool, vermiculate, spray foam, as well as a mixture of fiberglass and other types. Note that not all attics were verified to possess attic insulation.

Table 5-11: Type of Attic Insulation by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Cellulose Loose Fill	8%	2%	6%	13%	9%	6%	3%
Fiberglass Batting	66%	39%	68%	52%	66%	62%	29%
Fiberglass Loose	6%	46%	25%	21%	23%	13%	60%
Other	9%	1%	1%	10%	1%	15%	7%
Don't Know	11%	12%	0%	4%	1%	4%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	45	53	50	63	60	55	53

Attic Insulation Thickness. The average thickness of attic insulation, in homes with attic insulation present, ranged from 7.1 inches to 9.8 inches. The average R-value ranged from R21 (PECO) to R28

(MetEd). Due to limited access to attics, particularly in multifamily units, attic insulation thickness was not able to be determined in all instances where attic insulation was present

Table 5-12: Attic Insulation Thickness/R-Value by EDC

Thickness	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Thickness	8.1	9.8	8.7	8.4	8.7	7.7	7.1
R-Value	25.7	27.6	25.9	24.7	25.3	24.4	21.2
n	40	42	49	56	57	51	53

For homes with attic insulation, the table below indicates the proportion of insulation by R-value. In general, the majority of homes had attic insulation meeting or exceeding R-19. However, less than 20% (with the exception of Penelec) had R-38 or above. The 2011 PECO dataset found a substantial percent of homes with attic insulation below R-19 levels relative to the EDCs surveyed by the SWE team. It is unknown if there were differences in data collection and R-value calculations between the SWE surveys and those collected by PECO that would serve to explain these differences.

Table 5-13: Proportion of Attic Insulation R-Value by EDC

Attic R-Value	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
R1-R12	5%	1%	1%	6%	2%	10%	16%
R13-R18	7%	0%	13%	13%	13%	4%	31%
R19-R37	71%	82%	59%	65%	69%	71%	44%
R38-R59	15%	17%	20%	14%	15%	13%	6%
R60 or above	3%	0%	8%	1%	1%	2%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	32	27	44	49	44	38	44

Wall Insulation. The majority of surveyed homes had some level of wall insulation present. The range of homes verified to have no wall insulation present ranged from 11% to 31%. Surveyors were unable to verify the presence or absence of insulation in 10% to 33% of homes based on homes with no access to wall space. N/A refers to homes where wall insulation was not applicable.

Table 5-14: Presence of Wall Insulation by EDC

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	50%	57%	72%	77%	63%	69%	67%
No	18%	15%	11%	13%	15%	14%	31%
N/A	0%	0%	0%	0%	0%	0%	2%
Don't Know	33%	28%	16%	10%	22%	17%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Wall Insulation Type. Fiberglass batting is the predominant form of wall insulation (35% to 70%). Surveyors were not able to determine the type of wall insulation in 0% to 17% of surveyed homes. Other includes dense pack cellulose, rigid board, spray foam, fiberglass/other mixture, etc. Note that not all homes had wall insulation present and the number of total observations is limited.

Table 5-15: Type of Wall Insulation by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Cellulose Loose Fill	8%	3%	9%	9%	2%	2%	0%
Fiberglass Batting	56%	43%	70%	67%	67%	73%	35%
Fiberglass Loose	2%	31%	6%	2%	17%	0%	24%
Other	16%	8%	9%	17%	14%	7%	33%
Don't Know	18%	16%	5%	6%	0%	17%	8%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	37	40	47	55	45	51	48

Wall Insulation Thickness. The average thickness of wall insulation ranged from 4.1 inches to 4.8 inches. The average R-value ranged from R13 (PECO) to R16 (PPL). Due to limited access to wall space, particularly in multifamily units, wall insulation thickness was not able to be determined in all instances where wall insulation was present.

Table 5-16: Wall Insulation Thickness/R-Value by EDC

Thickness	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Thickness	4.1	4.8	4.7	4.5	4.5	4.8	4.5
R-Value	15.0	15.6	15.1	14.6	14.7	15.9	12.9
n	31	27	44	49	44	38	48

For homes with wall insulation, the table below indicates the proportion of insulation by R-value. With the exception of the PECO data, the majority of homes with wall insulation present were found to have R-13 or greater insulation. The 2011 PECO dataset found a substantial percent of homes with wall insulation below R-13 levels relative to the EDCs surveyed by the SWE team. It is unknown if there were differences in data collection and R-value calculations between the SWE surveys and those collected by PECO that would serve to explain these differences.

Table 5-17: Proportion of Wall Insulation R-Value by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
R1-R12	35%	12%	18%	36%	40%	34%	62%
R13-R18	37%	46%	44%	25%	23%	19%	10%
R19-R37	25%	42%	38%	39%	35%	45%	24%
R38-R59	3%	0%	0%	0%	2%	2%	4%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	32	27	44	49	44	38	44

Basement Wall Insulation. Based on the results of surveyed homes with basements, 10% to 36% of homes with basements possessed some level of basement wall insulation. In order to incorporate the 2011 PECO data, the SWE team assumed all homes where basement wall insulation was N/A referred to homes without basements and were excluded from the basement wall analysis.

Table 5-18: Presence of Basement Wall Insulation by EDC

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	28%	29%	24%	17%	18%	36%	10%

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
No	67%	68%	74%	78%	75%	61%	90%
Don't Know	5%	3%	2%	5%	8%	3%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	60	52	51	55	62	57	30

Basement Wall Insulation Type. Fiberglass batting is the predominant form of basement wall insulation (38% to 87%). Rigid board insulation is also fairly common (13% to 34%). Note the limited number of observations available for basement wall insulation. These limited observations restrict the level of confidence of reported statistics.

Table 5-19: Basement Wall Insulation Type by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Fiberglass Batting	61%	38%	41%	87%	46%	53%	79%
Fiberglass Loose	0%	27%	12%	0%	15%	3%	0%
Rigid Board	16%	14%	35%	13%	24%	34%	21%
Other	11%	7%	6%	0%	6%	10%	0%
Don't Know	12%	14%	6%	0%	9%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	18	14	11	11	13	23	3

Basement Wall Insulation Thickness. In surveyed homes with basement wall insulation, the average thickness of insulation ranged from 3.2 inches to 5.6 inches. The average R-value ranged from R11 to R19. Note the limited number of observations available for basement wall insulation based on both the overall number of homes with basement wall insulation present as well as surveyor ability to determine thickness and R-value in these homes. These limited observations restrict the level of confidence of reported statistics.

Table 5-20: Basement Wall Insulation Thickness/R-value by EDC

Thickness	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Thickness	3.2	4.2	3.3	3.3	4.1	3.6	5.6
R-Value	13.8	14.7	11.0	11.1	14.3	13.3	18.6
n	16	8	10	11	13	18	3

Floor Insulation. Based on the results of surveyed homes, 13% to 46% of homes with basements and or crawlspaces possessed some level of floor insulation. In order to incorporate the 2011 PECO data, the SWE team assumed all homes where floor insulation was N/A referred to homes without basements or crawlspace and were excluded from the floor analysis.

Table 5-21: Presence of Floor Insulation by EDC

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	30%	43%	13%	20%	40%	46%	18%
No	58%	52%	76%	75%	52%	50%	82%
Don't Know	12%	5%	11%	6%	8%	4%	0%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Insulation Present?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
n	62	57	58	64	65	64	61

Floor Insulation Type. Fiberglass batting is the predominant form of floor insulation when insulation is present (49% to 96%). Note that only a subset of the surveyed homes possesses floor insulation. As a result, the number of observations available for this metric is limited.

Table 5-22: Floor Insulation Type by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Fiberglass Batting	71%	49%	93%	96%	81%	90%	80%
Fiberglass Loose	5%	33%	0%	0%	15%	2%	0%
Rigid Board	0%	0%	0%	0%	0%	0%	10%
Spray/Expand Foam	5%	0%	0%	0%	0%	0%	0%
Don't Know	20%	18%	7%	4%	4%	8%	9%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
n	19	23	9	15	22	28	13

Floor Insulation Thickness. In surveyed homes with floor insulation present, the average thickness of insulation ranged from 3.7 inches to 5.9 inches. The average R-value ranged from R12 to R20. The limited number of observations available for floor insulation thickness and R-value is based on both the overall number of homes with floor insulation present as well as surveyor ability to determine thickness and R-value characteristics in these homes. These limited observations restrict the level of confidence of reported statistics.

Table 5-23: Floor Insulation Thickness/R-value by EDC

Thickness	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Thickness	5.9	5.8	4.1	5.2	5.5	5.3	3.7
R-Value	20.0	17.5	13.9	16.5	17.0	16.5	11.6
n	15	15	9	12	20	26	13

For homes with floor insulation, the table below indicates the proportion of insulation by R-value. With the exception of the PECO data, the majority of homes with floor insulation present were found to have R-13 or greater insulation. The 2011 PECO dataset found a substantial percent of homes with floor insulation below R-13 levels relative to the EDCs surveyed by the SWE team. It is unknown if there were differences in data collection and R-value calculations between the SWE surveys and those collected by PECO that would serve to explain these differences.

Table 5-24: Proportion of Floor Insulation R-Value by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
R1-R12	22%	0%	47%	11%	32%	28%	73%
R13-R18	7%	40%	23%	31%	8%	17%	15%
R19-R37	64%	60%	30%	58%	60%	54%	12%
R38-R59	7%	0%	0%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
n	15	15	9	12	20	26	12

5.3.2 Windows

Number of Windows. The average number of windows per surveyed household ranged from 15 to 20 windows. The minimum number of windows per household was 2 windows and the maximum was 57 windows.

Table 5-25: Average Number of Windows per Household by EDC

# of Windows	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. # of Windows	15.2	16.1	16.8	15.8	15.2	17.2	20.3
Max. # of Windows	49	35	54	57	48	56	54
Min. # of Windows	2	3	2	3	2	2	4
n	70	70	70	70	70	70	68

Total Window Area. The average total square footage of window area per household ranged from 122 sq. ft. (PECO) to 182 sq. ft. (MetEd).

Table 5-26: Average Area of Window Area per Household by EDC

Avg. Sq. Ft. of Windows	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. Sq. Ft. per Home	157.1	182.3	170.9	150.5	146.2	158.8	122.4
n	70	70	70	70	70	70	68

Glazing Type. The table below describes the glazing types preset at the surveyed homes. The majority of windows were double-paned. Less than 2% are triple-paned across all EDCs and 9% to 14% were considered single-paned. Where surveyors were unsure of low-E coating, windows were assumed to be standard double-paned.

Table 5-27: Window Glazing Type by EDC

# of Windows	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Single-paned	9%	10%	14%	12%	12%	12%	13%
Double-paned	79%	73%	67%	55%	62%	56%	77%
Low-E double-paned	11%	14%	18%	32%	25%	32%	8%
Triple-paned	2%	2%	0%	1%	1%	0%	2%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
n	1106	1068	1106	1069	1160	1155	1361

5.3.1 Roofs

Roof Color. The majority of surveyed homes have dark roofs (between 67% and 85%). The remainder of surveyed homes had mostly light colored roofs, with only very small percent (0% to 4%) having white roofs. The 2011 PECO dataset did not align with the data collected by the SWE team; however, their dataset reports 81% of homes also had dark-colored roofing.

Table 5-28: Roof Color by EDC

%	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
White	4%	0%	2%	1%	0%	4%
Light	24%	33%	22%	30%	15%	26%
Dark	73%	67%	76%	69%	85%	70%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

5.3.2 Air Sealing

Air Sealing. Air Sealing was assessed qualitatively by surveyors by checking for possible areas of leakage around doors, windows, recessed cans, and other gaps in the thermal envelope. Surveyed homes were assessed as either: well-sealed, partially sealed, or poorly sealed. A third of surveyed homes or less (5% -35%) were assessed as poorly sealed. The majority of homes (41% to 78%) were assessed as partially sealed, with a small percent of homes (10%-21%) assessed as well-sealed.

Table 5-29: Quality of Air Sealing by EDC

%	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Well Sealed	18%	17%	13%	21%	21%	10%
Partially Sealed	59%	78%	38%	41%	47%	56%
Poorly Sealed	23%	4%	22%	35%	25%	25%
Unable to Assess	0%	1%	27%	3%	7%	9%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

5.3.3 Duct Sealing

Duct Location. The majority of duct work (24% to 69%) in the surveyed homes was located in unconditioned space (typically basements, crawlspaces, or attics). A similar percent of homes either had ducts in conditioned space or a mix of conditioned/unconditioned space. N/A refers to homes without duct work. Responses were omitted when the surveyor was unable to confirm the location of the ductwork; the final number of observations (n) per EDC is included below.

Table 5-30: Duct Location by EDC

%	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Cond./Uncond. Mix	28%	26%	13%	5%	22%	17%	2%
Conditioned Space	29%	31%	9%	31%	19%	14%	14%
Unconditioned Space	32%	24%	52%	56%	45%	56%	69%
N/A	11%	19%	26%	7%	13%	13%	14%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	66	64	65	70	66	45	68

Duct Sealing. The table below presents a qualitative assessment of duct sealing in homes with existing ductwork. Well sealed ducts refer to existing ductwork sealed with mastic or approved tape

and no visible signs of air leakage around inspected HVAC joints. Well sealed refers to minimal gaps, while poorly sealed ducts were assessed when ductwork was not taped or sealed with appropriate materials or significant amounts of leakage were visible. More than half of homes with existing ductwork were assessed to be either partially or well sealed. However, between 12% and 50% of homes had ductwork that was unable to be assessed (i.e. unable to access duct location).

Table 5-31: Quality of Duct Sealing by EDC

%	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Well Sealed	9%	21%	24%	4%	15%	19%
Partially Sealed	28%	5%	24%	63%	33%	10%
Poorly Sealed	47%	57%	27%	20%	35%	21%
Unable to Assess	16%	18%	25%	12%	17%	50%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	64	60	52	65	62	65

*Does not include 2011 PECO on-site data

5.4 RESIDENTIAL HVAC

This section presents details on the residential space heating and cooling systems present at the surveyed homes.

5.4.1 Equipment Saturations by Fuel/Type – Heating

Fuel Type. Natural gas was the most prominent heating fuel found in residential homes (35%-88%), with the exception of PPL (only 21% of primary heating systems). Electric systems and oil systems were also fairly common in select EDCs. The saturation of electric primary heating systems ranged from 8% (Duquesne) to 30% (MetEd). The remaining fuel types include coal, propane, wood, etc.

Table 5-32: Fuel Type of Primary Space Heating Systems by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Natural Gas	88%	35%	62%	62%	44%	21%	61%
Electric	8%	30%	11%	23%	28%	29%	15%
Oil	0%	21%	17%	6%	10%	32%	19%
Coal	0%	4%	0%	0%	0%	4%	0%
Dual Fuel	1%	0%	0%	2%	6%	3%	0%
Kerosene	0%	2%	2%	0%	3%	0%	0%
Propane	1%	6%	3%	3%	3%	5%	5%
Wood	1%	1%	6%	5%	6%	7%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	69	70	68	70	70	70	62

Backup Systems. The saturation of homes with at least one back-up heating system ranged between 11% and 38% within the EDCs. The table below presents the fuel type of backup heating systems. However, note the small sample size in most EDCs. Sample sizes below 68 do not meet a 90/10 level of confidence.

Table 5-33: Homes with Back-Up Heating Systems by EDC

Back-Up Heating	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
% of Homes	11%	25%	23%	13%	19%	38%	13%
n	70	70	70	70	70	70	68

Table 5-34: Fuel Type of Secondary Space Heating Systems by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Natural Gas	69%	5%	15%	62%	15%	6%	35%
Electric	31%	41%	43%	30%	39%	66%	48%
Oil	0%	10%	15%	8%	11%	5%	0%
Coal	0%	6%	0%	0%	0%	3%	0%
Dual Fuel	0%	0%	0%	0%	6%	0%	0%
Propane	0%	5%	8%	0%	0%	6%	0%
Wood	0%	32%	15%	0%	28%	14%	17%
Other	0%	0%	4%	0%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	10	16	18	9	18	40	6

Primary System Type. Between 27% and 75% of primary heating systems are central furnaces. The next most common systems are boilers and heat pump systems.

Table 5-35: System Type of Primary Space Heating Systems by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Central Furnaces	75%	60%	60%	68%	58%	27%	64%
Heat Pumps	7%	9%	5%	17%	21%	12%	9%
Boilers	15%	15%	20%	10%	8%	32%	22%
Baseboard	0%	10%	8%	2%	7%	15%	0%
Stoves	1%	2%	4%	4%	6%	11%	0%
Space Heaters	0%	2%	1%	0%	0%	2%	5%
Other	2%	3%	2%	0%	0%	1%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	69	68	66	70	68	68	63

Primary Electric Heating System Type. Although there is only a limited sample of primary electric heating systems within each EDC, the system type among electric space heating is shown below. Air Source Heat Pumps are typically the most common, ranging from 17% (MetEd) to 82% (Duquesne) across the EDCs. Baseboard and central furnaces are also common forms of primary electric heating.

Table 5-36: System Type of Primary Electric Heating Systems by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Air Source Heat Pump	82%	17%	27%	63%	57%	36%	45%
Baseboard	0%	35%	40%	8%	21%	50%	0%
Furnace	18%	22%	6%	12%	18%	7%	31%
Boiler	0%	0%	0%	12%	0%	0%	0%
Geothermal Heat Pump	0%	19%	27%	5%	4%	3%	0%

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Wall Mounted Space	0%	8%	0%	0%	0%	0%	25%
Other	0%	0%	0%	0%	0%	4%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	6	18	7	17	19	20	10

Secondary System Type. Baseboard heating and central furnaces are common secondary systems across all EDCs. Heat Pumps, electric space heating and wood/coal stove heating are also common forms of back-up heating systems across the EDCs. Due to small number of homes with back-up space heating, the number of observations for this data is significantly limited.

Table 5-37: System Type of Secondary Space Heating Systems by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Central Furnaces	70%	31%	11%	78%	15%	13%	30%
Heat Pumps	11%	0%	5%	22%	13%	18%	30%
Boilers	0%	0%	19%	0%	11%	0%	0%
Baseboard	9%	31%	23%	0%	22%	32%	0%
Stoves	0%	38%	26%	0%	22%	16%	15%
Space Heaters	9%	0%	15%	0%	4%	17%	26%
Other	0%	0%	0%	0%	13%	5%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	10	16	18	9	18	40	7

5.4.2 Equipment Saturations by Type – Cooling

Penetration of Central AC Systems. The penetration of central air conditioning systems varies across the EDCs. Only 23% and 26% of homes do not have central AC systems in the Duquesne and PECO service areas, respectively. By comparison, 62% of the surveyed homes in the Penelec area were without Central AC systems. Of homes with central AC systems, a relatively small number of homes had more than one system.

Table 5-38: Penetration of Central AC Systems by EDC

# of Central AC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
0	23%	39%	62%	26%	27%	50%	26%
1	73%	61%	38%	69%	69%	45%	64%
2	4%	0%	0%	5%	4%	2%	10%
3+	0%	0%	0%	0%	0%	3%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Saturation of Central AC Systems. The saturation of primary Central AC systems ranges from 38% to 77%. The saturation of secondary systems in the surveyed homes ranged from 0% to 10% across the EDCs.

Table 5-39: Saturation of Central AC Systems by EDC

Saturation	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Primary	77%	61%	38%	74%	73%	50%	72%
Secondary	4%	0%	0%	5%	4%	10%	9%
n	70	70	70	70	70	70	68

Central AC System Type. While traditional central AC systems are the predominant system type for cooling (range of 59% to 92% across the seven EDCs), nearly every EDC also demonstrated the presence of air-source heat pump systems, mini-split systems, and geothermal systems.

Table 5-40: Central Air Conditioning System Type by EDC

Central AC Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Central AC Unit	87%	84%	85%	75%	73%	59%	92%
Central AC Unit (Mini Split)	0%	0%	3%	0%	0%	4%	0%
Geothermal	0%	7%	6%	2%	2%	2%	0%
Heat Pump	13%	9%	0%	24%	25%	32%	8%
Heat Pump (Mini Split)	0%	0%	6%	0%	0%	3%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	55	44	23	53	51	35	45

Penetration of Room AC Systems. The penetration of room air conditioning systems varies across the EDCs. Between 20% and 46% of homes surveyed have at least one room air conditioner. In addition, a relatively large percent of the surveyed homes have two or more air conditioners per household.

Table 5-41: Penetration of Room Air Conditioners by EDC

# of Room AC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
0	80%	54%	70%	73%	77%	58%	75%
1	8%	20%	11%	20%	11%	16%	5%
2	8%	13%	13%	7%	7%	19%	15%
3+	5%	13%	7%	0%	5%	7%	6%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Saturation of Room AC Systems. The total saturation of room air conditioners by EDC ranged from 34% (Penn Power) to 88% (Met Ed).

Table 5-42: Saturation of Room Air Conditioners by EDC

Saturation	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Room ACs	43%	88%	57%	34%	42%	76%	49%
n	70	70	70	70	70	70	68

5.4.3 Efficiency Levels

Central AC SEER Rating. The Central AC efficiency was infrequently provided on the equipment, but where the make and model were available the SWE team recorded and researched manufacturer data. The majority of Central AC systems were found to currently have a SEER rating below current federal minimum standards (SEER 13). Less than 18% of all Central AC systems (including heat pumps, geothermal and mini split systems) across all the EDCs were found to currently meet ENERGY STAR criteria of 14.5 SEER or better.

Table 5-43: Central AC System SEER Ratings by EDC

SEER Rating	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Below 13	47%	37%	36%	60%	47%	44%	3%
13	22%	32%	14%	13%	21%	29%	13%
14	8%	0%	0%	4%	3%	8%	17%
14.5 or above	3%	3%	18%	8%	9%	6%	0%
Don't Know	20%	28%	33%	14%	20%	13%	67%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	55	44	23	53	51	35	45

This table includes the Central AC systems where the SEER rating was unable to be determined. It is probable that a majority of these unknown systems are currently at or below the current minimum standard as manufacturer data was often unavailable for older systems. Also, note that the sample size is limited for Central AC systems as not all households currently utilize Central AC systems for cooling needs.

ENERGY STAR Room Air Conditioners. 4% - 35% of room air conditioners were ENERGY STAR rated across the EDCs. The SWE team documentation of ENERGY STAR Room ACs was based on the ability to visually detect the label or determine that a particular model was ENERGY STAR rated by searching for the make and model number on the ENERGY STAR website or manufacturer data. The number of room air conditioners with make/model number detail available is listed to demonstrate the limited sample size associated with this metric.

Table 5-44: ENERGY STAR Room Air Conditioners by EDC

ENERGY STAR Room AC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	12%	24%	12%	4%	24%	35%	9%
No	88%	76%	88%	96%	76%	65%	91%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	27	57	35	21	28	51	34

Programmable Thermostats. Roughly half of Central HVAC systems had a programmable thermostat installed, ranging from 39% (Penn Power) to 72% in the PECO service area. Homes without central systems were not included in this metric.

Table 5-45: Programmable Thermostats by EDC

Prog. Thermostat	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	54%	56%	56%	39%	50%	54%	72%
No	46%	44%	44%	61%	50%	46%	28%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	55	44	23	53	51	35	45

5.4.4 Other

Heating System Age. The average heating system is between 13 and 15 years old.

Table 5-46: Average Heating System Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	12.7	14.0	11.9	12.6	13.7	14.8	13.5
n	74	82	85	79	82	98	70

Heating Maintenance. The majority of homeowners reported that they had recently (within the last year) had a seasonal tune-up performed on their heating systems. Between 13% and 31% reported they had never had a seasonal tune-up performed on their heating systems.

Table 5-47: Time since Last Seasonal Tune-Up (Heating Systems) by EDC

Last Tune Up?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Equipment is < 1 year old	1%	5%	1%	5%	0%	1%	0%
Less than 1 year	55%	39%	67%	39%	43%	38%	56%
1-2 years	12%	18%	8%	23%	24%	31%	5%
More than 2 years	18%	8%	6%	15%	13%	10%	11%
Never	13%	31%	17%	18%	20%	20%	28%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	68	67	55	68	63	55	67

Heating System Set-Points. The average heating set point while homeowners were home and awake ranged from 67°F to 69°F. While asleep and/or away from home, homeowners generally reduced their heating set point. The 2011 PECO dataset is not represented in these tables as a result of different data collection methods related to heating system temperature set points.

Table 5-48: Heating System Temperature Set Points by EDC

Heating Set Points	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Awake	69	68	67	69	69	68
Asleep	68	66	67	68	68	66
Away	65	62	65	66	63	63
n	70	67	66	58	68	54

*Does not include 2011 PECO on-site data

Central AC System Age. The average heating system is between 8 and 12 years old.

Table 5-49: Average Central AC System Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	10.6	11.7	11.2	9.7	10.7	7.8	10.8
n	53	44	23	56	51	37	56

The table below presents the age range of central AC systems surveyed for each of the EDCs. Throughout most EDC's, 40% or more of central AC systems were older than 10 years of age. The number of observations is limited to those homes where Central AC systems were present.

Table 5-50: Central AC System Age Range by EDC

Central AC Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
0-3 Years	18%	20%	23%	18%	27%	30%	25%
3-10 Years	33%	32%	36%	42%	31%	44%	33%
11-15 Years	25%	21%	15%	28%	15%	16%	26%
16 Years or Older	24%	26%	27%	12%	27%	10%	16%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	53	44	23	56	51	37	56

AC System Maintenance. The majority of homeowners reported that they had recently (within the last year) had a seasonal tune-up performed on their AC system. Between 2% and 30% reported they had never had a seasonal tune-up performed on their AC systems.

Table 5-51: Time since Last Seasonal Tune-Up (Cooling Systems) by EDC

Last Tune Up?	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Equipment is < 1 year old	2%	3%	7%	2%	2%	2%	0%
Less than 1 year	49%	43%	70%	29%	36%	37%	50%
1-2 years	18%	22%	11%	26%	15%	28%	8%
More than 2 years	18%	3%	11%	18%	28%	12%	14%
Never	14%	30%	2%	25%	19%	22%	28%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	54	44	20	53	49	33	50

Cooling System Set-Points. The average cooling set point while homeowners were home ranged from 72°F to 73°F with no discernible difference between awake and asleep temperature. While away from home, homeowners generally raised their thermostat to reduce cooling times. The 2011 PECO dataset is not represented in these tables as a result of different data collection methods related to heating system temperature set points.

Table 5-52: Cooling System Temperature Set Points by EDC

Cooling Set Points	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Awake	74	73	72	73	73	73
Asleep	73	73	72	73	72	73
Away	79	77	75	75	77	76

n	55	44	20	43	49	29

*Does not include 2011 PECO on-site data

5.5 LIGHTING

This section presents details on the lighting equipment used in the surveyed residential sites.

5.5.1 Sockets per Home

Interior Sockets per Home. The average number of interior sockets per home ranges from a low of 44 in the Penelec service area to 59 sockets in the Penn Power area. These include all Edison-base, candelabra; pin-based and empty sockets found in homes and conditioned spaces. Exterior lighting is not included in this socket count.

Table 5-53: Number of Interior Sockets per Home by EDC

Number of Sockets	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Average per Home	50	53	44	59	59	54	54
n	70	70	70	70	70	70	68

Adjusted Interior Sockets per Home. After accounting for empty sockets, tube fluorescent lighting, specialty sockets (i.e. neon lights, xenon, zircon gas), and pin-based halogen bulbs, the total number of sockets per home reduces to a range of 38 to 48 sockets per home. This socket count aims to represent the total number of sockets eligible for CFL placement by removing sockets where CFL bulbs cannot easily be retrofitted.

Table 5-54: Adjusted Number of Interior Sockets per Home by EDC

Number of Sockets	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Average per Home	42	45	38	48	47	45	46
n	70	70	70	70	70	70	68

Exterior Sockets per Home. The average number of exterior sockets per home ranges from 5-7 sockets across the EDCs.

Table 5-55: Exterior Sockets per Home by EDC

Number of Sockets	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Average per Home	5	7	7	7	6	7	6
n	57	58	60	59	63	60	35

5.5.2 Bulb Type

Penetrations by Interior Bulb Type. The table below presents the penetration of interior lighting by bulb type. Nearly all homes have incandescent lighting. At least one compact fluorescent light (CFL) bulb can be found in 69% to 94% of residences. Tube fluorescent lighting is found in approximately

three-fourths of most residences. Halogen bulbs are found in less than half of all homes. LED bulbs are currently found in less than 16% of all homes.

Table 5-56: Penetration of Lighting by Interior Bulb Type by EDC

Bulb Type (Penetration)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CFL	77%	94%	69%	91%	88%	83%	82%
Halogen	41%	33%	23%	38%	27%	37%	38%
Incandescent	100%	99%	95%	100%	100%	99%	100%
LED	11%	16%	2%	15%	12%	15%	1%
Tube Fluorescent	72%	77%	72%	78%	76%	64%	71%
Other	16%	11%	7%	27%	28%	34%	6%
n	70	70	70	70	70	70	68

Saturations by Interior Bulb Type. Depending on the EDC, incandescent bulbs account for anywhere between 59% and 66% of all sockets in residences throughout Pennsylvania. While CFLs can be found in over two-thirds of houses (in six out of seven EDCs), CFL bulbs only account for 16% to 19% of all sockets. Tube fluorescent and halogen bulbs make the dominant majority of remaining sockets.

Table 5-57: Saturation of Lighting by Interior Bulb Type by EDC

Bulb Type (Saturation)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CFL	16%	19%	15%	18%	19%	16%	18%
Halogen	5%	4%	5%	6%	3%	6%	3%
Incandescent	65%	62%	66%	61%	59%	64%	66%
LED	0%	1%	0%	0%	0%	1%	0%
Tube Fluorescent	13%	12%	14%	13%	17%	12%	12%
Other	1%	1%	1%	2%	1%	2%	1%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	3663	3605	2938	4057	4354	3839	3778

CFL/LED Saturations based on Adjusted Interior Sockets. The table below presents the saturation of CFL and LED bulbs as a percent of sockets where high efficiency lighting could reasonably be achieved and excludes sockets where CFL/LED placement would be difficult or unrealistic.

Table 5-58: CFL/LED Saturations based on Eligible Sockets by EDC

Bulb Type (Saturation)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CFL	20%	22%	18%	22%	23%	20%	21%
LED	0%	2%	0%	0%	1%	1%	1%
n	3014	3089	2497	3323	3484	3154	3147

Saturations by Exterior Bulb Type. Incandescent bulbs account for anywhere between 57% and 78% of all exterior sockets in residences throughout Pennsylvania. Halogen and CFL lighting are the next most common forms of exterior lighting, ranging from 6% to 26% and 2% to 18% of exterior sockets, respectively.

Table 5-59: Saturation of Lighting by Exterior Bulb Type by EDC

Bulb Type (Saturation)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CFL	9%	9%	2%	16%	18%	11%	18%
Halogen	26%	13%	21%	6%	14%	11%	7%
Incandescent	57%	78%	74%	74%	66%	74%	61%
LED	1%	0%	0%	0%	0%	0%	0%
Tube Fluorescent	4%	0%	2%	1%	0%	2%	11%
Other	4%	0%	1%	3%	2%	2%	4%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	309	344	418	377	447	398	204

Average Wattage by Interior Bulb Type. The table below presents the average wattage of interior lighting by bulb type. The average wattage of incandescent bulbs ranged between 54W and 57W, suggesting a heavier mix of 40W and 60W bulbs than 75W to 100W bulbs in interior sockets. The average wattage of CFL bulbs ranges from 15W to 21W.

Table 5-60: Average Wattage by Bulb Type by EDC

Avg. Wattage	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CFL	17	15	21	16	18	16	15
Halogen	44	53	58	49	53	40	50
Incandescent	56	55	57	54	54	56	55
LED	7	14	-	7	28	7	2
Tube Fluorescent	48	34	41	44	40	46	39
n (for CFL Wattage)	575	676	465	741	679	608	345

5.5.3 Lighting Saturations by Room

Socket by Room Type. Across the EDCs the majority of lighting was found in bedrooms, followed closely by other high and medium use areas such as bathrooms, basements, kitchens, and living rooms. Closets, garages, and other rooms (i.e. attics, storage, etc.) are common low daily use areas, and represent anywhere from 7-14% of interior sockets.

Table 5-61: Interior Socket Saturation by Room Type by EDC

Room Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Basement	11%	14%	17%	11%	14%	14%	16%
Bathroom	14%	13%	14%	15%	14%	14%	14%
Bedroom	20%	18%	17%	17%	17%	17%	17%
Closet	3%	3%	2%	3%	3%	4%	2%
Dining Room	9%	6%	6%	7%	6%	5%	7%
Foyer/Hallway	8%	8%	6%	7%	7%	7%	10%
Garage	6%	5%	6%	6%	8%	5%	2%
Kitchen	13%	12%	12%	11%	11%	13%	12%
Living Room	12%	10%	10%	12%	13%	11%	14%
Office/Den	5%	4%	3%	7%	4%	4%	2%

Room Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Other	1%	6%	6%	4%	2%	5%	3%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	3663	3605	2938	4057	4354	3839	3778

5.6 DOMESTIC WATER HEATING

This section presents details on the water heating equipment present in the surveyed homes.

5.6.1 Equipment Saturations by Fuel/Type

Water Heating Fuel Type. Of the homes surveyed, 11% of homes in the Duquesne service area use electricity to heat their water and 32% use electricity in the PECO area. In the remaining EDCs the percent of homes that use electricity for water heating ranges from 38% to 57%. Met Ed has the highest electric water heater saturation, followed closely by PPL and West Penn Power. Natural gas is also prevalent for water heating purposes. Oil water heating is found in nearly 22% of homes in the PPL area, but is otherwise relatively absent.

Table 5-62: Water Heating Fuel Type by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Electric	11%	57%	38%	42%	54%	56%	32%
Natural Gas	88%	32%	60%	56%	45%	21%	61%
Oil	1%	9%	1%	0%	1%	22%	4%
Propane	0%	1%	0%	1%	0%	0%	3%
Solar	0%	0%	0%	0%	0%	1%	0%
Wood	0%	0%	0%	1%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	69	73	70	72	74	73	61

Water Heating System Type. Of electric water heaters, the large majority (93%-100%) are traditional storage tank water heaters. Note that the number of observations is limited only to those surveyed residences with electric water heating.

Table 5-63: Electric Water System Type by EDC

System Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Stand Alone Tank	100%	100%	100%	97%	98%	93%	97%
Heat Pump WH	0%	0%	0%	0%	2%	4%	3%
Tankless (On Demand)	0%	0%	0%	0%	0%	1%	0%
Don't Know	0%	0%	0%	3%	0%	2%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	7	39	30	32	38	40	20

Water Heating Age. The average electric water heater age by EDC ranges from 6 years to 10 years.

Table 5-64: Electric Water Heater Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	6.9	9.6	7.1	7.0	7.6	7.4	5.6
n	7	38	30	32	36	37	19

Tank Temperature. The average electric water heater tank temperature set point ranges from 120°F to 128°F.

Table 5-65: Electric Water Heater Tank Temperature by EDC

Tank Temp.	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Degrees (°F)	128	120	125	123	120	126	122
n	7	39	30	32	37	39	14

5.6.2 Efficiency Levels

Energy Factor. The water heater efficiency was infrequently provided on the name plate, but where the make and model were available the SWE team recorded and researched manufacturer data. The table below presents the percent of water heating system that do not currently meet the federal standard (units below EF=.90), as well as units that could be considered energy efficient (EF=.93 or above).

Electric water heater manufacturer efficiency was not available in homes surveyed for the 2011 PECO baseline study. Note the small sample sizes, particularly in the Duquesne area where the majority of water heating systems are fueled by natural gas.

Table 5-66: Electric Water Heater Efficiency by EDC

Energy Factor (EF)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Below .90	0%	8%	3%	23%	10%	9%
.90 - .92	62%	52%	49%	31%	51%	41%
.93 or above	11%	12%	15%	18%	14%	10%
Don't Know	27%	29%	34%	27%	25%	39%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	7	39	30	32	38	40

*Does not include 2011 PECO on-site data

Pipe Wrap. Between 0% and 34% of electric water heaters surveyed were found to have pipe wrap located on pipes near the water heater. Note the small sample sizes, particularly in the Duquesne area where the majority of water heating systems are fueled by natural gas.

Table 5-67: Water Heater Pipe Wrap by EDC

Pipe Wrap	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	0%	12%	9%	20%	13%	34%	17%
No	100%	88%	91%	80%	87%	66%	83%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	7	39	29	31	36	37	20

Water Heater Blanket. Tank wrap was found on 0% to 14% of electric water heating units surveyed. Note the small sample sizes, particularly in the Duquesne area where the majority of water heating systems are fueled by natural gas.

Table 5-68: Water Heater Blankets by EDC

Tank Wrap	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	0%	14%	6%	12%	8%	7%	7%
No	100%	86%	94%	88%	92%	93%	93%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	7	39	29	31	36	37	20

5.6.3 Water Efficiency Measures

Water efficiency measures aid in energy conservation by reducing hot water usage, and subsequently reducing the overall energy needed for water heating. The most typical water efficiency measures are low-flow showerheads and faucet aerators.

Faucet Aerators. On average, homes have between 3.5 and 4.1 sinks per home. As indicated by the saturations, homes average between 1.7 and 3.8 faucet aerators. This means that in select EDCs as few as 4% of sinks do not have faucet aerators while as many as 58% do not have faucet aerators in other areas.

Table 5-69: Sinks and Faucet Aerators by EDC

Faucet Aerators	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. # of Faucets	4.0	3.5	3.4	4.0	4.0	3.5	4.0
Avg. # Low Flow	2.9	3.3	2.0	1.6	2.4	3.2	3.3
% Low Flow	73%	93%	58%	41%	60%	89%	83%
n	70	70	70	70	70	70	68

Showerheads. On average, homes have between 1.5 and 1.7 showerheads per home. Low flow showerheads were found on 62% to 85% of all showerheads.

Table 5-70: Showers and Low Flow Showerheads by EDC

Showerheads	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. # of Showers	1.6	1.7	1.5	1.7	1.7	1.6	1.7
Avg. # Low Flow	1.1	1.4	1.3	1.1	1.0	0.9	1.4
% Low Flow	69%	85%	84%	66%	62%	58%	80%
n	70	70	70	70	70	70	68

5.7 OTHER APPLIANCES/EQUIPMENT

This section presents details on the major appliances and other smaller consumer electronics found in the surveyed residences.

5.7.1 Refrigerators/Freezers

Number of Refrigerators. Nearly every surveyed home had at least one refrigerator. Most surveyed homes (49%-71%) have only one refrigerator, and between 25%-39% have two refrigerators. Only a small number of surveyed homes (11% or less) have more than three refrigerators.

Table 5-71: Number of Refrigerators by EDC

#	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
0	0%	0%	0%	0%	0%	2%	0%
1	66%	71%	68%	63%	49%	59%	67%
2	33%	29%	25%	37%	39%	35%	33%
3	1%	0%	7%	0%	9%	4%	0%
4	0%	0%	0%	0%	1%	0%	0%
5	0%	0%	0%	0%	1%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Refrigerator Type. The most common type of refrigerator is the top-mount freezer across all seven EDCs, followed by side-by-side models, and bottom-mounted freezers. Compact refrigerators typically consist of 10% or less of all refrigerators found in homes.

Table 5-72: Refrigerator Type by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Bottom Freezer	12%	11%	5%	7%	15%	12%	10%
Compact	4%	4%	8%	7%	12%	7%	1%
Side by Side	31%	24%	24%	29%	19%	19%	33%
Top Freezer	54%	60%	63%	55%	54%	61%	50%
Other	0%	0%	0%	1%	0%	1%	6%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	97	92	94	95	118	101	90

Refrigerator Size. The average refrigerator volume, excluding compact refrigerators, ranges from approximately 18.2 to 21.7 cu. ft.

Table 5-73: Average Refrigerator Volume by EDC

Avg. Volume	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
cubic feet	19.6	20.3	18.2	19.8	19.7	18.7	21.7
n	92	85	85	90	100	81	87

Refrigerator Age. The average primary refrigerator ranged from 7 to 10 years old across the seven EDCs. Second refrigerators were, on average, older than primary units.

Table 5-74: Average Primary Refrigerator Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	7.4	7.9	9.6	9.0	9.9	8.9	9.3

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
n	68	70	70	70	69	64	68

Table 5-75: Average Secondary Refrigerator Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	12.7	15.5	16.1	18.0	20.9	15.7	11.0
n	23	18	18	20	32	22	19

ENERGY STAR Refrigerators. On average, one-third of all primary refrigerators currently possess the ENERGY STAR logo or are qualified as ENERGY STAR compliant. Where possible, the SWE team collected make/model information of refrigerators and verified ENERGY STAR status. For these EDCs, the percent of ENERGY STAR refrigerators ranged from 21-33%. The SWE Team did not verify the ENERGY STAR status of the refrigerators included in the PECO baseline study.

Secondary refrigerators, being typically older, were generally found not to possess the ENERGY STAR logo. However, note the small sample size associated with secondary refrigerators.

Table 5-76: ENERGY STAR Primary Refrigerators by EDC

ENERGY STAR	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	25%	32%	21%	33%	27%	24%	8%
No	75%	68%	79%	67%	73%	76%	92%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	69	68

Table 5-77: ENERGY STAR Secondary Refrigerators by EDC

ENERGY STAR	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	7%	15%	3%	0%	4%	4%	0%
No	93%	85%	97%	100%	96%	96%	100%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	27	22	24	25	48	32	22

Number of Freezers. The percent of homes with at least one freezer ranged from 21% in the Duquesne service area to 56% in the Penn Power area. Generally less than 6% of homes have two or more stand-alone freezers.

Table 5-78: Number of Stand-Alone Freezers by EDC

#	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
0	79%	53%	48%	44%	53%	56%	70%
1	20%	43%	48%	50%	42%	42%	30%
2	1%	2%	0%	5%	3%	2%	0%
3	0%	2%	5%	1%	1%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	70	70	70	70	70	70	68

Freezer Type. There is a substantial mix of upright and chest stand-alone freezers throughout all seven Pennsylvania EDCs.

Table 5-79: Stand-Alone Freezer Type by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Upright	49%	43%	37%	37%	52%	53%	49%
Chest	51%	57%	63%	63%	48%	47%	51%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	18	36	39	44	43	34	18

Freezer Age. The average freezer age ranged from 12 to nearly 19 years old across the seven EDCs.

Table 5-80: Stand-Alone Freezer Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	15.6	12.2	14.1	13.5	19.2	14.5	15.1
n	18	36	39	44	43	33	23

ENERGY STAR Freezers. Where possible, the SWE team collected make/model information of freezers and verified ENERGY STAR status. For these EDCs, the percent of ENERGY STAR freezers ranged from 4% to 13%. The SWE Team did not verify the ENERGY STAR status of the freezers collected for PECO.

Table 5-81: ENERGY STAR Stand-Alone Freezers by EDC

ENERGY STAR	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	7%	8%	13%	7%	4%	11%	0%
No	93%	92%	87%	93%	96%	89%	100%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
n	18	36	39	44	43	34	23

5.7.2 Clothes Washers/Dryers

Number of Clothes Washers. The percent of homes with at least one clothes washer (penetration) ranged from 84% to 97% of residences. A small number of residences had more than one private clothes washer.

Table 5-82: Number of Clothes Washers by EDC

Clothes Washer	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	84%	96%	95%	97%	94%	90%	91%
Saturation	84%	96%	98%	101%	95%	90%	91%
n	70	70	70	70	70	70	68

Clothes Washer Type. The majority (67%-81%) of clothes washers surveyed were top-loading, as opposed to horizontal-axis machines.

Table 5-83: Top-Loading vs. Front-Loading Clothes Washers by EDC

Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Front Loading	26%	19%	23%	13%	21%	23%	33%
Top Loading	74%	81%	77%	87%	79%	77%	67%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	61	65	64	70	68	64	62

Clothes Washer/Water Heating Type. The majority of clothes washers are supplied with either electric or natural gas water heating. The percent of clothes washers with electric water heating ranges from a low of 10% in the Duquesne service area to 57% in the PPL area.

Table 5-84: Clothes Washer/Water Heating Fuel Type by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Electric	10%	56%	37%	43%	52%	57%	31%
Natural Gas	89%	33%	62%	55%	47%	19%	62%
Oil	2%	9%	1%	0%	1%	23%	4%
Propane	0%	2%	0%	1%	0%	0%	3%
Solar	0%	0%	0%	0%	0%	1%	0%
Wood	0%	0%	0%	1%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	60	64	63	70	68	64	57

Clothes Washer Age. The average clothes washer ranged from 8 to 11 years old across the seven EDCs.

Table 5-85: Clothes Washer Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	9.4	10.1	9.1	10.0	10.7	7.0	7.7
n	58	65	64	69	66	64	62

Loads per Week. The average household washes 5 to 6 loads per week.

Table 5-86: Clothes Washer Loads per Week by EDC

Loads/Week	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Avg. Loads	4.7	4.7	5.3	5.0	5.1	5.0	5.6
n	61	65	64	70	68	64	59

ENERGY STAR Clothes Washers. 15% - 33% of clothes washers were ENERGY STAR rated across the EDCs. The SWE team documentation of ENERGY STAR clothes washers was based on the ability to visually detect the label or determine that a particular model was ENERGY STAR rated by searching for the make and model number on the ENERGY STAR website or manufacturer data. The SWE Team did not verify the ENERGY STAR status of the clothes washers included in the PECO baseline study. It should be noted that there are likely occasions where a clothes washer was ENERGY STAR compliant at one time, but may have since lost its rating due to increased efficiency standards.

Table 5-87: ENERGY STAR Clothes Washers by EDC

ENERGY STAR	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	28%	25%	25%	19%	25%	33%	15%
No	72%	75%	75%	81%	75%	67%	85%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	61	65	64	70	68	64	62

Dryer Fuel Type. Electric dryers are more prevalent on average than natural gas dryers. As expected, dryers that use bottle fuels are rare.

Table 5-88: Dryer Fuel Type by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Natural Gas	48%	14%	34%	23%	16%	8%	27%
Electric	51%	86%	66%	75%	83%	92%	63%
Propane	2%	0%	0%	2%	1%	0%	10%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	62	62	62	68	67	61	62

5.7.3 Dishwashers

Number of Dishwashers. 59% to 78% of homes surveyed contained a dishwasher, with a negligible number of homes having more than one.

Table 5-89: Dishwasher Saturation by EDC

Penetration (%)	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Dishwashers	78%	75%	59%	78%	71%	66%	76%
n	70	70	70	70	70	70	68

Dishwasher/Water Heating Type. The percent of dishwashers with electric water heating ranges from a low of 10% in the Duquesne service area to 65% in the PPL area.

Table 5-90: Dishwasher/Water Heating Type by EDC

Fuel Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Electric	10%	52%	35%	47%	53%	65%	30%
Natural Gas	88%	37%	63%	50%	46%	19%	63%
Oil	2%	9%	2%	0%	1%	16%	4%
Propane	0%	2%	0%	2%	0%	0%	3%
Wood	0%	0%	0%	1%	0%	0%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	55	53	36	52	52	47	48

Dishwasher Age. The average dishwasher age ranged from 8 to 11 years among surveyed residences.

Table 5-91: Dishwasher Age by EDC

Avg. Age	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Years	8.2	11.4	7.7	10.3	8.7	9.2	9.1
n	55	54	36	52	51	45	53

ENERGY STAR Dishwashers. 31% - 52% of dishwashers were ENERGY STAR rated across the EDCs. Where possible, the SWE team collected make/model information of dishwashers and verified ENERGY STAR status. The SWE Team did not verify the ENERGY STAR status of the dishwashers collected for PECO.

Table 5-92: ENERGY STAR Dishwashers by EDC

ENERGY STAR	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Yes	40%	35%	52%	37%	37%	42%	31%
No	60%	65%	48%	63%	63%	58%	69%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	56	54	36	52	52	47	53

5.7.4 Consumer Electronics

Number of Televisions. Nearly every residence surveyed had at least one television. On average, residences had between 2.8 and 3.2 televisions per household.

Table 5-93: Penetration/Saturation of Televisions by EDC

Televisions	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	98%	100%	97%	99%	98%	98%	99%
Saturation	277%	290%	277%	307%	301%	302%	320%
n	70	70	70	70	70	70	68

Television Type/Size. Approximately two-thirds to three-quarters of all televisions are currently estimated to have a screen-size of less than 36 inches. Of televisions with a screen size less than 36 inches, the majority of televisions are cathode ray tube (CRT). As television size increases, the majority of televisions are LCD and Plasma technology.

Table 5-94: Screen Size of Televisions by EDC

Televisions	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Greater than 36”	29%	37%	28%	33%	36%	26%	24%
Less than 36”	71%	63%	72%	67%	64%	74%	76%
n	200	198	185	213	220	203	215

Table 5-95: Type of Television (Greater than 36”) by EDC

Greater than 36”	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CRT	15%	33%	18%	20%	25%	32%	1%
LCD	64%	34%	69%	55%	47%	37%	55%
Plasma	12%	31%	10%	17%	19%	22%	21%
Other	9%	2%	3%	8%	10%	10%	23%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

n	56	81	50	68	84	51	50

Table 5-96: Type of Television (Less than 36") by EDC

Less than 36"	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CRT	65%	64%	64%	62%	60%	67%	74%
LCD	30%	24%	30%	34%	33%	27%	23%
Plasma	4%	11%	6%	2%	6%	6%	3%
Other	1%	1%	0%	2%	1%	1%	0%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	144	117	135	145	136	152	165

Number of Desktop/Laptop Computers. 82% or more of homes across the seven Pennsylvania EDCs have at least one PC (desktop and/or laptop) in their home, with the average home containing more than one PC. The penetration/saturation of desktops and laptops are also presented individually below.

Table 5-97: Penetration/Saturation of PCs by EDC

Computers	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	86%	87%	83%	87%	82%	85%	99%
Saturation	161%	141%	150%	169%	130%	154%	202%
n	70	70	70	70	70	70	68

Table 5-98: Penetration/Saturation (Desktop Only) by EDC

Desktop PC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	55%	70%	64%	61%	60%	66%	70%
Saturation	61%	78%	72%	72%	64%	83%	104%
n	70	70	70	70	70	70	68

Table 5-99: Penetration/Saturation (Laptop Only) by EDC

Laptop PC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	68%	43%	54%	66%	52%	55%	70%
Saturation	100%	63%	78%	97%	66%	71%	98%
n	70	70	70	70	70	70	68

PC Monitor Type. Twenty-six percent or less of PC Monitors surveyed were equipped with CRT Monitors. The majority of computers utilize LCD flat screen monitors.

Table 5-100: PC Monitor Type by EDC

PC Monitors	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
CRT	26%	20%	26%	24%	22%	26%	16%
Flat Screen	74%	80%	74%	76%	78%	74%	84%
n	47	53	51	49	46	56	71

Number of Tablet PCs. While relatively new to the market, the overall penetration of tablet PCs ranged from 4% to 15% across the six EDCs surveyed by the SWE team. PECO data was not available for tablet PC market penetration.

Table 5-101: Penetration/Saturation of Tablet PCs by EDC

Tablet PC	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Penetration	12%	4%	14%	8%	15%	10%
Saturation	12%	4%	15%	8%	15%	11%
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

Miscellaneous Consumer Electronics. The penetration and saturation data for various small consumer electronics collected by the SWE team are presented below. Similar data from the 2011 PECO baseline study were not available for comparison purposes.

Of the surveyed equipment, fax machines and Home Theater systems units are the least common items in the surveyed households. Gaming systems are present in roughly 50% of homes, stereo systems in roughly two-thirds of households. On average, households have at least one DVD player and phone charger.

Table 5-102: Penetration/Saturation of Miscellaneous Electronics by EDC

Misc. Electronics	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
DVD						
Penetration	84%	92%	84%	86%	93%	83%
Saturation	127%	133%	119%	125%	143%	134%
Fax Machine						
Penetration	12%	11%	8%	15%	9%	18%
Saturation	12%	11%	8%	15%	9%	23%
Gaming						
Penetration	42%	34%	42%	39%	43%	41%
Saturation	52%	46%	55%	61%	62%	63%
Home Theater						
Penetration	21%	24%	22%	13%	24%	28%
Saturation	27%	25%	22%	14%	27%	28%
Phone Charger						
Penetration	91%	95%	90%	95%	92%	84%
Saturation	171%	188%	182%	198%	177%	169%
Stereo						
Penetration	56%	60%	62%	66%	49%	60%
Saturation	67%	86%	83%	86%	58%	72%
VCR						
Penetration	39%	42%	59%	49%	47%	38%
Saturation	46%	49%	70%	59%	66%	53%
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

5.7.5 Other Equipment

Humidifiers/Dehumidifiers. Dehumidifiers are present in 30% to 65% of surveyed homes across the seven EDCs. Humidifiers are less common, present in only 14% to 33% of surveyed homes.

Table 5-103: Humidifier/Dehumidifiers Saturation by EDC

Saturation	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Humidifiers	31%	17%	15%	33%	30%	15%	14%
Dehumidifiers	30%	42%	51%	65%	53%	47%	39%
n	70	70	70	70	70	70	68

Humidifiers/Dehumidifier Usage. On average, dehumidifiers run between 4.8 and 5.9 months per year. Similarly, humidifiers run slightly less, an average of 2.9 to 5.0 months per year.

Table 5-104: Humidifier/Dehumidifier Use (Months/Year) by EDC

Avg. Months/Year	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Humidifiers	4.5	4.1	5.0	4.8	3.7	2.9	4.6
n	21	12	11	24	19	13	7
Dehumidifiers	4.7	4.9	4.8	5.9	4.8	5.4	5.5
n	22	29	25	42	39	35	24

Ceiling Fans. More than three-quarters of homes have at least one ceiling fan. Of the surveyed homes, the average number of ceiling fans in all homes ranges from 2.2 to 3.1 across the EDCs.

Table 5-105: Penetration/Saturation of Ceiling Fans by EDC

Ceiling Fans	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL	PECO
Penetration	76%	81%	75%	77%	81%	72%	87%
Saturation	223%	239%	228%	219%	230%	252%	306%
n	70	70	70	70	70	70	68

Ceiling Fan Usage. Approximately 24% to 42% of all ceiling fans are used 6 hours per day or more according to the results available in 6 of the Pennsylvania EDCs. Ceiling fan use was not available for PECO.

Table 5-106: Ceiling Fan Hours of Use by EDC

Used 6 hrs or more	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Yes	38%	42%	28%	24%	23%	42%
n	159	160	148	160	180	179

*Does not include 2011 PECO on-site data

Pools/Hot Tubs. The vast majority of homes do not have any outdoor recreational equipment such as a swimming pool or hot tubs. 88% of households or more have no private swimming pools. Similarly, 90% of homes surveyed do not have a hot tub or spa.

Table 5-107: Pool/Spa Saturation by EDC

Pool Type	Duquesne	MetEd	Penelec	Penn Power	WPP	PPL
Above Ground	7%	10%	6%	8%	6%	10%
In Ground	0%	1%	3%	2%	2%	2%
Hot Tub/Spa	2%	9%	11%	6%	3%	7%
n	70	70	70	70	70	70

*Does not include 2011 PECO on-site data

6 CONCLUDING REMARKS

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.[18] "

The results of this baseline study effort provide detailed and contemporary information across the seven largest EDCs in the state of Pennsylvania regarding baseline energy equipment saturations as well as electric equipment energy efficiency levels. These findings are intended to feed into the Electric Energy Efficiency Potential Assessment for the State of Pennsylvania conducted by the SWE team. Specifically, the baseline equipment saturation data is anticipated to supplement data collected through recent existing EDC appliance saturation studies, conducted with larger, more robust sample sizes than were possible through this endeavor. However, estimates of electric equipment efficiency levels are typically not a component of traditional appliance saturation assessments and data regarding the current saturation of energy efficient electric equipment is intended to be derived largely from the results of this report.

It was through the use of on-site data collection that the SWE team was able to collect accurate information regarding not only the type of equipment installed in residences throughout the state, but also the efficiency level of various major electric appliances, equipment, or end-uses. The study also collected valuable information on the levels of ceiling, wall, and floor insulation and other building shell characteristics. Finally, the contemporary nature of the data collection effort (SWE data collection occurred during Fall 2011; PECO data collection occurred during Spring 2010) captures these equipment types and efficiency levels during similar periods of EDC energy efficiency program maturity. These factors help to provide justification for the inputs of the energy efficiency potential assessment as well as confidence in the ultimate estimates of electric energy efficiency savings potential.

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

Appendix A ON-SITE SURVEY INSTRUMENT

Pennsylvania Statewide Residential Baseline Study – REV A
On-Site Inspection Forms

PARTICIPANT INFORMATION

PI.1- Owner/Renter Name	
PI.2- Name of Individual Present During Survey	
PI.3- House Address	
PI. 4- City/State/Zip	
PI.5- Telephone Number	
PI.6- Participant ID Number	

(Surveyor, please make sure all information above and throughout the document is completed and not left blank)

SURVEY DOCUMENTION (SD)

SD.1- Surveyor Name	
SD.2- Date Surveyed (MM/DD/YY)	
SD.3- Electric Distribution Company Name (check one)	☐ ~~PECO~~ ☐ PPL ☐ Duquesne ☐ First Energy (West Penn Power) formerly Allegheny ☐ First Energy (PennPower) ☐ First Energy (Penelec) ☐ First Energy (MetEd)

Pennsylvania Statewide Residential Baseline Study – REV A

On-Site Inspection Forms

BUILDING INFORMATION/CHARACTERISTICS (BI)

BI.1- House/Unit Type (check one)	1. Single-Family ☐ 2. Townhouse/Duplex ☐ 3. Multi-Family (Apartment ; 2-4 unit bldg) ☐ 4. Multi-Family (Apartment ; 5+ unit bldg) ☐ 5. Manufactured/Mobile Home ☐
BI.2- Size of manufactured home (check one)	1. Single Wide ☐ 2. Double Wide ☐ 3. Not a manufactured home ☐
BI.3- Year Home Was Built (estimate)	___ ___ ___ ___
BI.4- Front Facing Orientation (check one)	1. North ☐ 3. South ☐ 5. East ☐ 7. West ☐ 2. NE ☐ 4. NW ☐ 6. SE ☐ 8. SW ☐
BI.5- Predominant Construction Material (check one)	1. Wood Frame (2x6) ☐ 4. Concrete Block ☐ 2. Wood Frame (3x6) ☐ 5. Solid Brick ☐ 3. Wood/Block/Brick Combo ☐
BI.6- Roof Color (check one)	1. White ☐ 2. Light Color ☐ 3. Dark Color ☐
BI.7- Number of Occupants in Household (Greater than or equal to six months per year)	
BI. 8- Number of Bedrooms in Household	
BI.9- Weeks per Year Housing Unit Occupied	
BI.10- Estimated Square Footage of CONDITIONED Space (Area = W x L)	
BI.11- Estimated Volume of CONDITIONED Space (Volume = W x L x H)	
BI.12- Is Basement Part of Conditioned Space?	1. No Basement ☐ 2. Yes ☐ 3. No ☐
BI.13- Foundation Type (check one)	1. Slab On-Grade ☐ 4. Uncond. Basement ☐ 2. Enc. Crawl Space ☐ 5. Cond. Basement ☐ 3. Open Crawl Space ☐ 6. Other _____ ☐
BI.14- Number of Electric Meters Located At Residence?	

Pennsylvania Statewide Residential Baseline Study – REV A
On-Site Inspection Forms

INTERIOR LIGHTING

Socket #	Room Type	Socket Type	Existing Bulb Type	Control Type	Existing Bulb Watts
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
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24					
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26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

Lighting Room Codes		Socket Type Code	Bulb Type Code	Control Type Code
1. Living Room	9. Closet	1. Edison Base	1. Incandescent	1. No Control
2. Kitchen	10. Basement	2. Candelabra	2. CFL	2. Occupancy Sensor
3. Dining Room	11. Garage	3. Pin Base	3. Tube Fluorescent	3. Dimmer Switch
4. Bedroom	12. Other	4. Night Light	4. Halogen	4. 3-way Bulb
5. Bathroom	88. DK	5. Other	5. LED	88. Don't Know
6. Office/Den		88. Don't Know	6. No Bulb	
7. Foyer/Hallway			7. Other	
8. Utility Room			88. Don't Know	

3

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Pennsylvania Statewide Residential Baseline Study – REV A
On-Site Inspection Forms

INTERIOR LIGHTING

Socket #	Room Type	Socket Type	Existing Bulb Type	Control Type	Existing Bulb Watts
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
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69					
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72					
73					
74					
75					
76					
77					
78					
79					
80					

Lighting Room Codes		Socket Type Code	Bulb Type Code	Control Type Code
9. Living Room	9. Closet	6. Edison Base	8. Incandescent	1. No Control
10. Kitchen	10. Basement	7. Candelabra	9. CFL	2. Occupancy Sensor
11. Dining Room	11. Garage	8. Pin Base	10. Tube Fluorescent	3. Dimmer Switch
12. Bedroom	12. Other	9. Night Light	11. Halogen	4. 3-way Bulb
13. Bathroom	88. DK	10. Other	12. LED	88. Don't Know
14. Office/Den		88. Don't Know	13. No Bulb	
15. Foyer/Hallway			14. Other	
16. Utility Room			88. Don't Know	

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INTERIOR LIGHTING

Socket #	Room Type	Socket Type	Existing Bulb Type	Control Type	Existing Bulb Watts
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					
106					
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Lighting Room Codes		Socket Type Code	Bulb Type Code	Control Type Code
17. Living Room	9. Closet	11. Edison Base	15. Incandescent	1. No Control
18. Kitchen	10. Basement	12. Candelabra	16. CFL	2. Occupancy Sensor
19. Dining Room	11. Garage	13. Pin Base	17. Tube Fluorescent	3. Dimmer Switch
20. Bedroom	12. Other	14. Night Light	18. Halogen	4. 3-way Bulb
21. Bathroom	88. DK	15. Other	19. LED	88. Don't Know
22. Office/Den		88. Don't Know	20. No Bulb	
23. Foyer/Hallway			21. Other	
24. Utility Room			88. Don't Know	

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INTERIOR LIGHTING

Socket #	Room Type	Socket Type	Existing Bulb Type	Control Type	Existing Bulb Watts
121					
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					
136					
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					
151					
152					
153					
154					
155					
156					
157					
158					
159					
160					

Lighting Room Codes		Socket Type Code	Bulb Type Code	Control Type Code
25. Living Room	9. Closet	16. Edison Base	22. Incandescent	1. No Control
26. Kitchen	10. Basement	17. Candelabra	23. CFL	2. Occupancy Sensor
27. Dining Room	11. Garage	18. Pin Base	24. Tube Fluorescent	3. Dimmer Switch
28. Bedroom	12. Other	19. Night Light	25. Halogen	4. 3-way Bulb
29. Bathroom	88. DK	20. Other	26. LED	88. Don't Know
30. Office/Den		88. Don't Know	27. No Bulb	
31. Foyer/Hallway			28. Other	
32. Utility Room			88. Don't Know	

Pennsylvania Statewide Residential Baseline Study – REV A

On-Site Inspection Forms

EXTERIOR LIGHTING

Socket #	Room Type	Socket Type	Existing Bulb Type	Control Type	Existing Bulb Watts
1	13				
2	13				
3	13				
4	13				
5	13				
6	13				
7	13				
8	13				
9	13				
10	13				
11	13				
12	13				
13	13				
14	13				
15	13				
16	13				
17	13				
18	13				
19	13				
20	13				
21	13				
22	13				
23	13				
24	13				
25	13				
26	13				
27	13				
28	13				
29	13				
30	13				
31	13				
32	13				
33	13				
34	13				
35	13				
36	13				
37	13				
38	13				
39	13				
40	13				

Lighting Room Codes	Socket Type Code	Bulb Type Code	Control Type Code
13. Exterior Lighting	1. Edison Base 2. Candelabra 3. Pin Base 4. Night Light 5. Other 88. Don't Know	1. Incandescent 2. CFL 3. Tube Fluorescent 4. Halogen 5. LED 6. No Bulb 7. Other 88. Don't Know	1. No Control 2. Occupancy Sensor 3. Dimmer Switch 4. 3-way Bulb 88. Don't Know

MAJOR APPLIANCES

REFRIGERATORS (RF)

RF.1 Total Number of Refrigerators in the house (Enter "0" if none) ☐

	Manufacturer	Model #	Fresh Food Volume (Ft2)	How Many Months per Year Does Unit Operate?	Age (# of Years)	ENERGY STAR Unit? (1-Yes 2-No/DK)	Type: 1-Top Freezer 2-Bottom Freezer 3-Side by Side 4-Compact	Through the Door Ice? (1-Yes 2-No)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
RF.2								
RF.3								
RF.4								

FREEZERS-stand alone units (FZ)

FZ.2 Total Number of Freezers in the house (Enter "0" if none) ☐

	Manufacturer	Model #	Volume (Ft2)	How Many Months per Year Does Unit Operate?	Age (# of Years)	ENERGY STAR Unit? (1-Yes 2-No/DK)	Type: 1-Upright 2-Chest
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
FZ.2							
FZ.3							

COOKING (CK)

CK.1- Oven Fuel Type (check one)	1. Electric ☐	2. Natural Gas ☐	3. Propane ☐	4. Other_____ ☐
CK.2- Range Fuel Type (check one)	1. Electric ☐	2. Natural Gas ☐	3. Propane ☐	4. Other_____ ☐

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MAJOR APPLIANCES

DISHWASHERS (DW)
DW.1 Total Number of Dishwashers in the house (Enter "0" if none) ☐

	Manufacturer	Model #	Age (# of Years)	ENERGY STAR? (1-Yes 2-No/DK)	Estimated # of Loads per Week
	(a)	(b)	(c)	(d)	(e)
DW.2					
DW.3					

CLOTHESWASHERS (CW)
CW.1 Total Number of Clothes Washers in the house (Enter "0" if none) ☐

	Manufacturer	Model #	Age (# of Years)	ENERGY STAR? (1-Yes 2-No/DK)	Estimated # of Loads per Week	Type: 1-Front Loading 2-Top Loading
	(a)	(b)	(c)	(d)	(e)	(f)
CW.2						
CW.3						

CLOTHES DRYER(CD)
CD.1 Total Number of Clothes Dryers in the house (Enter "0" if none) ☐

CD.2 Dryer Fuel Type (check one)	1. Natural Gas ☐	2. Electric ☐	3. Propane ☐	4. Other _____ ☐

CD.3 Typical Drying Time (Check one use level for each time period)	Morning (5AM-12PM) (A)	Afternoon (12PM-5PM) (B)	Evening (5PM-8PM) (C)	Night (8PM-5AM) (D)
	1. Never/Rarely ☐ 2. Often ☐ 3. Always ☐	1. Never/Rarely ☐ 2. Often ☐ 3. Always ☐	1. Never/Rarely ☐ 2. Often ☐ 3. Always ☐	1. Never/Rarely ☐ 2. Often ☐ 3. Always ☐

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SMALL HOUSEHOLD APPLIANCES

TELEVISION & CABLE BOXES

	TV Size	Total # in home	CRT (#)	LCD(#)	Plasma (#)	Other (#)	Set-Top Box Present (#)
		(a)	(b)	(c)	(d)	(e)	(f)
SHA.1	Less than 36"						
SHA.2	36" or greater						

* Leave (B-H) blank if none ; enter 88 if don't know

COMPUTERS & PERIPHERALS

	Computer Type	Total # in home	CRT Monitor (#)	Flat Screen Monitor (#)	Powered Off when Not In Use (#)	Plug-In Peripherals – Printers, Routers, Etc. (#)
		(a)	(b)	(c)	(d)	(e)
SHA.3	Desktops					
SHA.4	Laptops					
SHA.5	iPad/Tablet					

* Leave (B-H) blank if none ; enter 88 if don't know

SEASONAL LOADS

	Equipment	Total # in home	Avg. Months per Year in Use
		(a)	(b)
SHA.6	Dehumidifier		
SHA.7	Humidifier		

* Leave (B) blank if none ; enter 88 if don't know

	Fans	Total # in home	Used Greater than 6 hrs/day
		(a)	(b)
SHA.8	Ceiling Fans		
SHA.9	Oscillating Fans		

* Leave (B) blank if none ; enter 88 if don't know

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PUMPS

	Equipment	Size (HP)	Motor Speed	Avg. Hours of Use Per Day
		(a)	(b)	(b)
SHA.10	Pool Pump		1. Single Speed ☐ 2. Two-Speed ☐ 3. Variable Speed ☐ 88. DK ☐	1. 6 Hours ☐ 2. 12 Hours ☐ 3. 24 Hours ☐ 88. DK ☐
SHA.11	Well Pump		1. Single Speed ☐ 2. Two-Speed ☐ 3. Variable Speed ☐ 88. DK ☐	1. 6 Hours ☐ 2. 12 Hours ☐ 3. 24 Hours ☐ 88. DK ☐

* Leave (A) blank if none ; enter 88 if don't know

OTHER MISCELLANEOUS PLUG LOADS

	Equipment	Total # in home	Continuously Plugged-In?
		(a)	(b)
SHA.12	VCR		1 Yes ☐ 2 No ☐
SHA.13	DVD/Blu-Ray		1 Yes ☐ 2 No ☐
SHA.14	Gaming System		1 Yes ☐ 2 No ☐
SHA.15	Stereo System		1 Yes ☐ 2 No ☐
SHA.16	Mobile Phone Charger		1 Yes ☐ 2 No ☐
SHA.17	Home Theater System		1 Yes ☐ 2 No ☐
SHA.18	Fax Machine		1 Yes ☐ 2 No ☐

ADDITIONAL COMMENTS (Comments on Major and Small Household Appliances)

POOLS/HOT TUBS (POOL)

	Equipment	Total # in home	Heated?	Fuel Type
		(a)	(b)	(c)
POOL.1	In Ground Pool		1 Yes ☐ 2 No ☐	1 Natural Gas ☐ 3 Propane ☐ 2 Electric ☐ 4 Other ☐
POOL.2	Above Ground Pool		1 Yes ☐ 2 No ☐	1 Natural Gas ☐ 3 Propane ☐ 2 Electric ☐ 4 Other ☐
POOL.3	Hot Tub		1 Yes ☐ 2 No ☐	1 Natural Gas ☐ 3 Propane ☐ 2 Electric ☐ 4 Other ☐

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On-Site Inspection Forms

HVAC SPACE HEATING (HT)

HT.1 Total Number of Major Space Heating System in the House (Enter "0" if none) ☐

		HT.2	HT.3	HT.4
		PRIMARY HEAT	SECONDARY	OTHER
Primary Fuel Type (see Heating Code Table)	(a)			
System Type (see Heating Code Table)	(b)			
Manufacturer (Indoor Unit)	(c)			
Model # (Indoor Unit)	(d)			
Estimated Age (# of Years)	(e)			
Efficiency Rating (SEER or AFUE)	(f)			
Programmable Thermostat	(g)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
% of Total Heat Load (estimate)	(h)			

*** Enter 88 if don't know : If no secondary or other systems, leave blank. Portable Heaters should not be included on this page. Refer to page 14.**

HEATING CODE TABLE

FUEL TYPE		SYSTEM TYPE	
1- Natural Gas	6- Coal	1- Furnace	7- Geothermal Heat Pump
2- Electric	7- Wood	2- Boiler (Water)	8- Ductless Heat Pump
3- Propane	8 - Other	3- Boiler (Steam)	9- Wood Stove
4- Kerosene	_____	4- Baseboard	10-Other
5- Oil	88 – Don't know	5- Wall Mounted Space Heater	88- Don't Know
		6- Air Source Heat Pump	

ADDITIONAL HEATING QUESTIONS

HT.5 – When did the primary heating system last undergo a seasonal check-up? *Note: Seasonal check-up does not include a service repair call. Only applies to normal system maintenance.*	1. Less than 1 year ☐ 2. 1-2 years ☐ 3. More than 2 years ☐ 4. Never ☐ 5. Equipment is < 1 year old ☐ 6. Not Applicable (No Central Heat)
HT.6 - Awake Heating Temperature Setting	°F
HT.7 – Sleep Heating Temperature Setting	°F
HT.8 – Away Heating Temperature Setting	°F

Pennsylvania Statewide Residential Baseline Study – REV A
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CENTRAL AIR CONDITIONING (CAC)

CAC.1 Total Number of Central Air Conditioning Units in the House (Enter "0" if none) ☐
(NOTE: Room Air Conditioning will be collected on the following page)

		CAC.2	CAC.3	CAC.4
		PRIMARY SYSTEM	SECONDARY	OTHER
System Type (check one)	(a)	1. Central AC Unit ☐ 2. Heat Pump ☐	1. Central AC Unit ☐ 2. Heat Pump ☐	1. Central AC Unit ☐ 2. Heat Pump ☐
Manufacturer (Outdoor Unit)	(b)			
Model # (Outdoor Unit)	(c)			
Estimated Age (# of Years)	(d)			
Size (Btu/hr)	(e)			
Efficiency Rating (SEER)	(f)			
Programmable Thermostat	(g)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
Ductless Mini-Split?	(h)	1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
Assess Sealing of Indoor Unit	(i)	1. Well Sealed ☐ 2. Partially Sealed ☐ 3. Poorly Sealed ☐	1. Well Sealed ☐ 2. Partially Sealed ☐ 3. Poorly Sealed ☐	1. Well Sealed ☐ 2. Partially Sealed ☐ 3. Poorly Sealed ☐

* Enter 88 if don't know : If no secondary or other systems, leave blank. Room ACs should not be included on this page. Refer to page 14.

ADDITIONAL COOLING QUESTIONS

CAC.5 – When did the primary heating system last undergo a seasonal check-up? *Note: Seasonal check-up does not include a service repair call. Only applies to normal system maintenance.*	0. No Central Cooling ☐ 1. Less than 1 year ☐ 2. 1-2 years ☐ 3. More than 2 years ☐ 4. Never ☐ 5. Equipment is < 1 year old ☐
CAC.6 Is the residence air conditioned most days, July – August?	1. Yes ☐ 2. No ☐ 88. Don't Know ☐
CAC.7 - Awake Cooling Temperature Setting	°F
CAC.8 – Sleep Cooling Temperature Setting	°F
CAC.9 – Away Cooling Temperature Setting	°F

ROOM AC (RAC) AND PORTABLE SPACE HEATERS (PSH)

ROOM AIR CONDITIONERS (DW)
RAC.1 Total Number of RAC Units in the house (Enter "0" if none) ☐

	Manufacturer	Model #	Size – Btu/hr	Age (# of Years)	ENERGY STAR? (1-Yes 2-No/DK)	EER Rating
	(a)	(b)	(c)	(d)	(e)	(f)
RAC.2						
RAC.3						
RAC.4						
RAC.5						
RAC.6						
RAC.7						

PORTABLE SPACE HEATERS (PSH)
PSH.1 Total Number of Portable Space Heaters in the house (Enter "0" if none) ☐

	Wattage	Is the heater used at all during the winter months?	Is the heater typically used between 6AM-8AM in winter?
	(a)	(b)	(c)
PSH.2		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
PSH.3		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
PSH.4		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
PSH.5		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
PSH.6		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐
PSH.7		1. Yes ☐ 2. No ☐	1. Yes ☐ 2. No ☐

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WATER HEATING (WH)

WH.1 Total Number of Water Heating Units in the House (Enter "0" if none) ☐

WATER HEATING

		WH.2	WH.3	WH.4
		PRIMARY	SECONDARY	OTHER
Primary Fuel Type (see WH Code Table)	(a)			
System Type (see WH Code Table)	(b)			
Manufacturer	(c)			
Model #	(d)			
Estimated Age (# of Years)	(e)			
Temp. Setting (°F)	(f)			
Efficiency Rating (EF)	(g)			
Pipe Wrap	(h)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
Water Heater Blanket	(i)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐

WATER HEATING CODE TABLE

FUEL TYPE		SYSTEM TYPE	
1- Natural Gas	6- Coal	1- Stand Alone Tank	6- Other
2- Electric	7- Solar	2- Tankless (On Demand)	88- Don't Know
3- Propane	8- Other	3- Indirect Fired	
4- Kerosene	_____	4- Tankless Coil	
5- Oil	88- Don't Know	5- Heat Pump Water Heater	

ADDITIONAL WATER HEATING QUESTIONS

WH.5 – Total Number of Sinks in Household?	
WH.6 - # of Low Flow Faucet Aerators installed in the home?	
WH.7 – Total number of Showers in Household?	
WH.8 - # of Low Flow Showerheads (<2.5 gal per min) installed in the home?	

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INSULATION (IN)

INSULATION

		IN.1	IN.2	IN.3	IN.4
		Roof Cavity	Side Wall	Floor Cavity	Basement Wall
Insulation Present	(a)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
Insulation Type (see Table below)	(b)				
Insulation Thickness *Inches* (88-DK)	(c)				
Insulation R-Value (88-DK)	(d)				

INSULATION CODE TABLE

Insulation Type		
1 – Fiberglass Batt	5 – Dense Pack Cellulose	8 – Vermiculate
2 – Fiberglass Loose Fill	6 – Rigid Board	9 – Other _____
3 – Cellulose Loose Fill	7 – Spray/Expand Foam	88 – Don't Know
4 – Rock Wool Loose Fill		

WINDOWS(WIN)

WINDOWS

		WIN.1	WIN.2	WIN.3	WIN.4
		Building/Window Orientation			
		North/NE	East/SE	South/SW	West/NW
# of Windows	(a)				
# that are single paned	(b)				
# that are double paned	(c)				
# that are triple paned	(d)				
Average age (years)	(e)				
Average condition of windows	(f)	1. Excellent ☐ 2. Good ☐ 3. Fair ☐ 4. Poor ☐	1. Excellent ☐ 2. Good ☐ 3. Fair ☐ 4. Poor ☐	1. Excellent ☐ 2. Good ☐ 3. Fair ☐ 4. Poor ☐	1. Excellent ☐ 2. Good ☐ 3. Fair ☐ 4. Poor ☐
Low-E Coating	(g)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
Argon Filled	(h)	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐	1. Yes ☐ 2. No ☐ 88. DK ☐
Total Square-Footage per Building Side	(i)	_____ *sq ft.*	_____ *sq ft.*	_____ *sq ft.*	_____ *sq ft.*

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AIR SEALING (AS) & DUCT SEALING (DS)

AIR SEALING

AS.1	**Qualitatively Assess Quality of Air Sealing:** **Well Sealed**: No Visible Gaps; Little to No Variation using Thermal Leak Detector **Partially Sealed**: Minimal Gaps ; Minor Variation using Thermal Leak Detector **Poorly Sealed**: Visible gaps ; Wide Variation using Thermal Leak Detector **Unable to Assess**: Cannot Visually Assess	1. Well Sealed ☐ 2. Partially Sealed ☐ 3. Poorly Sealed ☐ 88. Unable To Assess ☐
AS.2	Specify number of fireplaces?	
AS.3	Specify number of fireplaces where damper is present?	

DUCT SEALING

DS.1	**Qualitatively Assess Quality of Duct Sealing:** **Well Sealed**: Mastic of Foil Tape Applied on **All or Most** Joints **Partially Sealed**: Mastic or Foil Tape Applied on **Some** Joints or Minor Gaps Around Sealed Areas Appear **Poorly Sealed**: No Mastic or Foil Tape Applied ; Major Gaps Appear or General Purpose Duct Tape was Used **Unable to Assess**: Cannot Visually Assess	1. Well Sealed ☐ 2. Partially Sealed ☐ 3. Poorly Sealed ☐ 88. Unable To Assess ☐
DS.2	Are Ducts Insulated?	1. Yes ☐ 2. No ☐ 88. Unable To Assess ☐
DS.3	Specify Duct Location	1. Conditioned Space 2. Unconditioned Basement 3. Attic 4. Cond./Uncond. Mix 88. DK

ADDITIONAL COMMENTS ON MISCELLANEOUS COMMENTS

17 Inspection ID # _____

Pennsylvania Statewide Residential Baseline Study – REV A
On-Site Inspection Forms

DEMOGRAPHICS & OTHER (DEMO)

DEMO.1	What is the Age of the Oldest Person Who Would Be Considered the Head of Household?	1 24 Years or Younger ☐ 2 25 – 59 Years ☐ 3 60 Years or Older ☐ 4 No Response ☐
DEMO.2	What is the Highest Level of Education Completed by the Head of Household?	1 Less than HS Grad. ☐ 2 HS Grad or Equiv. ☐ 3 Some College, No Degree ☐ 4 Associate's Degree ☐ 5 Bachelor's Degree ☐ 6 Graduate Degree or higher ☐ 7 No Response ☐
DEMO.3	Do You Own/Rent this Home?	1 Own ☐ 2 Rent ☐ 3 No Response ☐
DEMO.4	Does Homeowner Pay Own Electric Bill or Does Someone Else Pay? (e.g. the landlord, if home is rented)	1 Home Owner Pay ☐ 2 Someone Else Pays ☐ 3 No Response ☐
DEMO.5	Have You Ever Had an Energy Audit Performed in Your Home?	1 Yes ☐ 2 No ☐ 3 No Response ☐
DEMO.6	Have you removed a refrigerator from your home in the past five years?	1 Yes ☐ 2 No ☐ 3 No Response ☐
DEMO.7	If the Answer to #6 above is yes, what did you do with the old refrigerator that was removed from the home? (Check only one)	1 Trash ☐ 2 I sold it ☐ 3 Picked up by retailer ☐ 4 Recycled by utility ☐ 4 Donated ☐ 5 Other (_____) ☐
DEMO.8	If the Answer to #6 above is yes, did you replace the removed refrigerator?	1 Yes ☐ 2 No ☐ 3 No Response/Don't Know ☐
DEMO.9	Have you removed a freezer from your home in the past five years?	1 Yes ☐ 2 No ☐ 3 No Response ☐
DEMO.10	If the Answer to #8 above is yes, what did you do with the old freezer that was removed from the home? (Check only one)	1 Trash ☐ 2 I sold it ☐ 3 Picked up by retailer ☐ 4 Recycled by utility ☐ 4 Donated ☐ 5 Other (_____) ☐
DEMO.11	If the Answer to #6 above is yes, did you replace the removed freezer?	1 Yes ☐ 2 No ☐ 3 No Response/Don't Know ☐

Appendix B RECRUITMENT LETTERS

<DATE>

<Customer Name>
<Street Address>
<City>, <State> <Zip Code>

Dear Sir/Madam,

Your home has been randomly chosen as a potential participant in a Pennsylvania state-wide study to gather information on the electrically-powered equipment installed in electric customers' homes. The Pennsylvania Public Utility Commission (PaPUC) is conducting this research to find ways to help PA consumers save energy and money.

You will be receiving a call from GDS Associates (the contractor conducting this research for the PaPUC) in the coming days. The GDS Associates representative will conduct a brief three to five minute telephone survey regarding the characteristics of your home. They will then ask your willingness to participate in both the study and permission to conduct an on-site survey at your residence. If you agree to the on-site survey, a GDS Associates representative will personally visit your home to gather additional information about the electrically-powered equipment (e.g., lighting and appliances) located at your residence. A $50 incentive will be offered to all selected participants who agree to participate in the on-site survey.

All data collected during this research will be anonymous and will be used only in the aggregate to assist the Commonwealth of Pennsylvania and <EDC Name> develop more effective energy efficiency programs.

Your participation in this survey is encouraged, but is entirely optional. If you choose to participate in the on-site survey, we will provide GDS Associates with your customer data (e.g. monthly consumption history) to help them perform the research.

If you have any questions or concerns, please feel free to contact the PaPUC at 717-425-7584 or via email (ra-act129@pa.gov).

Best regards,

<EDC Contact Name>
<EDC Contact Title>
<EDC Contact Department>

Appendix C PHONE RECRUITING SCRIPTS

Pennsylvania Residential Baseline Study
Recruiting Script

General Info:

(Do not read this general information to customers) All information for the random sample of residential customers eligible to be recruited will be maintained in an Excel data base. This information will be treated as confidential and will include information on customer name, address, phone number, the dates of the first, second and third recruiting phone calls, the status of the recruiting for each customer, and the name of the GDS employee doing the recruiting for each customer. For each customer contacted, a disposition status will be provided in the Excel data base, as follows:

1. *Customer agreed to participate in survey*
2. *Phone busy*
3. *Customer busy; Call back later (enter date and time to call back)*
4. *No answer, left voice mail message*
5. *No answer; no voicemail*
6. *Not interested*
7. *Number no longer in service*
8. *Other (please specify: _____)*

In the event that the phone is busy or there was no answer, GDS will make two more attempts to contact the potential participant. When possible, GDS will leave a voice mail message with call back information.

If there is no answer but an opportunity to leave a message and call back number, the following script will be used:

Phone Message:

Hello, my name is _____ from GDS Associates, calling on behalf of the Pennsylvania Public Utility Commission. You may have received a brief letter in the mail from <EDC Name> notifying you in advance of this call. I am contacting you to invite you to participate in a short 5-minute telephone survey or a more in-depth on-site survey of your residence. Only the first seventy respondents will be allowed to participate and you'll receive a $50 Visa Rewards card for your time. The PUC is conducting this research to find ways to help their Pennsylvania consumers save energy.

If you are interested in participating in these surveys, please feel free to call GDS Associates at 800-814-2616 ext. 8405 between the hours of 10AM and 7PM. If you would like to return this call outside of those hours, please leave a message and an appropriate time to return your call and we will call you back at your convenience.

If you have any questions or concerns about this call, please call the Pennsylvania Public Utility Commission at 717-425-7584 and reference "Energy Usage Survey"

Thank you, and have a good day.

If homeowner answers or calls back, the following recruiting script will be used:

Live Introduction:

Hello, my name is _____ from GDS Associates. You may have received a brief letter in the mail from <EDC Name> notifying the homeowners in advance of this call. I am calling on behalf of the Pennsylvania Public Utility Commission to conduct a brief, 5-minute survey of Pennsylvania consumers about energy usage and equipment. I am not selling anything. May I speak with someone who is familiar with your home's energy use and appliances?

We are working with the PUC to gather information on the appliances and other energy using equipment installed in your home. The PUC is conducting this research to find ways to help their Pennsylvania consumers save energy. Those who are selected for an on-site survey will receive a Visa Rewards card for $50.

The PA PUC and GDS Associates would like to conduct walk-though site visits of a large number of homes to gather further information about appliances, lighting, and other home building characteristics. Each participating homeowner will receive a Visa Reward Card for $50 once the site visit is completed. We expect this site visit will last approximately 1.5 to 2 hours. The information collected from your home and energy use will be kept confidential.

Q1: Would you be willing to let one of our representatives come to your home for this purpose?

If "yes" ask Q2

If "no" : That's all the questions I have for you today.

Q2: Do you authorize <EDC Name> to release your annual electric usage data to GDS Associates so that we can complete the on-site survey?

If "yes" schedule site survey (below)

If "no" : That's all the questions I have for you today.

[If "yes" to both above questions- surveyor will schedule a site visit]

Thank you for your help. Surveyors will be in your area between [start date] and [end date].
[Recruiter will now schedule an open time/date for a surveyor to conduct an on-site visit]

[Schedule time and date_____]. Again, thank you for your help. A surveyor from our office will come to [read address] at [read time] on [read date] and will provide you with proper identification. Who will be the contact for this visit? _____. If you should need to cancel or reschedule, please

contact us at 800-814-2616 ext. 8405 and we will be happy to accommodate you. The surveyor will have a letter of introduction and a sign on his/her car and we will confirm this appointment by phone in advance.

In addition to the on-site survey, if you have 5 minutes, I'd like to ask you a few questions about the appliances and heating and cooling equipment in your home. I only have nine short questions.

Do you have time to speak now?

a) 'Yes': [Proceed to survey].

b) 'No': Thank you for your time.

General Information

7. What type of home do you have (check one)?

   a. Single-family
   b. Townhouse/Rowhouse/Duplex
   c. Multifamily Building (2-4 units)
   d. Multifamily Building (5+ units)
   e. Mobile home/manufactured home
   f. Other (specific: _____

8. When was your home built? __ __ __ __ or don't know.

9. How many months a year is the home occupied? ___ ___ (number of months)

10. What fuel do you use as your primary heating fuel? (Circle one)

    a. Electricity
    b. Natural Gas
    c. Oil (#2 fuel oil)
    d. Kerosene
    e. Wood
    f. Solar
    g. Coal
    h. Other
    i. Don't know

11. What fuel do you use as your primary water heating fuel? (How do you keep your home warm?) (Circle one)

    a. Electricity

b. Natural Gas
c. Oil (#2 fuel oil)
d. Kerosene
e. Wood
f. Solar
g. Coal
h. Other
i. Don't know

12. What is your home's primary form of cooling? (Circle one)

a. Central Air Conditioner
b. Air Source Heat Pump
c. Room Air Conditioner
d. No cooling
e. Other
f. Don't know

13. How many bedrooms does your home/apartment have? (check one)
a. One
b. Two
c. Three
d. Four
e. Five
f. Six or more
g. Don't' know

14. How many people live in the home/apartment 6 months or more?
a. One
b. Two
c. Three
d. Four
e. Five
f. Six or more

If you have any questions, you can contact ***the Pennsylvania Public Utility Commission*** by calling 717-425-7584 and refer to the "PA Home Energy Usage" survey.

Again, if you need to cancel or reschedule your site visit, please contact us at 800-814-2616 ext. 8405. In addition, you should receive a letter of confirmation in the next few days confirming the date and time of your appointment. We will call 24 to 48 hours in advance of your site visit to confirm the appointment.

{Confirm address for site visit/ remind customer of $50 rewards card}

We appreciate your time, have a nice day.